

## City+ 2023 @ Perth

An International Conference for Early Career Researchers and  
PhD Students on Urban Studies



# Proceedings of City+2023@Perth International Conference on Geospatial Big Data and Artificial Intelligence for Cities

8 - 10 September 2023, Perth, Australia

Website: <https://yongzesong.com/cityplus-2023/> E-mail: [cityplus2023@gmail.com](mailto:cityplus2023@gmail.com)



## **Acknowledgment**

Curtin University provides the Bankwest Theatre as the venue for the conference.

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# Contents

<b>1. Introduction</b>	<b>9</b>
<b>2. Short courses</b>	<b>15</b>
Interactive Cloud Computing with Google Earth Engine and Geemap ( <i>Qiusheng Wu</i> )	15
Climate change will bring change and prosperity if we adapt to the changes and work together! ( <i>Fred Sanders</i> )	16
The Turing way a tool for Reproducible Research and Open Science ( <i>Fernando Benitez-Paez</i> )	16
<b>3. Advances in geospatial research and industries</b>	<b>19</b>
Simulating Built-up expansion in West Delhi with an integrated Neural Network and Agent Based-Prioritised Growth Model ( <i>Aviral Marwal and Elisabete Silva</i> )	19
Timber Urbanism: Assessing the carbon footprint of mass-timber, steel, and concrete structural prototypes for peri-urban densification in the Hudson Valley’s urban fringe ( <i>Eleni Stefania Kalapoda</i> )	20
Lessons from Chongqing: Public Rental Housing and Family Lives of the New Citizens ( <i>Weijie Hu</i> )	21
Achieving net-zero material consumption to build future cities ( <i>Yupeng Liu, Kangning Huang, Wei-Qiang Chen, and Karen Seto</i> )	22
Prediction of Lived Public Space ( <i>Selen Aksoy</i> )	23
Using Natural Language Processing to Identify Key Planning Strategies from Government Documents – A Case Study of 117 Chinese Cities from 2011 to 2019 ( <i>Emily Tianyuan Wang and Li Wan</i> )	25
A coupling model for measuring the substitution of subway for bus during snow weather: a case study of Shenyang, China ( <i>Jie Liu, Shaolei Wu, and Yongliang Wang</i> )	25
Success factors impacting strategy- and governance frameworks for environmental digital twins in the mining industry. ( <i>Tom Bos</i> )	27
Study on the impact of smart city construction to the green and high-quality development of cities ( <i>Shilong Li</i> )	28
Transforming Urban Futures: AI Advancements in Master Planning for Sustainable Cities ( <i>Alisha Shahid</i> )	29
Enhancing Workplace Productivity Through Evidence-Based Design ( <i>Ivy Chang</i> )	30
Using social media photographs deep learning to assess cultural ecosystem services for high-density urban green space management: Case from Central Beijing ( <i>Haiyun Xu, Mujie Ren, Guohan Zhao, and Jiaruan Duan</i> )	31
The green system design under the definition of coastal city ( <i>Zhiran Fan</i> )	33
Lessons from Chongqing: Public Rental Housing and Family Lives of the New Citizens ( <i>Weijie Hu</i> )	34
Hotspot Analysis of Oil Spill Events Using GIS; A Case Study of Niger Delta, Nigeria ( <i>Ajibola R. Oyebamiji, Mohammad A. Hoque, and Malcolm Whitworth</i> )	35

<b>4. Geospatial big data and AI</b>	<b>37</b>
How COVID-19 Impacts Air Pollution Exposure Among Disadvantaged Communities? Leveraging Crowd-Sourced Geospatial Data to Develop Healthy Communities ( <i>Tianjun Lu</i> ) . . . . .	37
Opportunities and Challenges of Geospatial Artificial Intelligence Foundation Models in the Context of ChatGPT Large Model ( <i>Can Zhang, Zhuoran Zhang</i> ) . . . . .	38
Investigating Non-linearity of Spaceborne Hyperspectral Datasets through Dimensionality Reduction Approaches ( <i>Kavach Mishra, Rahul Dev Garg</i> ) . . . . .	39
Uncovering the global and local structures of urban networks via Poincare Embedding ( <i>Chenglong Wang, Zhaoya Gong, Bin Liu, Pengjun Zhao, Zhenhua Chen</i> ) . . . . .	40
Evaluating the effect of plain afforestation project and future spatial suitability in Beijing ( <i>Tengyun Hu, Xucao Li</i> ) . . . . .	41
Exploring the measurement of place identity through social media data ( <i>Shuyu Zhang</i> ) .	44
The value of building a perception-based green elements database for empirical research on future vitality ( <i>Jiamin Li</i> ) . . . . .	45
GWRBoost:A geographically weighted gradient boosting method for explainable quantification of spatially-varying relationships ( <i>Han Wang, Zhou Huang</i> ) . . . . .	46
Developing X-minute city with the dockless bike-sharing service ( <i>Wenyan Fu, Yongping Zhang</i> ) . . . . .	47
Sentiment and semantic analysis: Urban quality inference using machine learning algorithms ( <i>Emily Ho, Michelle Schneider, Sanjay Somanath, Yinan Yu, Liane Thuvander</i> ) . . . . .	48
Block Saturation Level: a novel typology of block occupancy based on deep learning classification of satellite images ( <i>Augusto dos Santos Pereira</i> ) . . . . .	50
SALT: a multifeature ensemble learning framework for mapping urban functional zones from VGI data and VHR images ( <i>Hao Wu, Wenting Luo, Anqi Lin, Fanghua Hao, Ana-Maria Olteanu-Raimond, Lanfa Liu, Yan Li</i> ) . . . . .	51
Exploring Spatiotemporal Big Data to Examine the Complementarity between Shenzhen and Hong Kong ( <i>Qihao Wang, Sujun Guo, Yongfeng Wei, Henan Wang, Guanyi Chen</i> ) . . . . .	56
Factors of Social Network Platform Usage and Privacy Risk: A Unified Theory of Acceptance and Use of Technology2 Model ( <i>Xue Wang, Liwei Fan</i> ) . . . . .	58
Evaluating the Potential of Different Evapotranspiration Datasets for Distributed Hydrological Model Calibration. ( <i>Xiao Guo, Zhiyong Wu, Hai He, Zhengguang Xu</i> ) .	58
Natural Language Processing for the Classification of Social Media Posts in Post-Disaster Management ( <i>Ezgi Sendil</i> ) . . . . .	59
<b>5. Transport and health</b>	<b>61</b>
Street-level physical disorders, multi-scale socioeconomic disparities and neighbourhood satisfaction in Chinese older adults: Using street view data and machine learning approach ( <i>Qiyang Li, Mengqiu Cao, Linchuan Yang, and Ruoyu Wang</i> ) . . . . .	61
Study of Outdoor Public Space in Emergency Departments in Shanghai ( <i>Yuxuan Chen</i> )	62
The impact of urban transportation facilities on commuter's public transit satisfaction: a case study of Xi'an, China ( <i>Qianyu Zhou, Jing Zhu, and Yingling Fan</i> ) . . . . .	63
Predicting travel time reliability with automatic fare collection data for an urban rail transit network ( <i>Jie Liu, Yuhao Wang, Yubo Jiao, Gang Cheng, Paul M. Schonfeld, and Bo Du</i> ) . . . . .	64
Evaluate the physical activity vitality of urban greenways using trajectory entropy ( <i>Cailin Qiu, and Tianjie Zhang</i> ) . . . . .	65
Heterogenous Trip Distance-Based Route Choice Behavior Analysis Using Real-World Large-Scale Taxi Trajectory Data ( <i>Meiye Li, and Ting Wang</i> ) . . . . .	67

Impact of commuting time on work productivity: A quasi-longitudinal examination ( <i>Liang Ma</i> ) . . . . .	68
Research on the characteristics of commercial agglomeration and evolution of embedded residential rail transit stations —Comparative study based on the cases of three countries ( <i>Yixin Sun, and Wei Lu</i> ) . . . . .	69
Geospatial Analysis of Healthcare Accessibility and Equity in the Beijing-Tianjin-Hebei Region ( <i>Fengliang Tang, and Yingning Shen</i> ) . . . . .	70
Optimization of emergency medical supplies distribution in public health emergencies ( <i>Jie Liu, Ying Zhao, Yuhao Wang, Mingwei Hea, Wenbing Shui, and Bo Du</i> ) . . .	71
Enhancing Urban Rail Transit Resilience through Optimization ( <i>Jie Liu, Yunlong Lin, Wenxin Li, and Yuhao Wang</i> ) . . . . .	72
An ensemble learning-based neural network model for predicting urban rail transit ac- cidents ( <i>Xinyao Li, Weiyi Liu, Jie Liu, Paul M. Schonfeld, and Bo Du</i> ) . . . . .	74
<b>6. Sustainable cities and infrastructure</b>	<b>77</b>
Metro accessibility and space-time flexibility of shopping travel: A propensity score matching analysis ( <i>Rui Shao, Ben Derudder, and Yongchun Yang</i> ) . . . . .	77
Inequality of eye-level urban greenness provision across the top ten populated cities in U.S.A ( <i>Jingjing Yan, Xiao Huang</i> ) . . . . .	78
Spatial Patterns and Influencing Factors Analysis of Elderly Care Facility Accessibility: A Case Study of Suzhou, China ( <i>Wang Peng</i> ) . . . . .	78
Spatial location optimization of fire stations with traffic status and urban functional areas ( <i>Yuehong Chen, Guohao Wu, Yu Chen, and Zelong Xia</i> ) . . . . .	79
Ruralization in Metropolitan Areas: An Explanation Based on Shanghai ( <i>Jiahui Fan</i> ) .	80
An Automatic Approach to Extracting Large-Scale Three-Dimensional Road Networks Using Open-Source Data ( <i>Yang Chen, Xin Yang</i> ) . . . . .	81
Reconnecting Human Engagement with Urban Response through a Hypernetwork Model: Enhancing Urban Resilience in the Anthropocene ( <i>Zeyu Zhao, Yuhan Zheng, Tan Cheng</i> ) . . . . .	81
A smart dashboard for forecasting disaster casualties: An investigation from sustainable development dimensions ( <i>Reza Naghedi, Xiao Huang, Mohamad Gheibi</i> ) . . . . .	86
Identifying core driving factors of urban land use change from global land cover products and POI data using the random forest method ( <i>Hao Wu, Anqi Lin, Xudong Xing, Danxia Song, Yan Li</i> ) . . . . .	87
Sharing Economy, Housing, and Urban Regeneration in Shanghai ( <i>Shuning Liu, Yi Zhu</i> )	91
Household energy and carbon inequality considering rural-urban differences in China: Current status and future trends ( <i>Shuyu Sun, Kangkang Tong</i> ) . . . . .	93
A New Method of Extracting Built-up Area Based on Multi-source Remote Sensing Data: A Case Study of Baoding Central City, China ( <i>Ce Jiang, Yahui Miao, and Zenglei Xi</i> ) . . . . .	95
Developing process-based modelling to quantify urban energy service: Using two cities as cases ( <i>Ke Sun, Kangkang Tong</i> ) . . . . .	96
Enhancing Sustainable Value Creation: ESG Integration in Alternative Investments within the Infrastructure Sector ( <i>Ando, Jiaqing Yao</i> ) . . . . .	97
Spatial Optimization of Park Green Spaces by an Improved Two-Step Optimization Model from the Perspective of Maximizing Accessibility Equity ( <i>Lei Mu, Lijun Xing</i> ) . . . . .	99
Research on Low Carbon Spatial Allocation of Courier Outlets from the Perspective of Behavior Guidance - Taking Nankai District of Tianjin as an Example ( <i>YANG Xingyuan, DONG Hongjie, ZHANG He, and ZHANG Yutong</i> ) . . . . .	100
Coastal city learning model; reflecting climate change adaptation measures with other cities. ( <i>Fred C. Sanders, Karen Jonkers</i> ) . . . . .	101

Significance of different phases of BIM implementation towards sustainable construction project management ( <i>Rashid Maqbool, Bhargava Gullipalli, and Saleha Ashfaq</i> ) . . .	102
Sustainable planning for the Olympic Legacy. The Turin 2006 Winter Olympic Games case study. ( <i>Valerio della Sala</i> ) . . . . .	103
Investigating the effect of school proximity to green space on students' satisfaction using Google POI ( <i>Fatermeh Rajabi, Farhad Hosseinali, Hamidreza Rabiei-Dastjerdi, Mahdi Rajabi, and Mohammad Ali Aghajani</i> ) . . . . .	105
Study of key influential factors of culvert deterioration: A data driven approach ( <i>Ce Gao, Jingang Fang, Xuchen Wei</i> ) . . . . .	106
Identifying the Urban spatial environmental factors affecting insomnia and their synergies based on multi-source big data ( <i>Lijun Xing, Lei Mu, Yu Liu</i> ) . . . . .	107
Spatiotemporal evolution and driving forces of PM2.5-related mortality in Chinese cities ( <i>Huibin Mo, Shaojian Wang</i> ) . . . . .	107
Spatial Equality of Recreational Opportunity and Recreational Environment of Urban Park ( <i>Guo Ru</i> ) . . . . .	109
A framework of digital nomad experiences as revealed through means-end chain analysis ( <i>Weifeng Su</i> ) . . . . .	109
Infrastructure in Chengdu-Chongqing Economic Circle: Multi-dimensional Analysis ( <i>Ziming Wang</i> ) . . . . .	110
Review of the Vitality of Urban Public Spaces ( <i>Wei Dong, Jinxiu Wu</i> ) . . . . .	113
Unequal traveling: how school district system and school district housing characteristics shape the duration of families commuting ( <i>Geyang Xia</i> ) . . . . .	114
<b>7. Spatial methods</b>	<b>117</b>
A psychoacoustic approach for the diagnostic of urban soundscapes ( <i>Mohamed Amin HAMMAMI, Christophe CLARAMUNT</i> ) . . . . .	117
Urban ecosystem services: assessment pathways for regulating, institutional and cultural value ( <i>Vitaly A. Kryukov</i> ) . . . . .	119
The impact of Lean practices in improving the construction production for a better waste management towards sustainability ( <i>Rashid Maqbool and Boini Aishwarya Yadav</i> ) . . . . .	120
The Research on urban/ suburban Cultural Ecosystem Service Demand and Supply Spatial Distribution: A Case study from Shanghai, China ( <i>Zhenhua Bing</i> ) . . . . .	121
Spatiotemporal evolution of coordination and conflict of land use functions and influencing factors: a case study in Beijing, China ( <i>Wenhui Wang, and Jian Zhang</i> ) . . .	126
Local spatial heterogeneity of Wheat Yields in Western Australia ( <i>Kai Ren, Yongze Song</i> )	131
Urban Regeneration in China with Urban Morphology and Renewal Units ( <i>Yi Cheng</i> ) .	132
A Study on the Spatial Succession of Urban Center System Based on Spatial Syntax ( <i>Yi Shi, and Haipeng Wang</i> ) . . . . .	133
The Space for the Elderly: Aging-friendly Design Strategies for Informal Public Spaces in Old Town ( <i>Zhihan Zhang</i> ) . . . . .	134
The matching degree of supply and demand accessibility for emergency rescue service with social media data: A case study of heavy rainstorm disaster in Zhengzhou ( <i>Yun Ling</i> ) . . . . .	135
Optimizing Urban Functional Land Use through Heuristic Tuning for Dual Low Carbon Targets at Regional Land Use Structure and Local Pattern Scale Optimization ( <i>Yifei Yang, Xun Liang, and Jianjun Lyu</i> ) . . . . .	136
<b>8. Posters</b>	<b>139</b>
Enhancing Environmental Urbanism through Artificial Intelligence, Digital Twins, and Big-Data interplays ( <i>Carlos Eduardo Favero Marchi</i> ) . . . . .	139

Analysis of the protective contribution of nature reserves to carbon pool—Taking Tai'an City as an example ( <i>Li Yuanxi, Zhang Wenxin</i> ) . . . . .	140
Public Perception of Adaptively Reused Buildings in Singapore: A Case Study of CHI-JMES ( <i>Meng Zhang Ke Zhang Nikhil Joshi</i> ) . . . . .	141
Analysis of the Influencing Factors of Vitality and Built Environment of Shopping Centers Based on Mobile-Phone Signaling Data(MSD) ( <i>Xiaohe Bai, Min Zhou, and Weiming Li</i> ) . . . . .	142
Evaluation of settlement environment in the residential areas from a perspective of residents' satisfaction: a case of Beijing ( <i>Wenhui Wang , Jian Zhang</i> ) . . . . .	144
Heavy Metal Pollution in Soil: Analysis and Prediction in Gangdese, Tibet ( <i>Lai Sihan Liu Yansong</i> ) . . . . .	146
Sensing Multi-modal Mobility Patterns: A Case Study of Helsinki using Bluetooth Beacons and a Mobile Application ( <i>Zhiren Huang , Alonso Espinosa Mireles de Villafraanca , Charalampos Sipetas</i> ) . . . . .	148
Rapid Inversion of Heavy Metal Content in Urban Water Sediments Using Hyperspectral Data ( <i>Wang Xianju, Liu Yansong, Liu Qi, Wu Jing , Xue Kailun, Shen Qian</i> ) . .	148
Spatial Distribution and Influencing Factors of Natural Tourism Resources in Batang Area ( <i>Shao Qingqing, Liu Yansong</i> ) . . . . .	150
Pandemic led productivity challenges and how Lean and BIM can support AEC industry? ( <i>Rashid Maqbool, Win Min Myat</i> ) . . . . .	151
Optimization of Residential Public Space by Introducing Intergenerational Solidarity Performance Evaluation Index ( <i>Can Zhang, Yu Zhang</i> ) . . . . .	152





# 1. Introduction

**City+2023@Perth** International Conference, is held in 8-10 September 2023 at **Curtin University**, an innovative, global university (Australia, Malaysia, Singapore, Dubai, and Mauritius) known for its high-impact research, strong industry partnerships and commitment to preparing students for jobs of the future. The conference is hosted by the AI and Spatial Analysis Team of the School of Design and the Built Environment. We hope that City+2023@Perth can facilitate young researchers to work closely at the forefront of urban studies through disseminating their research, receiving valuable feedback, expanding academic networks and boosting potential collaborations.

The **City+2023@Perth** International Conference drew together more than 300 researchers from 29 countries and regions, including Australia, New Zealand, the United States, Mexico, Brazil, China, Hong Kong SAR, Macau SAR, Singapore, Japan, the United Kingdom, Ireland, Sweden, Finland, Germany, France, Spain, Italy, Austria, Czech, the Netherlands, Belgium, Turkey, Israel, Iran, Kazakhstan, India, and Saudi Arabia. The conference featured academic and industry keynote speeches and oral presentations, showcasing a broad range of research topics and perspectives from around the globe.



City+ research network is organising annual international conferences for early career researchers and PhD students on urban studies. The first event, **City+2017@Cambridge**, was launched at **University of Cambridge**, followed by **City+2018@London** at **University College London**, **City+2019@Delft** at **Delft University of Technology**, **City+ 2021@Milan** at **Polytechnic University of Milan**, **City+2022@Canberra** at **Australian National University**, and **City+2023@Perth** at **Curtin University**. To date, our conferences have already attracted more than 600 delegates coming from many universities and institutions across countries in Africa, Asia, Europe, and North America. It has demonstrated its potential to be a good platform for sharing research experiences and thinking, developing cooperation opportunities,

and addressing their urban concerns from multiple perspectives.

The theme of City+2023@Perth is “Geospatial Big Data and Artificial Intelligence for Cities”. City+2023@Perth invites abstracts for presentations that address, but are not limited to, the theme. The conference includes the following sessions:

- Keynotes. Include both keynote speech from academic researchers and industry managers.
- Industry workshop. Discusses industry topics and needs, and methods to fill gaps between academic research and industry.
- Short course session. Will introduce the latest methods and tools.
- Poster session. Video presentations for posters.
- Oral sessions:
  - Session 1. Advances in geospatial research and industries.
  - Session 2. Geospatial big data and AI.
  - Session 3. Transport and health.
  - Session 4. Sustainable cities and infrastructure.
  - Session 5. Spatial methods.

## Keynote Speakers



**Professor Melanie Johnston-Hollitt**

**Keynote Speaker (Physical in Perth)**

Curtin Institute for Computation (CIC)  
Curtin University, Australia



**Dr Filip Biljecki**

**Keynote Speaker (Physical in Perth)**

NUS Urban Analytics Lab  
National University of Singapore, Singapore



**Professor Yong Ge**

**Keynote Speaker (Online)**

Institute of Geographical Sciences and  
Natural Resources Research  
Chinese Academy of Sciences, China



**Dr Miguel González-Leonardo**

**Keynote Speaker (Online)**

El Colegio de México (COLMEX), Mexico;  
International Institute for Applied Systems  
Analysis (IIASA), Austria



**Dr Katarzyna Sila-Nowicka**

**Keynote Speaker (Online)**

University of Auckland, New Zealand



**Mr. Lalinda Karunaratne**

**Industry Keynote Speaker (Physical in  
Perth)**

Main Roads Western Australia, Australia



**Mr. Tom Bos**

**Industry Keynote Speaker (Physical in  
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Rio Tinto, Australia

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**Conference Chair**

Senior Lecturer, Curtin University,  
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**Short Course Lecturer**

Assistant Professor, University of  
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**Fred C. Sanders**

**Short Course Lecturer**

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**Fernando Benitez**

**Short Course Lecturer**

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**Liang Ma**

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**Muhammad Bilal Shaikh**

**Industry Chair**

Data Scientist, Edith Cowan  
University, Australia; CSIRO,  
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**Madelyn Cook**

**Technical Chair**

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**Omri Ram**

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<b>Tuyu Zhou</b>	Australian National University, Australia



## 2. Short courses

### Interactive Cloud Computing with Google Earth Engine and Geemap

No.  
6001

Qiusheng Wu

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#### Abstract

Google Earth Engine (GEE) is a cloud computing platform with a multi-petabyte catalog of satellite imagery and geospatial datasets. It enables scientists, researchers, and developers to analyze and visualize changes on the Earth's surface. The geemap Python package provides GEE users with an intuitive interface to manipulate, analyze, and visualize geospatial big data interactively in a Jupyter-based environment. The topics will be covered in this workshop include: (1) introducing geemap and the Earth Engine Python API; (2) creating interactive maps; (3) searching the GEE data catalog; (4) visualizing GEE datasets; (5) analyzing GEE datasets, and (6) exporting GEE datasets. More information about the geemap Python package can be found at <https://geemap.org>.

#### Keywords

Google Earth Engine, Cloud Computing, Big Data, Open Source, Geospatial

#### Reference

Wu, Q., (2020). geemap: A Python package for interactive mapping with Google Earth Engine. *The Journal of Open Source Software*, 5(51), 2305. <https://doi.org/10.21105/joss.02305>

#### Bio

Dr. Qiusheng Wu is a faculty member in the Department of Geography & Sustainability at the University of Tennessee, Knoxville. He is also an Amazon Visiting Academic and a Google Developer Expert (GDE) for Earth Engine. His research focuses on Geographic Information Science, remote sensing, and open-source software development. Dr. Wu is an advocate of open science and reproducible research. He has developed several open-source packages that have been widely used by the geospatial community, such as geemap, leafmap, and whitebox. More information about his research can be found at <https://wetlands.io>.

**Personal Website:** <https://wetlands.io>

No.  
6002

## Climate change will bring change and prosperity if we adapt to the changes and work together!

Fred Sanders

CPONH NGO research centre for scientific climate change adaptation programs, the Netherlands; Email: fredsanders.cponh@gmail.com

### Abstract

Climate changes is going to change the world, life and earth, and we have to adapt to it. Change often feels as negative, but changes are also the challenge of life to embrace positively. Of course climate change is not very positive, but we have to make it positive. Scientific research is needed on all fronts, on mitigation and adaptation measures and socially, it will change out lives, relation and prosperity in special in the cities where most of the world populations people live. For handling this challenge we have to use wisdom from other disciplines, from business schools, cultural schools, social and economic schools. Lets work together and create a better world for all species.

### Keywords

climate-change, adaptation

### Reference

Prof. Arjan van Timmeren MSc. Delft Un. of Technology.

### Bio

Fred is a coastal engineer with MBA and PhD in Climate change bottom-up civilian initiatives. Captain of the Dutch team in the H2020 MARIE CURIE program 'SOS Climate Waterfront' in which 160 EU researchers participate, including the Dutch team of 16 experts. He is a novelist of Dutch fiction and non-fiction, house-father and speaker if initiated. An outdoor man and traveller of all continents.

**Personal Website:** [www.cponh-sosclimatewaterfront.nl](http://www.cponh-sosclimatewaterfront.nl)

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No.  
6003

## The Turing way a tool for Reproducible Research and Open Science

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### Abstract

In a world of Open Data, AI tools, and a huge wave of new methods is hard to believe that projects coming out from our students are still in a stage where only a few or perhaps no one can reproduce the results., Reproducibility, reusability and overall, the concept of open science is still a mystery for most of our students. In an ideal world, all published results should be independently verifiable and easy to reproduce for other researchers or even the lecturer marking your assignment. For this to happen, the data and the code need to be harmonically integrated and shared to support the presented outcomes. Unfortunately, our students are not being taught data management, library administration, software development and continuous integration techniques



that allow organisations or projects to create openly available research outcomes. Regardless of the students' profiles and whether they rather keep working in academia or contribute within the private sector, concepts like GIT and version control are becoming essential for any spatial data scientist. Inspired by my experience in my recent Python lectures in the School of Geography and Sustainable Development, this short course aims to be an introduction to open science, reproducibility, version control, git, and GitHub. To cover this, we will use the Turing Way a comprehensive handbook that aims to provide all the information that researchers and data scientists in academia or provide sector need for reproducible research and open data science. Finally, this course will describe how these guidelines can be included in the GIScience field.

## Keywords

Reproducibility, Reusability, Open Science, Data Science, GIScience

## Reference

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## Bio

Lecturer in Spatial Data Science in the School of Geography & Sustainable Development at the University of St Andrews, Scotland. Fernando uses data science tools to develop new methods for spatiotemporal problems, focusing on data fusion methods and urban analytics. His current research focuses on developing spatial modelling methods that can be integrated within the epidemiologic-socio-economic models to tackle national and local policy questions.

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# 3. Advances in geospatial research and industries

## Simulating Built-up expansion in West Delhi with an integrated Neural Network and Agent Based-Prioritised Growth Model

No.  
6108

Aviral Marwal<sup>1</sup> and Elisabete Silva<sup>1</sup>

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### Abstract

The expansion of built-up areas is a complex phenomenon shaped by a range of factors that vary across space and time. While previous studies have been able to simulate existing land use through the coupling of ANN-ABM, the impact of futuristic development policies on land use simulation and prediction has largely been ignored. This can lead to an inaccurate assessment of land use and undermine the role of planning agencies in determining future land use patterns. To overcome this issue, this paper proposes an integrated ANN-ABM based Prioritized Growth Model applied to the West-Delhi region in Delhi that considers the roles of micro and macro agents in the region's expansion. The micro agents prioritize growth based on historical trends, which are computed using an MLP-Neural Network model, while macro agents prioritize growth based on futuristic planned interventions. The final conversion probability is derived based on the intensity of interaction between the micro and macro agents. Using the model to simulate land use for year 2021, we find higher accuracy in simulation ( $\kappa$  0.85) with planned interventions as compared to without ( $\kappa$  0.83). The model also predicts land use for year 2041 with and without consideration of planned interventions. The resulting change in spatial growth under these two scenarios is visualised through a change map, which identifies areas of gain and loss in the built-up area as growth patterns shift from a business-as-usual scenario to a planned growth scenario. The ANN-ABM prioritized growth model proposed in this study highlights the potential of planning interventions to shape future growth patterns. By providing insights into where future growth is expected to occur and how it can be channelled to prioritized locations, the model can be a useful tool to effectively measure, evaluate and manage the planning interventions.

### Keywords

Agent Based Model, Neural Network, Planning, Simulation

### Reference

### Bio

Aviral is a 3rd year PhD student at the Department of Land Economy, University of Cambridge, under the supervision of Professor Elisabete Silva. His research focuses on cities in the global

south, with an emphasis on understanding the interplay between travel, built environment, and accessibility to public services. In addition to utilizing geospatial modeling techniques such as GIS and R, Aviral’s research employs advanced tools of agent-based and neural network simulations to simulate future urban forms. Prior to pursuing his PhD, he earned a Master’s degree in Development Policy and a Bachelor’s degree in Engineering from IIT Delhi.

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No.  
6103

## **Timber Urbanism: Assessing the carbon footprint of mass-timber, steel, and concrete structural prototypes for peri-urban densification in the Hudson Valley’s urban fringe**

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<sup>1</sup>Columbia University, USA; Email: ek3130@columbia.edu

### **Abstract**

The current fossil-fuel based urbanization pattern and the estimated human population growth are increasing the environmental footprint on our planet’s precious resources. To mitigate the estimated skyrocketing in greenhouse gas emissions associated with the construction of new cities and infrastructure over the next 50 years, we need a radical rethink in our approach to construction to deliver a net zero built environment. This paper assesses the carbon footprint of a mass-timber, a steel, and a concrete structural alternative for peri-urban densification in the Hudson Valley’s urban fringe along with examining the updated policy and the building code adjustments that support synergies between timber construction in city making and sustainable management of timber forests. By quantifying the carbon footprint of a structural prototype for four different material assemblies—a concrete (post-tensioned), a mass timber , a steel (composite) and a hybrid (timber/steel/concrete) assembly applicable to the three new building typologies of the IBC 2021 (Type IV-A, Type IV-B, Type IV-C) that range between a nine to eighteen-story structure alternative—and scaling-up that structural prototype to the size of a neighborhood district, the paper presents a quantitative and a qualitative approach for a forest-based construction economy as well as a resilient and a more just supply chain framework that ensures the wellbeing of both the forest and its inhabitants.

### **Keywords**

mass-timber innovation, concrete structure , carbon footprint, densification

### **Bio**

Eleni Stefania is a New York-based architect-engineer and urban designer focused on designing and building more efficient, intelligent, sustainable buildings and cities. She graduated from Columbia University Graduate School of Architecture, Planning, and Preservation (GSAPP) with a Master of Science in Architecture and Urban Design (Class 2020), where she focused on performance-based architecture and city-making after having previously completed a five-year degree in Architectural Engineering from National Technical University of Athens (NTUA), Greece, focusing on building-simulation of timber structures, energy conservation, and sustainability in buildings and urban landscapes.

For her sustainability commitment from an ecologically conscious Performance-Oriented Architectural Perspective during her studies in NTUA, she was awarded the Stavros Niarchos architecture internship to the Platinum LEED certified masterplan of the National Opera and Library Complex in Athens, Greece (Renzo Piano Workshop Design Team) Eleni has over six years of

experience as an interdisciplinary designer on civic, cultural, institutional, and infrastructural projects that seek energy autonomy by utilizing the site's natural flows to restore balance with their larger ecological context. Her international projects concern issues of building performance for complex facades, grid shells, membrane structures, and diverse, complex structures, as well as water conservation, deindustrialization, environmental degradation, adaptive reuse, and the design of cultural landscapes that enabled her to synthesize new readings of natural systems, and identify the flows and dynamics that shape the world today and therefore helped her to envision projects that are consonant with the deep context of a place, its scale, its materiality, its broader environmental-socio political and economic agendas. She has served as a reviewer and contributor for several academic magazines and professional architecture conferences, such as Columbia GSAPP's "Urban Mag", GreenBuild Conference and Expo 2023 and UIA World Congress of Architects Copenhagen 2023, peer-reviewing publications on building technology and climate adaptation for Professor Billie Faircloth & Maibritt Pedersen Zari scientific panel.

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## Lessons from Chongqing: Public Rental Housing and Family Lives of the New Citizens

No.  
6107

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### Abstract

The 20th National Congress of the Communist Party of China called for the establishment of a new housing system featuring both home ownership and rental housing. It urged local governments to increase the supply of Public Rental Housing and make it available to new citizens, i.e., migrant workers and families. However, empirical answers about how Public Rental Housing can help new citizens take root in the cities and how it improves the overall well-being of the new citizens need to be clarified. The recent decision on the Public Rental Housing provision is mainly based on foreign experience and reflection on the effect of subsidized home ownership. Further evidence about the societal impact of the policy implementation is needed to promote the housing program on a large national scale. Based on empirical studies in Chongqing, this paper contributes by revealing the impact of Public Rental Housing on improving economic opportunities, increasing consumption and improving life quality, enhancing childbirth intention and improving upbringing style, as well as enhancing the sense of security and happiness. The paper maintains that such effect comes from policy details in affordable rent, the tenancy of unlimited duration, open eligibility, and access to public schools. These policy effects and implementation details should be considered in the national promotion of the Public Rental Housing program.

### Keywords

Public Rental Housing, housing policy, family life, new citizen, Chongqing

### Reference

### Bio

Weijie HU is a Lecturer in Architecture at Swinburne University of Technology, Australia. He holds a PhD in Architecture from the University of Sydney, Australia, and an MSc. in Architecture, Building and Planning at the Eindhoven University of Technology, the Netherlands. His research interest concerns urbanisation, social housing, land politics in China, and architectural

& urban design. Weijie’s writing has been published in many Q1 journals, including *Urban Geography*, *Journal of Urban Affairs*, and *Town Planning Review*. He regularly acts as a peer reviewer for these journals too. In 2017 and 2018, Weijie was a visiting scholar at Kanazawa University, Japan and the Chinese University of Hong Kong, where he was awarded research grants, including the Global Scholarship Programme for Research Excellence (2017-2018) and the JASSO Scholarship (2017).

Before joining the Swinburne University of Technology, he taught Architecture and Urbanism at an undergraduate & postgraduate level at the University of Sydney, the University of New South Wales, and Western Sydney University since 2016. He is also a registered architect in the Netherlands with working experiences in China, France, and the Netherlands. The projects he led and participated in have been awarded in Building of the Year Award ArchDaily (2017)S, ARCH 2017 AWARDS (2017), and the International Rural Architecture Award (2015). Weijie’s solo work about housing has been exhibited at Melbourne Design Week (2022).

No.  
6109

## Achieving net-zero material consumption to build future cities

Yupeng Liu<sup>1</sup>, Kangning Huang<sup>2</sup>, Wei-Qiang Chen<sup>1</sup>, and Karen Seto<sup>3</sup>

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### Abstract

Net-zero material consumption is one of the keystones for creating a zero-emission future. However, the anticipated population growth and global urbanization will create a vast demand for constructing new housing, commercial buildings and accompanying infrastructure. Such huge size of construction, especially in developing worlds, is expected to release 226 gigatonnes (Gt) of greenhouse gas emissions (GHGs) by 2050 — more than twice the amount used in existing infrastructure and claiming ~28% of the remaining carbon budget. The fundamental solutions are to reduce consumption of mineral-based construction materials and/or replace them by bio-based materials (e.g., wood). Such strategies could be named as ‘material-saving wedges’ according to the substantial synergy effect of material use reduction and carbon emission mitigation. However, we still have little understanding of how future building growth and urban form changes would manifest material use. Our primary goals in this study are to develop possible scenarios of future building growth and urban form and to estimate potential material use among different global and urban futures. Here we develop a dynamic and spatially explicit model to predict volumetric change of global building environment through 2050. We find global buildings will enlarge to 1.5 times of current size by 2050 and grow faster in volume than in lateral. Most of the developed and developing regions will experience a ‘net’ increase in building stock except for Europe. The largest amount of building expansion will occur in Asia and the fastest speed of building expansion will take place in Africa. At a region or single city level, we find five possible changing typologies based on the characteristics of building growth or shrinking, which are termed as upward and outward, mature upward, stabilized, mature flatted, and shrinking. We further estimate materials demand for future construction and renovation. We find the built-up infrastructure will essentially be ‘rebuilt’ once over next 30 years, which could lead to a total of 30% growth of in-use anthropogenic mass on the earth. However, we find a net-zero raw material consumption can be achieved based on the synergy of five ‘material-saving wedges’, including reduce demand for living/working space (-17±7%), life extension of in-use buildings (-16±6%), follow ‘material diet’ approach (-41±27%), reuse and recycle those debris from demolished buildings (-16±5%), and apply prefabricated construction technology (-1±0.5%) globally. Among them, the material diet approach could fundamentally change future structure of materials use——leading to a growing

demand on environment-friendly materials (e.g., wood) but significantly reducing demands on carbon-intensive and heavy-weight materials (e.g., steel and concrete). These findings indicate that as one of the climate stabilization wedges, the material-saving wedge is expected to profoundly affect materials supply chain and prices and makes great help for building sustainable cities and the world if we could take great advantage of them.

## Keywords

Urbanization, Urban form, Building stock and flow, Material use, Climate stabilization wedge

## Reference

## Bio

Dr. Wei-Qiang Chen is a professor of Resources and Urban Sustainability at the Institute of Urban Environment, Chinese Academy of Sciences (CAS). He obtained his bachelor and PhD degrees in Environmental Science and Engineering from the School of Environment at Tsinghua University, Beijing, and was working at the Yale School of Forestry and Environmental Studies during 2010-2015. His research focuses on material-energy nexus, sustainable management of materials and urban sustainability. His studies have been published in PNAS, Nature Communications, Environmental science and Technology, and other first-level journals. He served in the board of the International Society for Industrial Ecology during 2018/01-2020/21, and was the founding president of the Chinese Society for Industrial Ecology built in 2015. He is now serving as associate editor for the journals Resources, Conservation, and Recycling and Journal of Industrial Ecology.

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## Prediction of Lived Public Space

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No.  
6102

## Abstract

The city consists of facilities and data in many different layers produces own habits and own spaces in each layer. Public space limited to certain definitions in urban areas may not always meet that definition in its own physical boundaries. The questions of whether the spaces defined as public space are really public, to what extent are public and whether the city produces its own publicity has been the motivation of this study. The production of the city's own public space is possible with the different combinations of the attributes that make up the city and the unique relationships they create. While the city produces its own public space, this production process takes place not only on the real space, but through the representation of the space together with the location-based data generated by mobile technologies. When the production of public space or the production of publicity in an existing space is examined within the context of Henri Lefevbre's space production, each production creates its own spaces and every experience produces new symbols and new images. In this case, how can an individual who is on the move in the city know the publicity of his location? In order to evaluate this publicity in a space produced by the city itself, the units and the relationships between them have been tried to be examined using data mining methods. In this study, it has been accepted that the characteristics of walking distance will affect the lived public space value of location or this reason, the movement area of a variable position user is defined as a 500m diameter circle. In order to calculate the lived publicity

value of the continuously variable position of this circle, the study area is divided into pixels over which the circle will move. Attributes evaluated within these concepts are primarily divided according to their functions. Therefore, the data analytical question of the study is prediction of the lived public space value in any location over the numerical range of the photographs viewed.

## Keywords

Data Mining, Public Space, Lived Space

## Reference

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Toscano, P.: Instagram-city: new media, and the social perception of public spaces. Visual anthropology 30(3), 275- 286 (2017)

## Bio

I graduated from Istanbul Technical University, Architecture and Landscape Architecture with a double major program in 2012. I completed my master's degree in Architectural Design Program at Istanbul Technical University in 2015. Last term, I completed Ph.D. courses and passed the proficiency exam at Istanbul Technical University, Architectural Design Computing Ph.D. Program. During my Ph.D., I focused on circular cities, micro-mobility, and public space with a data analytic approach.



# Using Natural Language Processing to Identify Key Planning Strategies from Government Documents – A Case Study of 117 Chinese Cities from 2011 to 2019

No.  
6110

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## Abstract

Inter-city development disparity is a salient issue for both developed and developing countries. A causal determination of whether and to what extent variations in planning policies lead to different outcomes remains an onerous analytical challenge. Quantitative modelling of such causality requires the identification of a bundle of planning strategies from text-based planning documents in a holistic and temporally consistent manner such that the evolution of development outcomes could be investigated in relation to planning policy changes over time. Enabled by recent progress in natural language processing (NLP), this paper presents a novel NLP application for identifying key planning strategies from a large amount of text-based government documents through a case study of 117 prefecture-level cities in China. Based on official, city-level government reports from 2011 to 2019, the evolving policy strategies are identified and linked with the change of development outcome. Policy implications and directions for future research are discussed.

## Keywords

Urban Planning, Natural Language Processing, Human-machine collaborated

## Reference

## Bio

PhD Candidate at Department of Land Economy, University of Cambridge.

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## A coupling model for measuring the substitution of subway for bus during snow weather: a case study of Shenyang, China

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No.  
6104

## Abstract

The development of integrated public transportation network has received widespread attention in recent years. Especially in global northern cities, improving the substitution of subway for bus could meet the population travel demand during snow weather, which minimized the impact of snow weather on the public transportation network. Therefore, in this study, we selected a Chinese northern city-Shenyang as a case study. For obtaining the population travel demand, we collected the actual population flow data in the morning and evening peaks during snow weather. The network analysis was used to identify the loopholes and key stations in the subway and bus networks, respectively. And a coupling model was built to measure the coupling value of each

station in subway and bus networks, according to its population travel demand and supply capacity, which in further measure the substitution of subway for bus in the morning and evening peaks during snow weather. The results indicated that some subway stations were in a coupling state, while their surrounded bus stations were in a decoupling state. These subway stations could replace the bus network to reduce the impact and damage of snow weather on public transportation network. However, some subway stations and the surrounded bus stations were all in a decoupling state, which were under great pressure to meet the population travel demand during snow weather. This study can provide insight into optimizing public transportation network planning and design in many northern regions.

## Keywords

Coupling model, Substitution of subway for bus, Snow weather condition, Network analysis

## Reference

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Molarius, R., Keränen, J., Kekki, T., & Jukarainen, P. (2022). Developing Indicators to Improve Safety and Security of Citizens in Case of Disruption of Critical Infrastructures Due to Natural Hazards—Case of a Snowstorm in Finland. *Safety*, 8(3), 60.

Xu, X., Zhu, C., Wang, Q., Zhu, X., & Zhou, Y. (2020). Identifying vital nodes in complex networks by adjacency information entropy. *Scientific reports*, 10(1), 1-12.

## Bio

Dr. Jie Liu has graduated from Harbin Institute of Technology, with a doctoral degree in Management Science and Engineering. Dr. Liu has worked and studied in Tsinghua University and University of Cambridge as a visiting scholar. Over the past 10 years, she has gained extensive project management experience in research projects related to flood vulnerability based on land-use patterns, community recovery to earthquake, road network vulnerability to floods, dynamic resilience of local roads, the effects of extreme weather on driver behavior, and the relationship between stress reactivity and unsafe driving. As an associate professor and doctoral supervisor, Dr. Liu has served as PI/Co-PI and Co-Investigator on a broad range research projects sponsored by state, province, and local government agencies.

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# Success factors impacting strategy- and governance frameworks for environmental digital twins in the mining industry.

No.  
6112

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## Abstract

Rio Tinto provides the metals and minerals used to help the world grow and decarbonise with a strong focus on iron ore in the Pilbara region, situated in Western Australia. We do this in a responsible way: finding better ways is in our DNA. Use of spatial information and -technology is widespread in the mining industry with applications in all stages of the mine life cycle. Driven by several factors, Rio Tinto currently focuses on the development geospatial applications supporting environmental protection: environmental digital twins. There is a growing awareness in the mining industry that a regional approach is required for assessing and monitoring the cumulative impact in order to obtain approval for access to land and future ore bodies in more efficient and sustainable way. This awareness is a key-factor in driving the need for the development of an environmental digital twin. Furthermore, the shift in focus in recent years regarding the ‘Social License to Operate’ (SLO) from obtaining legitimacy and credibility to obtaining trust, drives the transition to more interactive decision making and consequently higher levels of information transparency are needed. Both developments are further amplified by remotely sensed data becoming increasingly available at a commercially viable price-point as well as recent technological advancements making it possible to integrate, analyse and distribute information in an environmental digital twin. In order for environmental digital twins to produce valuable information products, the dependency on data is evident. The data volumes and associated domain-specific maintenance workflows needed to support environmental digital twins over extensive time periods, spanning decades in the mining industry, present several challenges which lead many organisations, including Rio Tinto, to evaluate and adjust their strategy- and governance frameworks supporting (future) environmental digital twins. At the moment, Rio Tinto is conducting qualitative research into success factors that impact strategy- and governance frameworks for environmental digital twins. Key-findings to date include the identification of a need for a clear definition and a dedicated strategy- and governance framework as an enabler for the digital twin environment supporting one or more environmental digital twins. In addition, concepts such as federated governance and data meshes, which have the potential to support more collaborative forms of data management whilst allowing for continuous change and decision making by multiple stakeholders, are being actively researched.

## Keywords

environmental digital twin, success factors, governance

## Reference

## Bio

Enthusiastic GIS professional working in the role of Principal Advisor GIS for Rio Tinto Iron Ore with a drive for innovation and technological progress. I consider it both an honor and a joy to be working on location-based solutions with colleagues and partners and I still learn something new every day. Driven by a curiosity into what makes digital twins into a success, I’m studying GIScience (UniGIS) at the Vrije Universiteit Amsterdam where I’m hoping to finish my Master’s

in 2024. Outside of work and study, I enjoy mountain biking on the beautiful trails in Western Australia.

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No.  
6111

## Study on the impact of smart city construction to the green and high-quality development of cities

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### Abstract

Over the last years, with the accelerated development of the new-type urbanization in China, some cities are experiencing traffic congestion, housing tension, resource shortage, environmental pollution, and other problems, which restrict the sustainable and healthy development of cities. As a new model of urban development, smart city construction promotes urban innovation-driven development, accumulates economic growth momentum for cities, strengthens social support functions, enhances ecological and environmental performance, and also promotes the intersection and integration of green development and high-quality development of cities. Based on the theories such as New Schumpeterian growth theory and Porter's economic development stage theory, in the context of the development of new-type urbanization in China, this paper explores the influence of smart city construction on the green high-quality development of cities. This paper constructs a Difference in differences(DID) model based on the propensity score matching method, and empirically tests the positive effect of smart city construction on the green high-quality development of cities and the positive moderating effect of local government financial input in science and technology on the main effect using panel data of 156 prefecture-level cities in China, as well as the two dimensions of regional and administrative levels to heterogeneity analysis of the effect of smart city construction. Based on the empirical findings, this paper will make recommendations accordingly for the key work of smart city construction under the background of accelerated development of new-type urbanization in China.

### Keywords

Smart cities, Urban green and high quality development, DID, Heterogeneity analysis

### Reference

### Bio

Shilong Li is an associate professor at Chongqing University, China, and he is a visiting scholar at University of Michigan. His research is focus on the urban regeneration, environmental regulation and urban governance.

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# Transforming Urban Futures: AI Advancements in Master Planning for Sustainable Cities

No.  
6114

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## Abstract

The field of artificial intelligence (AI) has witnessed significant advancements that hold great potential to shape the future of cities, particularly in the domain of master planning. This abstract highlights the transformative impact of AI on urban master planning, showcasing its significance within the conference theme, "Geospatial Big Data and Artificial Intelligence for Cities." Master planning plays a crucial role in the development and evolution of cities. Traditionally, this process has relied on manual analysis and subjective decision-making, often leading to inefficiencies and suboptimal outcomes. However, the integration of AI technologies, such as machine learning, deep learning, and data analytics, has revolutionized the field, enabling a data-driven and more efficient approach to master planning. AI algorithms can leverage geospatial big data to analyze and interpret vast amounts of information related to urban environments. By processing diverse datasets, including satellite imagery, sensor data, demographic information, and infrastructure data, AI can provide valuable insights into various aspects of city development. This includes land use patterns, transportation networks, population density, environmental factors, and infrastructure requirements. The use of AI in master planning enables planners and policymakers to make informed decisions based on comprehensive and accurate data analysis. It allows for the identification of trends, patterns, and potential risks, empowering urban planners to forecast future scenarios and develop strategies that promote sustainable growth, resilience, and livability. Additionally, AI algorithms can optimize resource allocation, considering factors such as energy consumption, waste management, and water distribution, leading to more efficient and sustainable urban development. Moreover, AI facilitates scenario modeling and simulations, allowing for the exploration of multiple design options and their potential impacts. By considering various parameters and constraints, AI algorithms can generate alternative master plans, evaluating their feasibility and performance. This iterative process enables planners to assess the effectiveness of different strategies, supporting evidence-based decision-making and enhancing the overall quality of master plans. Furthermore, AI can improve citizen engagement in the master planning process. By integrating geospatial big data and AI-powered platforms, citizens can actively participate, provide feedback, and contribute to the planning process. AI algorithms can analyze public sentiment, extract valuable insights from citizen feedback, and incorporate them into the decision-making process. This inclusive approach fosters transparency, accountability, and a sense of ownership among the community, ultimately leading to more sustainable and citizen-centric cities. In conclusion, the advancements in the AI field, specifically in master planning, have the potential to shape the future of cities. By leveraging geospatial big data and AI algorithms, urban planners can make informed decisions, optimize resource allocation, and develop sustainable and resilient cities. This abstract aligns with the conference theme, "Geospatial Big Data and Artificial Intelligence for Cities," by emphasizing the pivotal role of AI in transforming the master planning process. It sets the stage for further exploration of AI applications in master planning and underscores the significance of this research for building cities that are both technologically advanced and human-centric.

## Keywords

Advancements in AI, Future of cities, Data-driven decision-making, Scenario modeling, Geospatial big data

## Reference

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## Bio

As a Remote Sensing & GIS Analyst, I am a recognized rising star in the field, honored as one of the Geospatial World 50 Rising Stars 2023. With expertise in integrating GIS and earth observation data, I excel in managing geodatabases and executing projects involving historic change analysis, land use suitability, watershed analysis, and spatial data pre-processing. Collaborative and driven, I have a Master's degree in Remote Sensing & GIS from the University of Science & Technology, where I developed an integrated GIS optimization framework for intelligent traffic signal systems. I have conducted research on forest cover change, evapotranspiration, and urban sprawl. With hands-on experience as a GIS Assistant and Remote Sensing & GIS Expert, I have executed image classification, land suitability analysis, and digitization processes. Proficient in ArcGIS, ERDAS Imagine, and Python, I am adept at complex spatial analysis. I hold certifications from the European Space Agency and Google. Fluent in Urdu and with advanced English skills, I am an effective communicator. Passionate and accomplished, I leverage geospatial technology for informed planning and decision-making.

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No.  
6113

## Enhancing Workplace Productivity Through Evidence-Based Design

Ivy Chang<sup>1</sup>

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## Abstract

Profound research has shown that the physical environment of a workplace can impact productivity, creativity, and overall satisfaction of the employees. The claims of office building and business district users for healthy, habitable, and productive workspaces have been constantly hidden in many urban projects due to deficient understanding of the complex user needs and spaces during the initial procurement and design stages of a construction or renovation project. One of the primary reasons for this gap is the traditional approach to urban analysis and urban design, which tends to focus on aesthetics and functionality while overlooking the social and organizational implications of urban fabrics and urban design choices. As a result, many spaces end up being inefficient, uncomfortable, and even harmful to the health and well-being of their occupants. By utilizing innovative evidence-based design methods, this research takes Shenzhen Futian Central Business District as an example and adapts space performance evaluation based on space syntax to systematically consider the social and organizational implications of urban design choices. The outcome will be a feedback loop that ensures responsive urban design to the needs of the end users, by enabling analysis of varied occupant needs and providing intuitive feedback to urban designers.

## Keywords

Space Syntax, Geospatial Analysis, Evidence-based Urban Planning and Design

## Reference

## Bio

I'm a graduate of University of Huddersfield, and are passionating about social impacts and spatial justice of urban planning and design. I possess a wealth of knowledge and experience in developing strategies and solutions to enhance the livability and sustainability of urban environments. In these years, I dedicate myself in conducting research to inform the development of innovative design strategies, policies, and solutions to improve urban living conditions.

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### Using social media photographs deep learning to assess cultural ecosystem services for high-density urban green space management: Case from Central Beijing

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No.  
6105

## Abstract

In the high-density urban context, urban green spaces are a valuable public resource for improving local human well-being. The fine government of urban green spaces in the high-density urban context is challenging due to limited spatial resources. In the search for effective governance, there is a need to identify the cultural ecosystem services (CES) as benefits and place attachments that people gained and perceived from urban green spaces. Focusing on central Beijing as the case study, we addressed four key questions: How to use social media photographs combing with deep learning to assess public perceived CES efficiently? What's the spatial pattern of the CES that people perceived in central Beijing? Which kind of CES is most perceived by the public and how does this CES relate to current urban green and blue spaces in central Beijing? We used geo-tagged digital images that local people posted on the Littleredbook web platform to identify spatial patterns of CESs that people perceived in central Beijing. Using deep learning image analysis, social media photos were categorized into nine types of CESs. The nine CESs were analyzed by combining contingency tables, kernel densities, and correspondence analyses with land cover and landscape features. Results were discussed in light of findings derived from other CES spatial mapping and assessment studies. Social Recreation was the main CES perceived by people in central Beijing, followed by natural appreciation while few photographs depicted educational engagement. The spatial distribution of these CESs is associated with different social and biophysical landscape features, such as the presence of vegetation types and recreational attractions in central Beijing. Meanwhile, the social recreation values are provided more by micro-green spaces in built-up areas than by urban parks and forests. Our results demonstrate that combing deep learning and social media photographs is useful for assessing cultural ecosystem services at the megacity scale. These findings could help planners to approach public perceptions in relation to socio-cultural and bio-physical landscape features comprehensively, to foster more effective and inclusive urban green spaces management strategies in the high-density urban context.

## Keywords

high-density urban context, social media, deep learning, cultural ecosystem services, green space management

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## Bio

Dr. Haiyun Xu. is an Associate Professor at the Department of Landscape Architecture, Beijing University of Civil Engineering and Architecture. She studied Cultural Landscape at the Universities of Copenhagen and Gottingen and received a Ph.D. in Landscape Architecture and Urban Planning (2020) at the University of Copenhagen. She is a Young Scholar of the Beijing Overseas Talent Project. Her research aims at promoting sustainability in landscape planning management through a deeper understanding of the interrelationships between nature-social ecosystem services and landscape change. Her current studies focus on topics including cultural landscape and cultural ecosystem service, cultural route, and heritage corridor, green infrastructure planning and management, public participation in landscape planning and management, public perceptions and landscape democracy, and regional sustainable development.

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## The green system design under the definition of coastal city

No.  
6101

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## Abstract

This paper was focus on resilience for energy damage reduction, increase of retention and conversion landscape energy, and enhancement of urban resilience to make the urban city part of the ecosystem through the design of relevant urban resilience systems. In such context, a research to reduce disasters and increase the efficiency of energy conversion in the ecosystem is conducted. The key cities studied are mainly places I've investigated, with Shanghai, Singapore, San Francisco and Chennai as the main cases. Research Objectives Scope 1: To design an ecological framework on the resilient basis to increase resilience and uncertainty of cities in response to the hazards of sea level rising and climate warming, and to set resilient system recovery indicators and evaluation coefficients for resilient systems with operability. Scope 2: Based on the shoreline and tidal conditions of different Pacific cities, the paper studies how to convert landscape energy under different urban textures and provide specific design strategies and conversion process in the form of prototype.

## Keywords

Urban Resilience, Green system, Green Prototype

## Bio

Education: MAUD&MLA(2015-2019)

National University of Singapore Master of Arts in Urban Design

Nanjing Forestry University Master of Landscape Architecture

Work Experience (2020.07-NOW)

Jiangsu Provincial Planning and Design group Landscape Architecture and Tourism Planning Department NanJing, P. R. China

Urban planner: Focus on landscape ecology planning, City master plan, Regional Tourism planning, Site Planning (constructive-detailed planning), Conservation of historic sites, Residential Area Planning

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## Lessons from Chongqing: Public Rental Housing and Family Lives of the New Citizens

No.  
6107

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## Abstract

The 20th National Congress of the Communist Party of China called for the establishment of a new housing system featuring both home ownership and rental housing. It urged local governments to increase the supply of Public Rental Housing and make it available to new citizens, i.e., migrant workers and families. However, empirical answers about how Public Rental Housing can help new citizens take root in the cities and how it improves the overall well-being of the new citizens need to be clarified. The recent decision on the Public Rental Housing provision is mainly based on foreign experience and reflection on the effect of subsidized home ownership. Further evidence about the societal impact of the policy implementation is needed to promote the housing program on a large national scale. Based on empirical studies in Chongqing, this paper contributes by revealing the impact of Public Rental Housing on improving economic opportunities, increasing consumption and improving life quality, enhancing childbirth intention and improving upbringing style, as well as enhancing the sense of security and happiness. The paper maintains that such effect comes from policy details in affordable rent, the tenancy of unlimited duration, open eligibility, and access to public schools. These policy effects and implementation details should be considered in the national promotion of the Public Rental Housing program.

## Keywords

Public Rental Housing, housing policy, family life, new citizen, Chongqing

## Reference

## Bio

Weijie HU is a Lecturer in Architecture at Swinburne University of Technology, Australia. He holds a PhD in Architecture from the University of Sydney, Australia, and an MSc. in Architecture, Building and Planning at the Eindhoven University of Technology, the Netherlands. His research interest concerns urbanisation, social housing, land politics in China, and architectural & urban design. Weijie's writing has been published in many Q1 journals, including Urban Geography, Journal of Urban Affairs, and Town Planning Review. He regularly acts as a peer reviewer

for these journals too. In 2017 and 2018, Weijie was a visiting scholar at Kanazawa University, Japan and the Chinese University of Hong Kong, where he was awarded research grants, including the Global Scholarship Programme for Research Excellence (2017-2018) and the JASSO Scholarship (2017).

Before joining the Swinburne University of Technology, he taught Architecture and Urbanism at an undergraduate & postgraduate level at the University of Sydney, the University of New South Wales, and Western Sydney University since 2016. He is also a registered architect in the Netherlands with working experiences in China, France, and the Netherlands. The projects he led and participated in have been awarded in Building of the Year Award ArchDaily (2017)S, ARCH 2017 AWARDS (2017), and the International Rural Architecture Award (2015). Weijie's solo work about housing has been exhibited at Melbourne Design Week (2022).

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## Hotspot Analysis of Oil Spill Events Using GIS; A Case Study of Niger Delta, Nigeria

No.  
6106

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### Abstract

Oil spills are globally becoming a threat to the environment and various ecosystems. They may result from accidental discharges, or malicious acts of vandalization. Hotspots analyses of these oil spills via GIS spatio-temporal techniques are efficient and effective for mapping the high intensity or frequency in an area. This is done by correlating each feature within the context of its neighbours and ensure not just high values, but also statistically significant prominence. It further helps to depict if high or low values cluster spatially. Oil spill data from the agency in charge of oil spill events in Nigeria, the National Oil Spill Detection and Response Agency (NOSDRA) was collected and processed to generate the hotspot maps and Inverse Distance Weighted (IDW) maps for the oil-producing Niger Delta states in Nigeria. In addition, the volumes piled and recovered were also plotted within the ArcGIS environments for visual understanding. Finally, 1km buffers were applied to each of the spill points to estimate the areas that would be impacted by these spill events. Oil spill hot spot maps can most effectively guide the actions and plans of environmental activists, government, police and policy makers and help prepare for possible future oil spills.

### Keywords

Oil spills, Spatio-temporal, Hotspot analysis, Inverse Distance Weighted interpolation, Buffer, Niger Delta

### Reference

### Bio

A PhD research student interested in the application of GIS to Geosciences, with focus on environmental pollution, groundwater quality and sustainable management of water resources.

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## 4. Geospatial big data and AI

### How COVID-19 Impacts Air Pollution Exposure Among Disadvantaged Communities? Leveraging Crowd-Sourced Geospatial Data to Develop Healthy Communities

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No.  
6205

#### Abstract

The COVID-19 pandemic has revealed global structural inequalities and deepened environmental injustice and health disparities, hindering the healthy city development. For example, air pollution has disproportionately impacted disadvantaged communities (often with high proportion of low-income and people of color members). While the lockdown measures and other restrictions may alleviate air pollution emissions and exposure, questions remain on whether this is true for disadvantaged communities. I used a crowd-sourced open data from the PurpleAir website (one of the widely used low-cost sensor networks) and data from CalEnviroScreen 4.0 (a tool to identify disproportionate burden of pollution in California, US). I investigated the air pollution concentrations (i.e., Particulate Matter 2.5 [PM2.5]) by dividing the Los Angeles County into eight regions with a focus on comparison before and during the COVID-19 pandemic (March 2019-March 2020 vs. March 2020 vs. March 2021). While disadvantaged communities are the most susceptible to hazardous events, low-cost air pollution monitors were lacked. I found that a notable decline of air pollution exposure appeared during the study period; however, some disadvantaged communities experienced higher-than-average concentrations when lockdown measures were lifted. Disadvantaged communities had a higher percentage of days over 35  $\mu\text{g}/\text{m}^3$  than non-disadvantaged communities. Particularly, in the San Fernando Valley region in 2019, the gap could be as high as 45%. This study confirmed that lower air pollution concentrations were shown in non-disadvantaged communities as compared to disadvantaged communities. Overall, while the lockdown restrictions were a catalyst for a decrease in particulate concentration levels, the disparity between disadvantaged and affluent communities is still apparent. This study highlights the feasibility of using crowd-sourced geospatial data to identify air pollution exposure disparities. Additionally, this approach can be extended to other jurisdictions and geographic scales to assess environmental injustice and health inequity, thus promoting healthy and resilient city planning.

#### Keywords

Crowdsourcing, low-cost sensors, environmental justice, disadvantaged communities, COVID-19

#### Bio

Dr. Tianjun Lu is an Assistant Professor in the Department of Earth Science and Geography at California State University, Dominguez Hills. He received his Ph.D. in Planning, Governance, and

Globalization from Virginia Tech and was a Research Scientist at the University of Washington. Dr. Lu's recent work has been published in *Transportation Research Part D: Transport and Environment*, *Environmental Science and Technology*, and *Science of the Total Environment*. His scholarly contribution mainly falls into multidisciplinary fields including transportation planning, air pollution exposure assessment, environmental justice, and community engagement. Dr. Lu has rich experience in developing nationwide air quality models funded by the US Environmental Protection Agency (i.e., air pollution exposure models in the continental US), community-level air quality project funded by the Minneapolis Department of Health, MN and CSUDH, and community-based transportation measurements and modeling work funded by US Department of Transportation. Currently, he has served as the primary investigator for multiple funded projects in California, including the California telecommuting project to identify statewide patterns and trends of telecommuting, climate and environmental impacts of warehousing, and the Community Air Monitoring Program in Southern California.

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No.  
6211

## Opportunities and Challenges of Geospatial Artificial Intelligence Foundation Models in the Context of ChatGPT Large Model

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### Abstract

The integration of geospatial artificial intelligence (AI) base models within the ChatGPT's large-scale model holds tremendous potential, offering opportunities and challenges for geospatial analysis and decision-making. This paper explores the potential benefits of integrating geospatial AI base models, including enhanced spatial understanding, integration of heterogeneous data sources, and improved spatial reasoning and prediction.

By incorporating geospatial AI base models, ChatGPT can gain a deeper comprehension of spatial relationships and patterns. This enhanced spatial understanding enables more accurate analysis of geospatial data, such as satellite imagery, GPS coordinates, and geospatial databases. Additionally, the integration of heterogeneous data sources, such as social media data, weather data, and transportation information, allows for a more comprehensive and holistic geospatial analysis. Moreover, geospatial AI base models contribute to improved spatial reasoning and prediction. By machine learning techniques, these models can identify spatial trends, forecast future scenarios, and provide valuable insights for urban planning, environmental management, and disaster response.

However, leveraging geospatial AI base models to their full extent within the ChatGPT framework presents several challenges, such as data quality and quantity, computing and scalability, interoperability and integration, as well as ethical and privacy concerns associated with big data. To mitigate these challenges and maximize the opportunities presented by geospatial AI, this paper proposes several strategies, including optimizing and refining the geospatial AI base models through advanced training techniques, integrating geospatial libraries and tools into the ChatGPT framework, fostering interdisciplinary collaborations between geospatial experts and AI researchers, and addressing ethical and privacy concerns through responsible data governance and privacy-preserving techniques.

The findings of this paper shed light on the current research landscape and provide insights for researchers and practitioners seeking to harness the potential of geospatial artificial intelligence within the ChatGPT's large-scale geospatial analysis and decision-making models.

## Keywords

Geospatial artificial intelligence (AI), ChatGPT, Spatial analysis, Big data

## Bio

Can Zhang is a PhD student at Faculty of Architecture, the University of Hong Kong. Her research interests include urban building energy model, sustainable development, zero carbon building and big data in the construction industry.

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## Investigating Non-linearity of Spaceborne Hyperspectral Datasets through Dimensionality Reduction Approaches

No.  
6215

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## Abstract

Spaceborne hyperspectral remote sensing has been revived with the launch of new sensors in the last five years. With a wide swath and lower repeat time, the plethora of data brought in by these sensors can facilitate obtaining detailed thematic information about the Earth's surface resources and their continuous monitoring. Although such datasets represent the five Vs of geospatial big data, these Vs can be problematic for hyperspectral data handling, especially volume, which introduces feature repetition, inconsistency and high computation costs in information extraction. Developing new data compression or dimensionality reduction methods becomes necessary in this context. Moreover, traditional approaches such as the principal component analysis (PCA), being linear, cannot deal with complex spectral and spatial patterns found in scenes containing intimate spectral mixtures like an urban area. Machine learning-based non-linear data compression methods like t-distributed stochastic neighborhood embedding (t-SNE), autoencoder and its variants can successfully handle such patterns. This study has executed these methods on two spaceborne hyperspectral datasets of Ahmedabad, India, captured by Hyperion and PRISMA sensors. The resultant low dimensional space's quality is analyzed considering the topological preservation of the original dataset by using label-independent Lee and Verleysen's co-ranking matrix and loss of quality measure. Findings suggest that multi-layer autoencoder outperforms single-layer autoencoder and t-SNE, requiring only a small neighborhood size to produce a high-quality encoding. Single-layer autoencoder and t-SNE show similar trends. The former performs slightly better and requires a very high neighborhood size to generate a good-quality encoding. These insights are significant for urban information extraction as there are few direct comparative assessments between machine learning-based non-linear data compression methods in earlier studies.

## Keywords

Hyperion, PRISMA, dimensionality reduction, urban mapping, artificial intelligence, non-linearity

## Bio

Kavach Mishra is a PhD candidate and senior research fellow at the Geomatics Engineering Group, Civil Engineering Department, Indian Institute of Technology Roorkee, India. He is working on

the characterization of impervious surfaces using hyperspectral data and machine learning techniques as part of his PhD thesis. His research interests include hyperspectral and thermal remote sensing applications, machine learning, multi-sensor fusion, information extraction and time-series analysis. He has 3 journal papers, 3 book chapters, 6 full-length international conference proceedings and 2 extended abstracts as part of national/international conference proceedings to his credit.

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No.  
6207

## Uncovering the global and local structures of urban networks via Poincare Embedding

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### Abstract

Understanding spatial structures of urban networks is of great significance for the spatial planning of urban and regional development. Traditionally, researchers often provided limited descriptions characterizing urban networks by indicators at the city-level, e.g., population, economic output, and income levels. However, these approaches fail to capture the complex relationships between cities that embedded in the external relations to other cities. With the emergence of urban flow data and advanced techniques in the complex networks approach, methods have been developed to examine either local or global structures, but they cannot capture both global and local structures simultaneously. This paper proposes a novel GeoAI method for urban network analysis, which effectively reveals the global hierarchy and local proximity of urban networks by learning the relational embeddings of cities in a Poincare space. In addition, a series of measures based on the Poincare embeddings are presented to quantify the global and local network structures. By using human movement flows between cities in the past years, the structural changes of urban networks under the impact of the pandemic are analyzed, and the preliminary experiments demonstrated the validity of the new method.

### Keywords

network structure; hyperbolic space; node embedding

### Bio

I am a master student in School of Urban Planning and Design at Peking University, China, supervised by Professor Zhaoya Gong. I received my B.S. degree at Wuhan University in 2023, guided by Professor Zhenzhong Chen, Mengjun Kang, and Limin Jiao. My current research interests include Geospatial Artificial Intelligence (GeoAI) and Computer Vision.

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# Evaluating the effect of plain afforestation project and future spatial suitability in Beijing

No.  
6203

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## Abstract

Taking the “One Million-Mu (666 km<sup>2</sup>)” Plain Afforestation (Phase I) Project (Phase I afforestation) in Beijing city as an example, we monitored the growth status of planted forest patches using long-term remote sensing images, and evaluated the impacts of afforestation on land use change and vegetation growth. We found there is a large space for improvement regarding the ecological benefits of the project. Moreover, we found that forest patches with decreasing greenness after the afforestation, were mainly converted from farmland patches with high greenness and low heterogeneity in terms of normalized difference vegetation index (NDVI). This implies that those farmland patches are inappropriate for afforestation. According to the results from Phase I afforestation and the impact of urbanization on green space, we constructed a series of spatial variables and generated a suitability map for the next “New Round of One Million-Mu (666km<sup>2</sup>) Afforestation project” (Phase II). We modeled the spatial distribution of Phase II afforestation based on the derived suitability map. This study is crucial for the scientific evaluation of afforestation projects for space planning (e.g., urban green space planning). The evaluation and modeling framework built in this study can be used to support the decision making and policy implementation of afforestation projects in China.

## Keywords

urban land use; afforestation; forest growth; suitability; segmentation; forest modeling

## Reference

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## Bio

Tengyun Hu, research associate at Beijing municipal institute of city planning and design. She is interested in smart city planning, implementation and urban research with land use/cover change monitoring and modeling. She was authored many papers in top international journals such as

Remote Sensing of Environment. Two papers were selected as ESI high citation papers. Many creative reseachs have been applied in urban planning and government of Beijing and other cities in China.

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No.  
6213

## Exploring the measurement of place identity through social media data

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### Abstract

In recent years, new media technologies have drastically changed the way individuals interact with and experience places. Traditionally, place identity has been understood as the individual's sense of self in relation to a specific location. However, with the rise of new media technologies, the meaning of place identity has expanded to include online communities and virtual spaces. For example, online social media platforms, such as Facebook and Instagram, have created virtual communities where individuals can share their experiences and connect with others in a place-based context. The meanings and dimensions of place identity changed over time (Lengen & Kistemann, 2012). After 2010, the hot area of place identity shifted towards place marketing until now (Peng et al., 2020). The measurement of place identity has traditionally been based on self-report measures, such as questionnaires and interviews. However, in the new media era, researchers have developed novel methods of measuring place identity, including the analysis of social media data and geolocated tweets. These methods provide valuable insights into the ways in which individuals experience and express their place identity in the new media era. Song et al., (2021) use online reviews of TripAdvisor and machine learning approaches to investigate sense of place of the Las Vegas Strip. However, with the development of social media platforms and dataset, how to use those data to do quantitative research and to measure place identity have not been adequately discussed. This study explores the utilization of social media data, and applies with Latent Dirichlet Allocation (LDA) topic model, TF-IDF text mining and machine learning methods to measure place identity. The study shows how online reviews can provide strong empirical evidence for personal identity and experience in built environment projects. This research approach can be used by urban designers and planners to better understand the place, neighborhoods and cities with the perspective of social sensing.

### Keywords

Place identity, social media data, text mining, machine learning

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## Bio

Shuyu Zhang is a PhD candidate in the Section of Urban Design of the Department of Urbanism at TU Delft. Her research project aims to shed light on the complex challenges around urban regeneration with more accurate data support. Her main interests include urban regeneration analytics, data analysis, placemaking, environmental psychology, environmental behavior, public participation, and data-driven urban design.

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### The value of building a perception-based green elements database for empirical research on future vitality

No.  
6206

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## Abstract

Current research on urban greenspace is characterised by several features: quantitative enthusiasm is high, with a rapid rise in the number of studies in all disciplines in recent years, particularly because the epidemic has led to an increased focus on health and public health; but qualitatively, there is less effective collaboration between different disciplines, as evidenced by a lack of reliable empirical data to verify relevant conjectures. The field of urban design has not yet fully emerged from the old idea - that green elements are aesthetic ornaments to grey elements - due to differing or vague definitions of green space. Despite the general push by cities to increase the number of green spaces in parks, there is a lack of scientific evidence on what constitutes a quality green space. Some of the research that has been done proves to us that green elements in green spaces are of particular value, including but not limited to ecological, economic, cultural and social, and that in order to obtain these values, designers need to carefully design sites so that the green elements are of reasonable quantity and scientific form so that they are pleasant to use and effective. How to study the relationship between green elements and the study of spatial vitality? The field of urban design can start with morphology. However, perceptual information on green elements is a relatively subjective product, and while in the past studies were often only obtained through surveys and interviews, the development of big data should change this. We therefore need a new database that both dynamically records the location, species and growth of trees, as in the case of New York's Big Tree Map, and links people's comments, changes in environmental quality and other visualisations of their value to the city. At a more microscopic scale, the database can also record as much information as possible on the morphology of green elements, such as canopy shape and shaded area, with the help of monitoring and so on. With such sufficient data, artificial intelligence can assist researchers in discovering scientific correlations between the spatial satisfaction and spatial vitality of complex morphological assemblages. In other words, the application of new technologies to construct spatio-temporal information related to green elements and space use in green spaces will be an important twist in the field of urban design research. Decentralised researchers can all contribute to the construction of this database, bringing together individual examples to form a platform; for governments, the platform can be a landscape monitoring platform to control changes in the quality of urban green elements.

## Keywords

greenspace; green elements; empirical research

## Reference

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## Bio

Phd student in Chongqing University architecture since 2021. The research direction is urban design, urban green space and urban vitality space.

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## GWRBoost: A geographically weighted gradient boosting method for explainable quantification of spatially-varying relationships

No.  
6208

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## Abstract

The geographically weighted regression (GWR) is an essential tool for estimating the spatial variation of relationships between dependent and independent variables in geographical contexts. However, GWR suffers from the problem that classical linear regressions, which compose the GWR model, are more prone to be underfitting, especially for significant volume and complex nonlinear data, causing inferior comparative performance. Nevertheless, some advanced models, such as the decision tree and the support vector machine, can learn features from complex data more effectively while they cannot provide explainable quantification for the spatial variation of localized relationships. To address the above issues, we propose a geographically gradient boosting weighted regression model, GWRBoost, that applies the localized additive model and gradient boosting optimization method to alleviate underfitting problems and retains explainable quantification capability for spatially-varying relationships between geographically located variables. Furthermore, we formulate the computation method of the Akaike information score for the proposed model to conduct the comparative analysis with the classic GWR algorithm. Simulation experiments and the empirical case study are applied to prove the efficient performance and practical value of GWRBoost. The results show that our proposed model can reduce the RMSE by 18.3% in parameter estimation accuracy and AICc by 67.3% in the goodness of fit.

## Keywords

Geographically weighted regression; Gradient boosting; Spatial Heterogeneity; Model Complexity

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## Bio

Han Wang is a graduate research assistant at S3-Lab of Peking University, advised by Prof. Zhou Huang and Prof. Yu Liu. Previously he got a B.Eng. degree from Wuhan University in 2020. His research interest includes geospatial data mining, human-environment interaction and earth observation for sustainable development

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### Developing X-minute city with the dockless bike-sharing service

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No.  
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## Abstract

The policy of creating a “15-minute City” or “20-minute City” is gaining attention as a sustainable development strategy focused on improving access to essential amenities within a short time using different travel modes such as walking or cycling. The concept of “X-minute city”, where residents can access essential amenities within a specified time frame of typically 5 to 30 minutes, is an expanding framework. However, there is currently no coherent definition and an established methodological framework for alternative travel modes such as dockless bike-sharing service in scholarly literature. Drawing from open-source geospatial data from Hangzhou, China, this paper proposes a modified approach to identifying where X-minute city (with x being 10, 15, 20 or 30 minutes) may exist. Using this approach, we explore accessibility to key amenities within X-minute city and how this differs across geography and mode of travel (walking, riding private bikes or riding shared bikes). Our research may ultimately contribute to the sustainable development of cities by improving the efficiency and accessibility of urban transportation systems.

## Keywords

X-minute city, bike-sharing, sustainable development

## Reference

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## Bio

Fu Wenyan is a student majoring in Urban Management at the School of Public Affairs of Zhejiang University. Her research interests mainly focus on shared micro-transportation, urban big data, and land finance. She has won several honors, such as the first prize in the National Skill Competition of Land and Spatial Planning and the Excellent Undergraduate Thesis of Hohai University. With solid academic background and research experience, Fu is committed to contributing to the field of urban development and management.

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## Sentiment and semantic analysis: Urban quality inference using machine learning algorithms

No.  
6202

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## Abstract

Sustainable urban transformation asks for comprehensive knowledge about the built environment, including people's perceptions, use of sites, and wishes. In order to gain a deeper understanding of people's opinions about a specific topic or location, qualitative interviews are conducted. The analysis of such textual data is an iterative process, partly conducted manually and often time-consuming. This study explores the automatization of the interview coding process by investigating how state-of-art natural language processing techniques classify sentiment and semantic orientation from interviews transcribed in Swedish. For the sentiment analysis, the Swedish Bidirectional Encoder Representations from Transformers (BERT) model KB-BERT was used to perform a multi-class classification task on a text sentence level into three different classes: positive, negative, and neutral. For the semantic analysis, Named Entity Recognition (NER) and String Search was used to perform multi-label classification to match domain-related topics to the sentence. The models were trained and evaluated on partially annotated data sets. The results demonstrate that the implemented deep learning techniques are a possible and promising solution to achieve the stated goal. Still, there is a need to explore and develop these methods



further. An important factor is that these deep learning models are heavily data-driven and need accurately annotated domain-specific data to reveal their full potential.

## Keywords

urban planning, sentiment analysis, semantic analysis, built environment

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## Bio

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No.  
6216

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## Block Saturation Level: a novel typology of block occupancy based on deep learning classification of satellite images

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## Abstract

Defined as “the group of private or public buildings and open space composing an island surrounded by public roads or streets” (Hermosilla et al., 2014, p. 69), city blocks are an essential unity in urban morphology. Because of how their shape and composition influence many aspects of a city’s form, structure, and function – shape of buildings, insolation, street accessibility, traffic flow, etc. (Hermosilla et al., 2014; Taima et al., 2019; Vanderhaegen and Canters, 2017), the specialized literature presents many methodologies for systematic measurement and classification of these basic urban elements. Therefore, urban planners have at their disposal a wide range of conceptualized metrics at the block level, among them, those related to 1) basic geometry (perimeter, area, orientation, etc.); 2) composition (public space area, private space area, built-up area, vegetation covered area, etc.); 3) disposition (mean and standard deviation of the buildings orientation, maximum compactness among bright areas, etc.); and 4) context (local accessibility, connectivity, movement flow, etc.). These indicators are the basis upon which typologies of urban blocks are generated, which in turn can be used for the assessment of larger intra-urban areas (Novack et al., 2014; Novack and Stilla, 2018; Rhodes, 1990; Shpuza, 2023; Vanderhaegen and Canters, 2017, 2010; Voltersen et al., 2014) However, these indicators often rely on high-resolution satellite and LIDAR data that may not be available for urban planners and managing teams, especially in many cities of developing countries. In this case, planning processes are left without alternatives for block classification. To address this issue, this work introduces the Block Saturation Level (BSL), a categorical indicator, with ordinal classes, which presents occupancy of the terrain of urban blocks from low to high, based on patterns identified by Deep Learning models. A dataset with classified blocks was generated for Brazilian cities, using freely available multi-spectral imagery – 2 meters resolution –, from the China-Brazil Earth-Resources Satellite – CBERS-4. This dataset was then used for training a convolutional deep neural network, reaching a precision of over 95%. BSL classification was applied to Curitiba Metropolitan Area – CMA –, a Brazilian urban region with more than 3 million people, which is an important case of urban planning in the country, being a reference of successful urban planning and an influential model for Latin-American cities (Szuchman, 2017). In the context of the new planning for the CMA, this typology was used to explain different rates of intra-urban population growth, which helped evaluating the usefulness of the typology for the construction of urban growth scenarios. BSL has the advantage of being intuitive and results show that intra-urban population growth in Curitiba, from 2010 to 2022, is highly explainable by levels of block saturation, which opens a promising application of the typology for evaluation of urban growth scenarios, especially in cases that real-estate development is oriented by freely available plots in installed blocks.

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## Bio

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### **SALT: a multifeature ensemble learning framework for mapping urban functional zones from VGI data and VHR images**

No.  
6212

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## Abstract

Urban functional zone mapping is essential for providing deeper insights into urban morphology and improving urban planning. The emergence of Volunteered Geographic Information (VGI), which provides abundant semantic data, offers a great opportunity to enrich land use information extracted from remote sensing (RS) images. Taking advantage of very-high-resolution (VHR) images and VGI data, this work proposed a SATL multifeature ensemble learning framework for mapping urban functional zones that integrated 65 features from the shapes of building objects, attributes of points of interest (POIs) tags, locations of cellphone users and textures of VHR images. The dimensionality of SALT features was reduced by the autoencoder, and the compressed features were applied to train the ensemble learning model composed of multiple classifiers for optimizing the urban functional zone classification. The effectiveness of the proposed framework was tested in an urbanized region of Nanchang City. The results indicated that the SALT features considering population dynamics and building shapes are comprehensive and feasible for urban functional zone mapping. The autoencoder has been proven efficient for dimension reduction of the original SALT features as it significantly improves the classification of urban functional zones. Moreover, the ensemble learning outperforms other machine learning models in terms of the accuracy and robustness when dealing with multi-classification tasks.

## Keywords

urban functional zone mapping; SALT features; ensemble learning; Volunteered Geographic Information

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## Exploring Spatiotemporal Big Data to Examine the Complementarity between Shenzhen and Hong Kong

No.  
6214

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## Abstract

Shenzhen and its neighboring international metropolis, Hong Kong, share a remarkably close connection and frequent interactions. Since the beginning of China's reform and opening up, the complementary factors of industry, market, function, space, and labor between Shenzhen and Hong Kong have attracted hundreds of thousands of residents, businessmen, commuters,



tourists, and students to travel across the border daily. This study aims to demonstrate the complementarity between the two cities against the backdrop of frequent exchanges by analyzing the hotspot regions of the geographical space, travel characteristics of the population, and population classification. The paper employs information technology and open-source data from social media platforms to extract massive spatiotemporal data with geographical tags and user attributes for analysis, constructing a method for studying spatiotemporal dynamic data that can be tracked and monitored. It also integrates API (Application Programming Interface), Points of Interest (POI), user check-in spatial analysis, and advanced data computation techniques using machine learning to calculate the categories of people commuting between the two places and the hotspot regions they are most likely to visit. The conclusions of this paper demonstrate that this research method can effectively validate the complementarity between Shenzhen and Hong Kong to a certain extent and deepen its definition from a temporospatial perspective. Moreover, based on their complementary features, this study provides policy suggestions for the dynamic development of the Shenzhen-Hong Kong metropolitan area and proposes a smart city method prototype for monitoring and regulating the sustainable development of metropolitan areas.

## Keywords

Smart City, Geospatial Data, Big Data Analysis, Machine Learning, Shenzhen-Hong Kong Metropolitan Area Development, Metropolitan Area Dynamic Development Research

## Bio

Qihao Wang is a Chinese urban planning researcher and practitioner in the field of urban planning and design. His research focuses on urban planning informatization, planning design supported by urban spatial big data, urban planning implementation, and chief designer system. His related work spans various areas, such as geospatial big data research, industry and science innovation, chief designer projects, planning consultation, urban renewal, urban design, short-term construction planning, and urban investment banking. In the urban planning research field, which has a strong social science nature, he is adept at using natural science theories, approaches, and techniques (e.g., urban spatial big data) to assist in identifying urban issues, exploring solutions, and formulating strategies.

Qihao has been invited to give presentations at several international academic forums, including City+, International Chinese Planning Annual Conference, World Conference on Transport Research, Urban Public Transit Development Forum, and China Planning Annual Conference. His paper was also invited for presentation at City+ 2022. He has participated in the planning and organization of several international study camps and workshops related to urban planning and design.

## Factors of Social Network Platform Usage and Privacy Risk: A Unified Theory of Acceptance and Use of Technology2 Model

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### Abstract

The trust and use of social network platforms by users are instrumental factors that contribute to the platform's sustainable development. Studying the influential factors of the use of social network platforms is beneficial for developing and maintaining a large user base. This study constructed an extended UTAUT2 moderating model with perceived privacy risks to analyze the factors affecting the trust and use of social network platforms. 444 participants completed our 35 surveys, we verified the survey results by structural equation model. Empirical results reveal the influencing factors that affect the trust and use of social network platforms, and the extended UTAUT2 model with perceived privacy risks increases the applicability of UTAUT2 in the social network scenarios social networking platforms can increase their use rate by increasing the economics, functionality, entertainment, and privacy security of the platform.

### Keywords

perceived privacy risk, social network, trust, use, UTAUT2 model

### Bio

Wang Xue, female, second year PhD, China University of Petroleum (East China), her research interests include social media Big Data and energy economy

## Evaluating the Potential of Different Evapotranspiration Datasets for Distributed Hydrological Model Calibration.

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### Abstract

Evapotranspiration (ET), a key component of the hydrological cycle, is regarded as an intermediate variable of soil moisture that affects runoff. Various global satellite-based and numerical datasets provide continuous and high spatiotemporal resolution data, which makes it possible to calibrate hydrological parameters against ET. However, the accuracy of ET datasets varies with region and algorithm, introducing uncertainties in hydrological parameter calibration. This study focused on evaluating the potential of different ET datasets in the calibration of distributed hydrological model parameters. Five different ET datasets were evaluated using the water balance method to explore the effect of intrinsic dataset accuracy on applications. Two calibration schemes were proposed to take advantage of the temporal dynamics and spatial patterns of the raw ET datasets. Overall, the calibration scheme for the temporal dynamics of ET at the grid-scale provided better streamflow simulations at the basin outlet than the calibration scheme for

the spatial patterns of ET datasets. The performance of streamflow simulation at the sub-basin scale varied with calibration schemes depending on the accuracy of ET datasets. Three metrics (bias, root mean square error, and correlation coefficient) showed that there is a high potential for selected ET datasets to improve soil moisture simulations, as compared to the streamflow-only calibration scheme.

## Keywords

Evapotranspiration; Parameter calibration; VIC model; Hydrological simulation

## Bio

Xiao Guo is a Ph.D. candidate of Hydrology and Water Resources at Hohai University in China. She received her bachelor degree in Hydrology and Water Resources Engineering from Hohai University in 2019. Her research interests include climatic change impacts on hydrology and water resources, hydrological modeling, multi-objective optimization algorithm, and geospatial data applications in hydrology and water resources. Xiao Guo has published 2 peer-reviewed papers on some international prestigious SCI journals and had overseas education experience at CSIRO in Australia.

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## Natural Language Processing for the Classification of Social Media Posts in Post-Disaster Management

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## Abstract

Information extracted from social media has received great attention since it has become an effective alternative for collecting people's opinions and emotions based on specific experiences in a faster and easier way. The paper aims to put data in a meaningful way to analyze users' posts and get a result in terms of the experiences and opinions of the users during and after natural disasters. The posts collected from Reddit are classified into nine different categories, including injured/dead people, infrastructure and utility damage, missing/found people, donation needs/offers, caution/advice, and emotional support, identified by using labelled Twitter data and four different machine learning (ML) classifiers.

## Keywords

disaster, NLP, postdisaster management, sentiment analysis

## Bio

The author completed a Bachelor's degree in Civil Engineering and started a venture to develop digital solutions for construction project management. She gained hands-on experience as a project control engineer and completed long-term internships before pursuing a Master's degree in Software Engineering. During her studies, she developed a system that classifies social media posts related to disaster management and applied natural language processing techniques. She is currently working on a Master's degree in Earthquake Engineering, creating a macrosismic database of earthquakes in Turkey for future earthquake prediction systems. The author leads

the product development team at Bimcrone, which offers a BIM-based project management platform, and serves as a consultant at Quakecom, providing a communication infrastructure after earthquakes to report trapped individuals and accelerate planning processes. The author's focus is on the implementation of digital solutions in Civil Engineering and earthquake engineering for disaster management. She plans to establish a platform to provide training and hands-on projects on software solutions in the fields of Civil Engineering and Earthquake Engineering. In addition to her academic and professional pursuits, she will also be speaking on post-disaster management and technology at DCW and GEOBusiness events.

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# 5. Transport and health

## Street-level physical disorders, multi-scale socioeconomic disparities and neighbourhood satisfaction in Chinese older adults: Using street view data and machine learning approach

No.  
6302

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### Abstract

Neighbourhood satisfaction plays a significant role in life satisfaction and well-being of urban residents. There is a handful of evidence suggesting that physical disorders may be negative to neighbourhood satisfaction. However, most previous studies mainly focused on general population, and there has been little evidence into older adults especially in developing countries. Using wave 1 of the World Health Organization (WHO) longitudinal cohort Study on Global Ageing and Adult Health (SAGE) conducted in China in 2010, this study examines the effect of street-level physical disorders on older adults' neighbourhood satisfaction. Furthermore, it tests how street-level physical disorders may contribute to multi-scale socioeconomic disparities in neighbourhood satisfaction. It uses street view images along with the machine learning approach to estimate street-level physical disorders. Socioeconomic status is assessed at multi-scales including individual-level, neighbourhood-level and city-level. Multilevel logistic regressions are used to model and association among street-level physical disorders, multi-scale socioeconomic disparities and neighbourhood satisfaction. Results show that higher levels of physical disorders is associated with higher odds of reporting low neighbourhood satisfaction (2nd quartile: odds ratio = 3.620, 95% confidence interval = 1.536, 8.531). Sensitivity analysis again confirms the above finding. The moderation analysis suggests that individual-level household income strengthens the effect of physical disorders on neighbourhood satisfaction, while city-level population density weakens the effect of physical disorders. Our findings demonstrate the importance of reducing street-level physical disorders for promoting neighbourhood satisfaction through urban planning and design. Also, since the negative effect of street-level physical is more pronounced in denser cities, more attention should be paid to these cities.

### Keywords

Physical disorders; Socioeconomic disparities; Neighbourhood satisfaction; Older adults; Street view

## Reference

### Bio

Qiyang Li mainly focuses on health geography research, pays special attention to the impact of the urban built environment on various health indicators, and is conducting research about using experimental methods to explore the relationship between environments and mental health.

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No.  
6305

## Study of Outdoor Public Space in Emergency Departments in Shanghai

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### Abstract

The purpose of this research is to investigate the utilization of outdoor public space in emergency departments in Shanghai with the aims of design and use improving. Field research and mapping were used to collect data on the location, scales and occupancy of outdoor public space in emergency departments of 22 3A-Grade general hospitals in Shanghai. The study found that the outdoor public space in emergency departments of those hospitals investigated were generally small in scale, which poses a challenge for effective ambulance and outdoor site rescue during mass casualty incidents like Covid-19. In addition, the entrances of some emergency departments were located too far away from the main entrance of the hospital or had visual barriers, making it difficult for emergency patients way-finding. Some hospitals were designed during earlier period when the spatial relationship between the entrances to the emergency department and the hospital was not well considered. Additionally, the lack of outdoor public space of emergency departments in city center lead the difficulty to hospital spatial expansion in the future due to the land constraints. The study suggests that attention should be paid to the design and reservation of outdoor public space in emergency departments. Those new constructed hospitals should prioritize the design of outdoor public space, while reducing way-finding difficulty through strategic spatial location and visualization. The renovation and expansion of emergency departments in city center should prioritize the expansion of outdoor public space and reserve sufficient outdoor space for flexible use during mass casualty incidents.

### Keywords

Emergency Department, Healthcare Architectural Design, Outdoor Public Space

## Reference

### Bio

I am a Ph.D. student in the School of architecture at Tsinghua University, with a research focus on healthcare environment design, particularly emergency department space design in healthcare architecture. Recently, my research has been centered on emergency healthcare facility design in the city of Shanghai, China, and the spatial adaptability of emergency departments in response to patient surge during the Covid-19 outbreak.

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# The impact of urban transportation facilities on commuter's public transit satisfaction: a case study of Xi'an, China

No.  
6303

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## Abstract

Urban transportation facilities play an important role on both urban development and people's choice of travel mode, especially for those who commute by public transit. Commuter's public transit satisfaction differs under different urban transportation facilities. Therefore, promote public transit commute satisfaction is the key to improving urban transit facilities. Existing studies worldwide mainly focus on the impact of built environment or travel characteristics (including travel mode choice, travel time, etc.) on travel/commute satisfaction, while domestic studies pay more attention on the public transit service and individual subjective. However, few studies examined the impact of traffic facilities on commuter's public transit satisfaction. Based on this, this study takes Xi'an, China as the research area. With the quota sampling method, we collected data by smartphone app Daynamica developed by the University of Minnesota and the environmental audit. Using ordered logistic regression, we found that the accessibility of public transportation, bus & subway accessibility, number of air-conditioned bus lines, subway stations, traffic lights present, no private cars occupy the edge of roads at night, no commercial shops, colleges and historical & cultural sites present, comfort perception of travel environment are positively correlated with commuter's public transit satisfaction. Meanwhile, the number of accessible bus lines, subway stations that are still under construction, and traffic policemen present have a negative impact on commuter's public transit satisfaction. In addition, public transit commuting within the weekday will be difficult to lead to a good commuting experience. As for personal characteristics, education level, married or cohabited and the attitude to life also affect commuter's public transit satisfaction. Our study finally put forward suggestions to promote commuter's public transit satisfaction, including the optimization of overall arrangement of public transit stations and traffic lights, the enhancement of humanitarian approach in public transit, the improvement of traffic congestion and the solving of resident's night parking problem.

## Keywords

commuter's public transit satisfaction; urban transportation facilities; traffic congestion

## Reference

## Bio

Zhu Jing, female, born in February 1982, has a doctor's degree, an associate professor, an academic master's supervisor, a professional master's supervisor, a system expert of the National Natural Science Foundation of China, a visiting scholar of the University of Minnesota, a member of the China Urban Planning Association, a member of the International China Urban Planning Association, a member of the Transportation and Health Technical Committee of the World Transportation Congress, and a double bachelor's degree in urban planning and English. Research direction: urban transportation and public health, urban and regional planning, rural planning, urban renewal.

# Predicting travel time reliability with automatic fare collection data for an urban rail transit network

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## Abstract

The rapid development of Urban Rail Transit Networks (URTNs) provides convenience to passengers and shortens their trip times. However, train delay occurs frequently in many cities, resulting in passengers' travel delay. Travel Time Reliability (TTR) is low in URTN systems during peak hours. Poor TTR decreases the passengers' satisfaction and weakens their willingness to use URTNs. Accordingly, transportation projects not only focus on improving the speed or expanding the capacity of transportation, but also on improving the service quality of existing transportation. TTR is an important indicator for assessing the transportation service quality, which greatly affects the passengers' travel experience and satisfaction. Therefore, measuring and predicting passengers' TTR in a URTN not only helps operators to assess the transportation efficiency and service quality, but also guides passengers in scheduling their trip time for arriving at destination stations on time. The machine learning techniques are applied here to predict the TTR of a URTN during different periods. TTR on a URTN is measured by the buffer time index, which is the ratio of the 95th percentile trip time to the average trip time. First, the TTR of Origin station-Destination (OD) station pairs with sufficient recorded Automatic Fare Collection (AFC) data is measured during different periods (morning peak, evening peak, and non-peak periods) according to passengers' trip time obtained from AFC data. Then, twenty features of OD station pairs are obtained for predicting TTR on a URTN. The two-way analyses of variance without repeated measures are carried out to determine whether statistically significant differences exist in OD features between different levels of TTR. Thirdly, the sequential forward selection algorithm is performed to select OD features as input data to avoid the curse of dimensionality. Finally, three machine learning models, i.e., Support Vector Regression (SVR), Multi-layer Perceptron Regressor (MLPR), and deep residual network (ResNet), are applied to TTR in a URTN. The proposed method was applied to measuring and predicting the TTR of Chengdu's URTN using 27 weekdays of AFC data. Experiments on Chengdu's URTN show that machine learning techniques with a personalized algorithm can effectively predict the TTR in a URTN during different time periods. The SVR regressor had low MAPE and SMAPE for the TTR prediction during the evening peak and off-peak periods and the ResNet showed strong robustness in TTR prediction. The proposed method can also be used to assess transportation efficiency and quality, as well as guide passengers in scheduling their travel.

## Keywords

Travel Time Reliability Prediction; Urban Rail Transit; Machine Learning Model; Automatic Fare Collection Data; Buffer Time Index



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## Bio

I am Yuhao Wang. I currently study at Kunming University of Science and Technology. My research interest is the resilience and reliability of transportation. I have proposed models and methods for predicting time reliability and measuring resilience of rail transit networks, which are verified effective according to the real case study.

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### Evaluate the physical activity vitality of urban greenways using trajectory entropy

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No.  
6301

## Abstract

Existing studies rarely use large-scale trajectory data to analyze the movement behavior of urban greenways; they mostly conduct on-site research on greenway segments and interview movement participants. The vitality of the movement environment is mostly studied from the perspective of the built environment, which requires specialized personnel, and the indicators are complex and difficult to standardize. This study proposes a method to assess the vitality of urban greenways for movement using movement trajectory entropy and analyzes the spatial pattern of movement characteristics of residential greenways using Beijing as a case study. The results show that 61.06% of residents have round-trip behavior when exercising, 5.64% have a clear purpose, and the destinations are mainly large urban parks and major urban-level greenways. More than 80% of the residents preferred to choose low- to medium-intensity greenway exercise, and high-intensity exercise behavior showed clustering characteristics in suburban areas. The vitality of greenways

for exercise tends to decrease overall from the central city to the inner suburbs, but there are obvious clusters in the city with relatively high.

## Keywords

urban greenways, physical activity vitality, trajectory data, trajectory entropy

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## Bio

Qiu Cailin ,Department of Urban and Rural Planning, School of Architecture, Tianjin University, Tianjin, China. Research Field: Healthy Cities.

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## Heterogenous Trip Distance-Based Route Choice Behavior Analysis Using Real-World Large-Scale Taxi Trajectory Data

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No.  
6308

## Abstract

Advanced route choice provides theoretical support for optimizing urban traffic guidance, alleviating traffic congestion and improving urban residents' travel satisfaction, and hence plays an important role in building smart city and realize smart travel. Most early researches on route choice behavior analysis relied on the data collected from the stated preference survey or through small-scale experiments. This manuscript focused on the understanding of commuters' route choice behavior based on the massive amount of trajectory data collected from occupied taxicabs. The underlying assumption was that travel behavior of occupied taxi drivers can be considered as no different than the well-experienced commuters. To this end, the DBSCAN algorithm and Akaike information criterion (AIC) were first used to classify trips into different categories based on the trip length. Next, a total of 9 explanatory variables were defined to describe the route choice behavior, and the path size(PS) logit model was then proposed, which avoided the invalid assumption of independence of irrelevant alternatives (IIA) in the commonly seen multinomial logit (MNL) model. The taxi trajectory data from over 11,000 taxicabs in Xian,

China, with 40 million trajectory records each day were used in the case study. The results confirmed that commuters' route choice behavior are heterogenous for trips with varying distances and that considering such heterogeneity in the modeling process would better explain commuters' route choice behaviors, when compared with the single traditional MNL model.

## Keywords

Route choice behavior, Heterogenous trip, Taxi trajectory data, Multinomial Logit (MNL) model, Path Size (PS)-Logit model

## Reference

## Bio

Meiye Li received the master's degree in transportation planning and management from Chang'an University, Xi'an, China, in 2019. He is currently pursuing his doctoral degree with the Intelligent Transportation System Research Center, Southeast University, Nanjing, China. His research interests include intelligent transportation systems, traffic forecasting, and spatial-temporal data mining.

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## Impact of commuting time on work productivity: A quasi-longitudinal examination

No.  
6310

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## Abstract

Commuting is a vital aspect of daily life that can greatly impact work productivity. With limited research investigating this hypothesis, this study uses a quasi-longitudinal design to explore the causal effects of commuting time on work productivity during a COVID-19 pandemic lockdown. Survey data was collected from 550 white-collar employees in Greater Melbourne, with respondents reporting their commuting behavior and work productivity before and during the lockdown. Regression models and cross-lagged panel models were used to analyze the data. The study found that, on average, job performance and working hours declined slightly during the pandemic lockdown period, but there were significant variations between employees. Long commuters reported improved job performance and more working hours when working from home during the pandemic. However, female employees with young children experienced the greatest drop in work productivity while working from home, highlighting the need for childcare support.

## Keywords

Commuting time, work productivity, quasi-experiment, cross-lagged model

## Reference

## Bio

Liang obtained PhD in Urban Studies and Planning at Portland State University (US) in 2014. His research focuses on the interactions between the built environment, travel behavior, health,

and social equity. He currently serves as Transportation Research Board's Standing Committee (AME80) member and an editorial board member of three international transportation journals, including Transportation Research Part D, Travel Behavior and Society, and Communications in Transportation Research. He was awarded the "Outstanding Young Talent" by Ministry of Transport of China in 2021. His recent NSFC funded project examines the impact of daily commuting on employee health and productivity in megacities.

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## Research on the characteristics of commercial agglomeration and evolution of embedded residential rail transit stations ——Comparative study based on the cases of three countries

No.  
6304

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### Abstract

From the perspective of China's urban construction, the development speed of most urban rail transit lags behind the development speed of the city itself. Therefore, the land layout and building functions around the rail transit station area continue to evolve and improve in the process of urbanization. The commercial agglomeration and evolution characteristics of the embedded rail transit station area have become a research focus in recent years. The development models of some high-density cities in the world can be used for reference. The three subway lines, Fukuoka Kikuma Line (Line 3) in Japan, Madrid Line 1 in the Netherlands and Northeast Singapore Line (NEL) in Singapore, are all subway lines that mainly serve urban residential areas in various cities. The development and evolution of the residential rail transit adjacent to commercial space plays an important role in improving the vitality of residential areas and meeting the daily living needs of urban residents. Through systematic analysis, induction and comparison, this paper finds that they have the common characteristics of clustering and correlation at the levels of both inside and outside the station area, land use, building functions, etc., and in the specific evolution mode, they echo with different urban built environments. The success of these rail transit station evolution models can not be separated from efficient urban planning control and guidance. The experience of the three cases in sustainable evolution, collaborative development, refined guidance and control is of great significance to the modernization and innovative development of China's urban rail transit stations in the future.

### Keywords

Station space evolution; Residential rail transit stations; Business model; Urban planning mechanism

### Reference

### Bio

Dear Organizing Committee Hello I'm Sun Yixin, a sophomore student of Dalian University of Technology, Dalian, Liaoning Province, China. I'm honored to have the opportunity to participate in this city+ 2023@Perth As a contribution to the International Conference of Young Scholars on Urban Research, I would like to share with the experts and seniors the research content of the symposium 3: The theme of transportation and health. My research topic is Research on

the characteristics of commercial integration and evolution of embedded residential rail transit stations - Comparative study based on the cases of three countries, The main content of the paper is to systematically analyze and summarize the commercial development models around some high-density urban rail transit stations in the world, and summarize the common characteristics of their clustering and correlation, hoping to provide inspiration for the modernization construction of urban rail transit stations in China in the future. I sincerely hope that the organizing committee of the conference can provide me with this learning opportunity, and I will continue to work hard to improve my thesis. I hope that I can share the research results with young scholars in various urban research fields and experts and seniors.

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No.  
6306

## Geospatial Analysis of Healthcare Accessibility and Equity in the Beijing-Tianjin-Hebei Region

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### Abstract

With the rise of urbanization, transportation and healthcare have become key concerns in city planning. Improving healthcare accessibility has become a priority, especially in regions where cross-regional medical treatment is necessary. This study focuses on the Beijing-Tianjin-Hebei region, where new policies have been implemented to allow for such treatment and aims to explore the accessibility and equity of medical facilities in the region. The aim of this study is to evaluate the accessibility and equity of three-tier healthcare services in the Beijing-Tianjin-Hebei region. The objective is to provide insights into the current status of medical facility distribution, identify potential disparities, and suggest strategies for optimizing the layout of medical facilities in the region. The study uses a two-step floating catchment area (2SFCA) method to calculate the accessibility of three-tier healthcare services in three areas of the Beijing-Tianjin-Hebei region. The Gini coefficient is then employed to analyze the spatial equity of local medical facilities. Additionally, the study explores the correlation between factors such as population, gender, education level, road network, POI density, and the Gini coefficient of three-tier healthcare. The study reveals that the current distribution of three-tier healthcare services in the Beijing-Tianjin-Hebei region is uneven, with disparities in accessibility and equity across different areas. The analysis of correlation factors shows that population, education level, and POI density are significantly correlated with the Gini coefficient of three-tier healthcare, while gender and road network have less influence. The study highlights the importance of using geospatial big data to optimize the layout of medical facilities in urban areas. The results suggest that policymakers should focus on improving the accessibility and equity of medical facilities in the Beijing-Tianjin-Hebei region, by considering the impact of population, education level, and POI density on healthcare distribution. By providing insights into the current status of medical facility distribution and identifying potential disparities, this study can help to improve healthcare accessibility and promote social equity in urban areas.

### Keywords

Healthcare accessibility; healthcare Gini coefficient; Beijing-Tianjin-Hebei region; two-step floating catchment area (2SFCA) method; enhanced 2SFCA method

## Reference

## Bio

My name is Fengliang Tang, and I am currently studying urban and rural planning at the School of Architecture, Tianjin University in China. I graduated from the University of Liverpool with a bachelor's degree and from University College London with a master's degree. My current research interests include urban regeneration, urban equity and efficiency, and the application of temporal-spatial big data in cities.

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### Optimization of emergency medical supplies distribution in public health emergencies

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No.  
6307

## Abstract

Public health events occur frequently and cause huge losses to the economy and society. The COVID-19 pandemic which broke out at the end of 2019 has caused more than 6.9 million deaths and more than \$10 trillion in economic losses. One of the major reasons is that the Emergency Medical Supplies (EMS) are short and the distribution of those medical materials is untimely. Therefore, reasonable and timely distribution of EMS is important to rescue activities and reduce the harm of diseases during public health events. However, the studies on the optimization of EMS distribution do not fully consider the difference in demand and requirement for EMS in different regions when a public health event occurs. This paper considers the differences in the requirement of EMS categories and distribution time in different regions, and develops a multi-objective optimization model to optimize EMS distribution. The EMS distribution is optimized by scheduling the best vehicle routes and the EMS loaded on the vehicles. The objective functions of the model are minimizing distribution costs and maximizing the loading rate of distribution vehicles. The constraints in the model include vehicle load constraints, distribution time constraints, vehicle running mileage constraints et al. The proposed model is a multi-variety EMS distribution problem, which is difficult to use an accurate algorithm to solve in a short time when the distribution network is large. Therefore, to reduce the model solving difficulty, the multi-objective optimization model is transformed into a single objective model, and the multi-variety EMS distribution problem is transformed into a single EMS distribution problem by splitting region nodes. Then, a genetic algorithm is applied to solve the problem. The EMS distribution in Yunnan province is taken as a case study. In the real case, Kunming is the distribution center to distribute three kinds of EMS to 15 grade-A hospitals in 15 regions of Yunnan Province. The result shows that the proposed model can not only effectively reduce the distribution cost, but also significantly improve the loading rate of vehicles, which improves the efficiency and economy of EMS distribution when public health events occur.

## Keywords

Vehicle Routing Problem;Emergency Medical Supplies;Genetic Algorithm;Multi-Objective Optimization

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## Bio

Research fellow in the field of vehicle routing problem and transportation, have a certain understanding of vehicle routing problem modeling and its related solving algorithms, and have relevant basic professional knowledge. Currently studying at Kunming University of Science and Technology, the author has some experience in vehicle routing problem modeling and solving.

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No.  
6309

## Enhancing Urban Rail Transit Resilience through Optimization

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## Abstract

Urban Rail Transit (URT) is one of the critical infrastructures of a city and plays an important role in providing large-volume travel services and alleviating urban congestion. However, the interruption of urban rail transit lines caused by different events has a huge negative impact on the operation of a URT. Therefore, it is of great significance to explore the vulnerability of a URT network to reduce the negative impact caused by network interruptions and guarantee the service level of URT operation. Previous studies have not yet used the optimization method to identify a certain number of stations/links whose interruption has the greatest impact on the vulnerability of a URT. In addition, train turn-back operations and bus connection operations during URT network interruptions are seldom considered when measuring the vulnerability of a URT. Therefore, this study proposed service vulnerability indicators for a URT network, including the proportion of affected passengers, the rate of increase in average travel distance for passengers, and the reduction in network transport efficiency. The vulnerability of a URT varies a lot when



different sets of stations/links are interrupted. Therefore, a multi-objective optimization model is developed to obtain a certain number of stations/links whose interruption has the greatest impact on the vulnerability of a URT. The NSGA-II (Non-dominated Sorting Genetic Algorithm II) is applied to solve the model. The proposed model is applied to Wuhan's metro network and the result shows that the model and algorithm can effectively identify the station /link set that has the greatest impact on the vulnerability of Wuhan's metro network. The research can reasonably measure the vulnerability of a URT and guide the protection of critical stations/links to effectively reduce a URT's vulnerability.

## Keywords

Vulnerability, Urban Rail Transit, NSGA-II

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## Bio

Graduate of Grade 22, majoring in Road Traffic and Transportation, School of Traffic Engineering, Kunming University of Science and Technology, with knowledge of mathematical optimization modeling, multi-objective optimization algorithm solving, complex network theory, etc. At present, I mainly study the vulnerability of rail transit network, and have certain research experience in influencing factors of rail transit network vulnerability and reducing rail transit network vulnerability.

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# An ensemble learning-based neural network model for predicting urban rail transit accidents

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## Abstract

Urban Rail Transit (URT) accidents not only seriously affect the safety and reliability of its operations, but also reduce its service level to passengers. Based on historical traffic accident data, studies have analyzed and predicted road traffic accidents using statistics and machine learning methods. However, few studies have used URT accident data to predict accidents in URT. In addition, URT accident data is heterogeneous and contains values, text, and accident descriptions. Therefore, statistical or classical machine learning methods cannot make full use of URT accident data information when predicting URT accidents, which is difficult to obtain good prediction results. This study proposes an ensemble learning-based neural network model for URT accident prediction. To effectively use heterogeneous accident data, different artificial neural network models are developed for learning. Specifically, Convolutional Neural Networks (CNNs) are used to capture the spatial patterns in the accident data, and the Bidirectional Encoder Representations from the Transformers (BERT) model are used to learn complex relations between words and phrases in the accident text descriptions. Finally, the results of each model are combined for accident consequence classification. The proposed model is applied to Chongqing's URT accident prediction using its historical accident data. With 956 recorded historical accident data, the proposed ensemble learning model achieves a prediction accuracy of 82%, which is at least 20 percent higher than that of the commonly used machine learning models, such as multilayer perceptions, support vector machines, and naïve Bayes. Additionally, we found that the ensemble learning model can improve the accuracy by more than 5% compared to using a single deep neural network and avoid overfitting. This study can forecast the consequence of URT accidents with limited historical accident data, which is effective to direct the URT operation department in identifying frequently occurring accidents and accidents that cause huge consequences for the operation, and thus the targeted maintenance and emergency strategies can be developed to decrease the accident rates and reduce the impact of accidents on URT operations.

## Keywords

urban rail transit, accident prediction, ensemble learning, historical accident data

## Reference

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## Bio

I am Li Xinyao from Wuhan University majoring in Information Security. My research interests are privacy-preserving computation, machine learning, and deep learning. I have applied interpretable machine-learning techniques to tackle some complex problems arising in cities. One of my works has been recognized by the 2021 MCM/ICM Finalist Price, which encourage me to do more work in this field. I am trying to use my knowledge to solve some cities' problems.

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# 6. Sustainable cities and infrastructure

## Metro accessibility and space-time flexibility of shopping travel: A propensity score matching analysis

No.  
6418

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### Abstract

Space-time flexibility is defined as the extent to which individuals can participate in activities at different locations and different times. High space-time flexibility of travel enables people more freedom to choose when and where to make trips and assists in achieving both environmental and social sustainability. Applying a quasi-experimental approach – propensity score matching – to data obtained from 624 interviews in Chengdu (China), this paper aims to examine the effects of metro accessibility on space-time flexibility of shopping travel for non-daily goods. The results show that people residing around metro stations (i.e., high calculated accessibility) have a higher level of space-time flexibility of shopping travel than those living elsewhere. Meanwhile, people who perceive easy access to metro services (i.e., high perceived accessibility) are also likely to have a higher level of space-time flexibility. The findings highlight the importance of metro accessibility from the perspective of time geography. In practice, improving calculated and perceived accessibility to metro services may be an effective urban planning strategy to increase residents' space-time flexibility of shopping travel and inform policy recommendations for the design of sustainable cities.

### Keywords

Space-time flexibility, shopping travel, transit-oriented development, sustainable city design

### Bio

Rui Shao is a Ph.D. candidate at Ghent University in Belgium. Her research focuses on ICT use, the built environment, and sustainable travel behavior.

## **Inequality of eye-level urban greenness provision across the top ten populated cities in U.S.A**

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### **Abstract**

Eye-level urban greenness can have significant implications for public health, social equity, and environmental sustainability. However, the benefits of eye-level urban greenness may not be equally distributed across communities. Under the complex and diverse composition of societies in the top ten populated cities in the U.S.A., the inequalities of eye-level urban greenness provision deserve more attention and are in urgent need of a comprehensive estimation. Simulated eye-level urban greenness can better mimic the human-eye view in a 3D city model. It can work better to reflect the inequality of reception and provision of eye-level urban greenness, helping to improve the engagement of communities. The results show that the ten top cities in the United States have different eye-level urban greenness distribution patterns, and they experience varying degrees of inequalities in eye-level urban greenness provision for different socioeconomic groups.

### **Keywords**

environmental justice, eye-level urban greenness, greenness provision inequality

### **Bio**

Jan. 2020 - now Ph.D. study in Environmental Dynamics, Department of Geosciences, University of Arkansas, AR, USA Sep. 2017 - Dec. 2019 M.S. in Physical Geography, College of Earth and Environmental Sciences, Lanzhou University (LZU), Lanzhou, China Oct. 2018 - Mar. 2019 Visiting Scholar in Environmental Dynamics, Department of Geosciences, University of Arkansas, AR, USA Sep. 2013 - Jun. 2017 B. S. in Atmospheric Sciences, School of Atmospheric Science, Lanzhou University (LZU), Lanzhou, China

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## **Spatial Patterns and Influencing Factors Analysis of Elderly Care Facility Accessibility: A Case Study of Suzhou, China**

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### **Abstract**

Spatial Patterns and Influencing Factors Analysis of Elderly Care Facility Accessibility: A Case Study of Suzhou, China The effective allocation of elderly care facilities is crucial for ensuring the quality of life for the elderly population in urban areas, especially in the context of population aging. Accessibility is an important indicator for assessing the rational and effective distribution of such facilities. Analyzing the spatial heterogeneity of elderly care facility accessibility provides a decision-making basis for optimizing their spatial configuration. This study takes Suzhou, a city in Jiangsu Province, China, as a case study. Based on data on elderly care facility locations, urban road networks, street-level population data, and other socioeconomic statistics, an improved two-step floating catchment area method is used to measure the spatial accessibility of elderly care

facilities at the street level. Combining the Gini coefficient and spatial autocorrelation analysis, this study explores the spatial differentiation characteristics of elderly care facility accessibility in Suzhou and investigates the key factors influencing the spatial pattern of accessibility.

The findings of this study are as follows: The accessibility of elderly care facilities in Suzhou exhibits a concentric distribution pattern. Accessibility gradually decreases from the city center to the suburbs. The central concentric rings around the ancient city area have better accessibility, while the central rings outside the ancient city area have moderate accessibility. The peripheral rings in the suburbs have poorer accessibility. Elderly care facilities in Suzhou demonstrate a centripetal agglomeration pattern. High accessibility areas are concentrated within the inner ring road and its surrounding areas, including the ancient city area, Shishan area, and Chengnan area. Low accessibility areas are concentrated in the far suburbs, particularly in the suburban areas with a mix of urban and rural characteristics. The allocation of elderly care resources in the city center is relatively balanced, with small differences in accessibility, whereas the accessibility of elderly care services in the suburbs exhibits significant variations. The spatial pattern of elderly care facility accessibility in Suzhou is significantly influenced by population density and economic development. The centripetal distribution of elderly care facilities meets the demand of a high proportion of the elderly population in the city center. However, it also reveals significant disparities in the financial investment of the government in the construction of elderly care facilities, which are dependent on the fiscal capacity of the district-level government.

## Keywords

Elderly care facility; Accessibility; Spatial patterns; Influencing factors; uzhou;

## Bio

Wang Peng is a Ph.D. student in Urban and Rural Planning at the School of Architecture and Urban Planning, Nanjing University. His research focuses on urban spatial governance, with particular interests in sustainable development, sustainable infrastructure, and spatial statistics.

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## Spatial location optimization of fire stations with traffic status and urban functional areas

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No.  
6402

## Abstract

Efficient spatial deployment of urban fire stations is highly desired to address the frequent and complex modern urban fires. Various spatial location optimization approaches have been developed to site fire stations. However, most approaches ignored the impact of the traffic status and the actual demand areas of fire services in the rapid urbanization. This paper develops a multi-objective spatial optimization model to account for the traffic status with the online map and the actual demands of fire services with urban functional areas in siting fire stations. A case study in Nanjing, China is conducted to select fire stations with the developed model. Results demonstrate its effectiveness in siting fire stations and highlighting important policy implications for fire departments to ensure urban safety and resilience.

## Keywords

spatial optimization; fire station; traffic status; urban functional areas

## Bio

Yuehong Chen received the B.S. degree from Hohai University, Nanjing, China, in 2010, and the M.Sc. and Ph.D. degrees from the State Key Laboratory of Resources and Environmental Information System, Institute of Geographical Sciences and Natural Resources Research, University of Chinese Academy of Sciences, Beijing, China, in 2013 and 2016, respectively. He is an Associate Professor with the College of Hydrology and Water Resources, Hohai University. His research interests include geographic big data and geospatial artificial intelligence.

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No.  
6419

## Ruralization in Metropolitan Areas: An Explanation Based on Shanghai

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## Abstract

In recent years, academic debates on urbanization and ruralization have always existed, one of the important points is to emphasize the connection between urban and rural areas rather than a single urban or rural centrism. Metropolitan areas usually have good economic levels and living convenience, while the rural areas not only carry the overflow functions of big cities but also provide an ecological living environment. Based on the case of Shanghai, using mobile phone signaling data, POI data, traffic travel data and other big data, this paper analyzes the characteristics of urban-rural linkages, mainly including transportation linkages, population travel linkages, functional linkages, and public service linkages, to identify the characteristics of ruralization in the Shanghai metropolitan area, and further combines interviews with relevant departments and actual investigation, to explain the connotation and mechanism of ruralization in Shanghai metropolitan area at present. The expected conclusions are as follows: (1) The villages and cities in Shanghai metropolitan area have very close relationships, which are mainly reflected in the convenience of public transportation, the convenient flow of population, the long-term development of core functions in rural areas, and the attractiveness on citizens of rural ecological leisure functions, etc. (2) The ruralization of Shanghai metropolitan area is not only about the development of the rural areas themselves and the improvement of farmers' living standards, but also about the continuous blurring of the boundaries between rural and urban areas and the free flow of various factors such as population, commodities, and resources. It is of great significance for us to re-understand the relationship between urban and rural areas in metropolitan areas. (3) Ruralization in Shanghai metropolitan area is greatly influenced by national and local policies and institutional mechanisms, which deserved an in-depth analysis.

## Keywords

ruralization, Shanghai, Metropolitan Area

## Bio

2011-2016, BA in Urban Planning, Harbin Institute of Technology 2016-2019, MA in Urban and Rural Planning, Tongji University 2019-2021, Assistant Urban and Rural Planner, Shanghai



## An Automatic Approach to Extracting Large-Scale Three-Dimensional Road Networks Using Open-Source Data

No.  
6409

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### Abstract

3D road networks are amongst the indispensable elements of smart city, which has been explored in various ways. However, researchers still faces challenges extracting 3D networks on a large scale. The global digital surface models (DSMs) with relatively high spatial resolution make it possible to extract 3D road networks. Nevertheless, the complete and accurate elevation of road networks cannot be obtained directly because of the limitation in sensors on the DSM production platform. Thus, we proposed a novel approach to extract large-scale 3D road networks, integrating terrain correction and road engineering rule constraint, by using the Advanced Land Observing Satellite World 3D-30 m DSM, OpenStreetMap and FABDEM. The simplification and terrain correction algorithm were applied to remove most of the edges with excessive grades and reduced the negative impact of the built-up environment in DSM on the extraction accuracy. Moreover, the tunnel parts of the 3D road networks were refined based on road engineering standards. Nanjing of China, Aalborg of Denmark and Los Angeles of the United States are selected as study areas. Using 3D road networks from unmanned aerial vehicle photogrammetry, light detection and ranging and Google Earth as references, we validated the road elevation accuracy of our method and obtained an overall root-mean-square error of 3.80 m and a mean absolute error of 1.94 m. The 3D topology of interchanges with different radii was reconstructed completely. Overall, our work is an endeavour to utilise multiple open-source data to extract large-scale 3D road networks and benefits future research related to smart city reconstruction and 3D urban analysis.

### Keywords

3D road networks; FABDEM; AW3D30 DSM; OSM

### Bio

Yang Chen is a Ph.D. Candidate in Geography (Cartography and GIS) at the School of Geography, Nanjing Normal University

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## Reconnecting Human Engagement with Urban Response through a Hypernetwork Model: Enhancing Urban Resilience in the Anthropocene

No.  
6424

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## Abstract

Natural and anthropogenic disasters caused by global climate change greatly affect the inhabitants' quality of life. It's crucial to connect human engagement with urban response, particularly in the Anthropocene context, where human agency is embedded in the intricate network that responds to urban disruptions. This study introduces the Quality of Urban Life (QOUL) framework to connect the objective-built environment and subjective public perception, and further explores urban resilience through a human-need-driven hypernetwork model. Through the Latent Dirichlet Allocation modeling and hyper-edge analysis, this study investigates resilience of lifeline systems under sustained shocks and interpret the underlying correlation with the built environment. Our findings reveal that: 1) QOUL deserves the root in connecting public perception with built environment; 2) Most lifeline systems exhibit comparable trends of enhanced resilience in response to sustained shocks, albeit with similar spatial effects and varying duration for recovery; and 3) Hypernetwork identifies critical functions that are vulnerable during the recovery, and uncover the engineering entities that impact these functions. This study offers an inadvertent yet extensively replicated global study of urban resilience using real-time resident request data. Urban policymakers can use the hypernetwork approach for urban resilience strategies toward a globally resilient urban future in the Anthropocene.

## Keywords

Urban resilience, Quality of urban life (QOUL), Hypernetwork, Urban lifeline system, the Anthropocene

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## Bio

Zeyu Zhao, a Ph.D. from Tsinghua University, concentrates his research on urban and anthropogenic resilience. He innovatively employs human-generated data from municipal governments to deepen understanding in his field. His scholarly contributions include four published papers in noteworthy journals like *IJDRR*, *IT PRO*, and *EER*. At Tsinghua University, he excelled academically, achieving a flawless 4.0/4.0 GPA and securing the top rank among 67 classmates. His exceptional performance earned him the National Scholarship in 2020 and the Special Scholarship in 2021—both distinguished accolades awarded to fewer than 1% of students. Furthermore, he was honored with the Postgraduate First Class Award in 2022, affirming his academic prowess.

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## A smart dashboard for forecasting disaster casualties: An investigation from sustainable development dimensions

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## Abstract

Natural disasters are known to cause widespread and severe damages all over the world annually. Flood events are responsible for economic and human life losses. One of the most important indicators of the damage level in a flood crisis is the number of casualties. This index is evaluated annually in all countries based on natural disasters. Studies indicate that the death rate caused by floods correlates with countries' development over time. In the present study, quantitative values of three sustainability indicators were extracted in the Czech Republic, Iran, and the United States between 1990 and 2020. These indicators are the Human Development Index (DPI), Gross Domestic Product(GDP), and Climate-Change Impacts (CCI), representing the Social, Economic, and Environmental aspects of sustainable development, respectively. Then, the mathematical relationships between the development indicators and the number of human

losses caused by disasters were evaluated using statistical distributions based on time series. In the final step, using Artificial Intelligence (AI) methods, including Artificial Neural Network (ANN), Adaptive Neuro-Fuzzy Inference System (ANFIS), and Random Tree (RT), a prediction of the number of potential fatalities per natural disaster was obtained. The outcomes showed that each country's deaths caused by natural disasters could depend on different parameters and impact coefficients. In addition, the ANFIS algorithm, with more than 98% accuracy, has the most efficiency in determining the severity of the event. With the help of this AI system, it is possible to evaluate society's behavior and its resilience against floods from a holistic viewpoint.

## Keywords

Disaster control; Flood damage; Artificial Intelligence; Time-series analysis; Sustainability

## Bio

I am Reza Naghedi, a Ph.D. student in geosciences at the University of Arkansas. As a member of Dr. Xiao Huang's research group, I am working on the intersection of climate change and transportation networks for my Ph.D. program. We are addressing how different natural hazards such as flooding affect traffic in different cities. I have a Master's degree in civil and environmental engineering from the Amirkabir University of Technology, Iran.

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## Identifying core driving factors of urban land use change from global land cover products and POI data using the random forest method

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## Abstract

Rapid urbanization at the expense of the environment led to a reduction in vegetation cover, and consequently aggravated land degradation, urban water logging, heat island effect and other effects. Revealing the driving mechanism behind urban land use change facilitates deeper insight into the human and biophysical effects in the urbanization process and thereby supports the sustainable urban development. This work proposed a margin-based measure of random forest for core driving factor identification of urban land use change, which mainly included urban vegetation change, constructed land, water bodies, etc., using multitemporal global land cover products and point-of-interest (POI) data. Taking the land use change in Wuhan from 2010 to 2020 as the case study, the proposed method was employed to measure and sort the driving forces of 24 biophysical and human factors. The results suggested that the margin-based method was more reliable and sensitive than the traditional importance measure of random forest when detecting the driving mechanism behind land use change. Meanwhile, both the importance values and the ranking orders of driving factors measured by the margin-based method were stable regardless of which similarity measure was chosen and applied. The findings also showed that topographic conditions persistently affected urban land use change, while transportation factors, instead of business services, gradually became the most important human driving factors in Wuhan in the last 10 years.

## Keywords

Driving factor; land use change; global land cover products; point of interest; random forest

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## Bio

Anqi Lin received the Master degree in geographic information science from the University of Pittsburgh in 2016 and the Ph.D. degree from Central China Normal University, Wuhan, China, in 2022. She is currently a post-doctor focusing on the spatial big data analysis and mining, land use mapping, and urban environment modeling.

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## Abstract

The evaluation of the relationship between the sharing economy and housing is a key issue for scholars and practitioners who are searching for an ideal urban regeneration plan. While the effects of the sharing economy on housing prices have been the subject of numerous studies, there is not yet a holistic understanding of interrelations and difference between conservation areas and sharing accommodation in the literature. To fill this gap, this study presents and discusses the main findings retrieved from the investigation developed in Shanghai at the township level between 2014 and 2021. This study addresses this challenge by proposing a methodology including the individual, total and interaction effect tests to elucidate mechanism among these factors. In the case study conducted for Shanghai district, we looked at the spatial heterogeneity of the housing market's effects within regions and discovered significant effects concentrated in the historical city centers. The findings demonstrate that conservation areas and Airbnb both have favorable influence on property prices. The larger-scale urban regeneration work had some good benefits on neighboring property values, whereas the smaller-scale effort led to lower values in suburban areas. Their effects on the three areas, however, were different. The findings also show that the positive effect on house prices is diminished by the interaction between the sharing economy and urban regeneration. This study forms part of the literature on the interrelationship between conservation areas, Airbnb and housing rental market in the context of urban regeneration.

## Keywords

Sharing economy; Airbnb; Housing rental market; Urban regeneration; Shanghai

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## Bio

Ms. Shuning Liu is a PhD student of public policy at Shanghai university of finance and economics. Her main research interests are related to sustainable technology innovation and urban development policy. In particular, she has undertaken extensive research in the importance of sharing economy policy to urban development. She has excellent research track record (received more than 70 citations on Google Scholar; H-index-3 on Google Scholar). She has published seven papers in leading journals, such as *Journal of Cleaner Production*, *Energy*, *Environmental Science and Pollution Research*. In 2022, she gave a presentation on 16th IACP Annual Conference about Urban and Rural Health and Sustainable Development. She was awarded the 2018 National Scholarship of China. She went to Nanyang Technological University in Singapore for a short exchange visit.

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## Household energy and carbon inequality considering rural-urban differences in China: Current status and future trends

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No.  
6420

## Abstract

Residential sector accounts for 17% of global total anthropogenic GHG emissions (Fan et al., 2017). Environmental impacts in the household sector include direct impacts from daily activities and indirect impacts generated by the production of goods and services purchased by households.

(Zhang et al., 2017). Meanwhile, there exist great differences between rural and urban areas in China with the rapid urbanization and this will lead to regional inequality and rural-urban differences of household energy and carbon footprint. Previous studies either revealed the rural-urban energy and carbon differences in one region or in the past period (Chen et al., 2019; Mi et al., 2020), or explored the future energy and carbon reduction measurements which just focused on rural or urban areas (Sun et al., 2021; Chen and Chen, 2017). The temporal change of energy and carbon inequality considering rural and urban disparities from the past to the future have not been comprehensively investigated. This research collects a province-level panel data including final energy use in homes and for transportation and socio-economic data from multiple statistical yearbooks from 2000 to 2019 and gathers the 2007, 2010 and 2017 MIRO table from the CEADs. The purpose of this research is to reveal the spatial-temporal patterns of household energy and carbon disparities in both direct and indirect way and to assess the future change trend of carbon inequality. This study chooses Gini coefficient to explore energy and carbon inequality at the national level and defines a disparity ratio (rural-versus-urban ratio) to quantify the rural and urban gap. When exploring direct energy use, we focus on two energy use intensity indicators: energy use per capita (as the proxy of energy sufficiency) and energy use intensity (based on floor area, EUI). It is found that the overall inequality of per capita energy use and EUI are both decreasing at the national level over 20 years. The contribution of coal use to the overall inequality remains the major factor and the contribution of natural gas becomes the second important factor as time goes on. At the provincial level, we observe that the rural-urban disparities of both RECP and EUI in most provinces are gradually narrowing over 20 years. Household income, energy infrastructure and housing stock have significant influence on RECP to some extent in rural and urban residents. Energy infrastructure also have a paramount effect on the EUI disparities between rural and urban residents, while income level may have no significant effect on EUI disparities. We further explore the rural and urban difference of household carbon footprint. On this basis, this study will simulate the temporal changes in rural-urban disparities in energy use and carbon footprint under a low-carbon energy transition scenario over the next 40 years. We will design business-as-usual scenario and energy-transition scenario considering socio-economic factors. In BAU scenario, we assume that the production technologies in each sector and the economy structure in the future are the same with those in 2019. In energy-transition scenario, we further simulate several cases including coal substituted by electricity and natural gas to explore the effect of energy transition on carbon footprint and its inequality. These findings demonstrate future policies should systematically incorporate both clean energy popularization and infrastructural impact to ensure just and low-carbon urbanization in developing countries.

## Keywords

Household energy use; carbon footprint; rural-urban differences; MRIO

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## Bio

Shuyu Sun, from China-UK Low Carbon College, Shanghai Jiao Tong University; The research direction is energy and carbon inequality; Input-output analysis

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## A New Method of Extracting Built-up Area Based on Multi-source Remote Sensing Data: A Case Study of Baoding Central City, China

No.  
6401

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## Abstract

With the in-depth development of geographic information technology, the accurate extraction of urban built-up area (BUA) based on remote sensing data is of great significance for predicting urban spatial evolution patterns. In order to avoid the defect of single data source in low extraction accuracy, a new method for high-precision extraction of BUA based on multi-source remote sensing data was proposed. On the basis of Landsat 8 multi-spectral remote sensing data images, first of all, the built-up area extraction index (BAEI) was used to identify the preliminary extraction of BUA. Secondly, for the purpose of improving the extraction precision of BUA, the preliminary training samples of BUA were selected by combining the National Polar-Orbiting Partnership/Visible Infrared Imaging Radiometer Suite (NPP/VIIRS) nighttime light (NTL) data. The preliminary training samples of BUA were then adjusted through the normalized difference vegetation index (NDVI) as well as the modified normalized difference water index (MNDWI) to get the final training samples of BUA. In the follow-up phase of the study, further accurate identification was achieved via the support vector machine (SVM) algorithm based upon those selected samples, and then the images fusion and continuity correction were carried out between this result and BAEI extracted result. Finally, taking advantage of the neighbourhood statistics analysis (NSA) to adjust and remove the part of the non-urban centre which was misjudged as the BUA, thus obtaining the final BUA. According to the accuracy assessment and comparative analysis with other classic methods related to BUA extraction, it was found that this method had better performance on both overall accuracy and Kappa coefficient, respectively, 0.915 and 0.762, which can extract BUA more precisely. In short, this method shows a new perspective on the research of BUA, and provides technical support and practical experience for scientific and reasonable urban planning.

## Keywords

built-up area; support vector machine; built-up area extraction index; neighbourhood statistics analysis; nighttime light data

## Bio

Mr. Jiang is a doctoral candidate in Zhou Enlai School of Government, Nankai University, majoring in urban development and management. His main research direction is territorial space planning, urban network, scale politics and coastal zone comprehensive management under multi-source data. He has published 6 papers in *Cities*, *Land*, *Geocarto International*, *Tobacco Regulatory Science*, *Design Engineering*, etc., which have been retrieved by SCI/SSCI/EI database. At present, he is interested in taking advantage of multi-source remote sensing data and Internet big data for urban land use monitoring and urban renewal, and analyzing its influencing factors and optimization direction in combination with econometric regression model and optimal decision-making model.

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No.  
6416

### Developing process-based modelling to quantify urban energy service: Using two cities as cases

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## Abstract

The low-carbon transition of urban energy systems is important for climate change mitigation. While there have been many studies focused on exploring actions changing the physical system, another field of studies explored social services provided by energy use in society, instead of only focusing on energy carriers. Many scholars have proposed to track energy use to the final stage to quantify the amount of energy services (such as lighting, space heating, and mobility) either using the final useful energy or exergy. The exergy analysis is based on the second law of thermodynamics that reflects energy quantity and quality. Exergy-based analysis has been used for sectoral efficiency analysis of energy (Lin et al. 2015), industry (Mancini et al. 2022), households (Laner et al. 2015), and the national economy (Brockway et al. 2015). However, there is relatively little research at the city level to quantify the demand for energy services and analyze related patterns, due to a lack of city-specific methodology. Therefore, this research aims to develop a detailed process-based energy service quantification model that is suitable for cities. We applied both exergy-based analysis and the final useful energy (based on the first law of thermodynamics) for comparison. The developed method was applied to Suzhou and Jiaxing, Jiangsu, China as cases, using data from 2019. The results showed that 89.53% of the primary exergy was used by the industrial sector, while from the perspective of final use, 53.7% of the exergy was used for various forms of thermal processes, including industrial heat, commercial heat, etc. It was found that the efficiency of the industrial sectors in Suzhou and Jiaxing was 37.15% and 33.24%, respectively; 7.79% and 7.60% for the residential sector; 5.25% and 10.22% for the commercial sector, and 12.89% and 13.65% for the transportation sector. This result is consistent with the results displayed in the IEA's Value of Early Action on Energy Efficiency report (IEA. 2022). The industrial sector uses the most energy services (814,000 TJ in total), of which ultra-high temperature energy services above 1000°C (such as blast furnace steelmaking and cement calcination) accounted for ~35.53%. The total amount of energy services in the residential sector is 15,600 TJ, of which energy services for appliances (such as televisions, refrigerators, etc.) accounted for ~50.04%. The energy services in the commercial sector were 2750 TJ, with the largest proportion being heating (such as cooking, heating, etc.) (accounting for 35.16%). There are significant differences in the distribution of energy services among different sectors, but overall, the energy services related to thermal processes (calcination, cooking, space heating, etc.) are the largest, at 785,000 TJ, accounting for 93.66%, of which 331,000 TJ is used



for power generation, accounting for 39.51%. This study developed a city-level energy service quantification model and demonstrated its applicability to cities in China. Using such a model, cities can identify which process to focus on for improving energy efficiency and reduce energy use/demand without compromising services needed by society.

## Keywords

Energy service, Exergy analysis, Climate change

## Reference

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## Bio

Sun Ke, China-UK Low Carbon College, Shanghai Jiaotong University, major in Low Carbon Environment. Received a Bachelor's degree in Engineering from Shanghai Jiao Tong University, majoring in Nuclear Engineering and Technology. The main research areas include multi-scale urban carbon accounting and urban metabolism analysis.

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## Enhancing Sustainable Value Creation: ESG Integration in Alternative Investments within the Infrastructure Sector

No.  
6422

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## Abstract

The integration of environmental, social, and governance (ESG) factors in alternative investments within the infrastructure sector has gained significant attention due to the growing recognition of the importance of sustainable value creation. This paper presents a comprehensive analysis of the application of ESG integration in alternative investments within the infrastructure sector.

The study begins with a thorough literature review, highlighting the relevance of ESG factors in investment decisions and identifying the existing gaps in research related to ESG integration in infrastructure investments. Drawing on a systematic methodology, the paper conducts in-depth case studies of selected infrastructure projects, evaluating the incorporation of ESG factors in investment strategies and assessing their impact on sustainable value creation.

The comparative analysis of the case studies reveals common trends and patterns in ESG integration practices, shedding light on the strategies employed and the effectiveness of ESG integration in enhancing sustainable value creation. The findings demonstrate that ESG considerations play a crucial role in the evaluation and selection of infrastructure projects, with a focus on environmental impact, social inclusiveness, and robust governance frameworks.

The paper concludes by providing implications for alternative investors operating in the infrastructure sector and offers recommendations for improving ESG integration practices. It also discusses policy implications for promoting sustainable investments in infrastructure. This research contributes to the existing literature by providing empirical evidence and insights into the application of ESG factors in alternative investments within the infrastructure sector, ultimately fostering the integration of sustainability considerations in investment decision-making processes.

## Keywords

Infrastructure investment, alternative investments, ESG integration, sustainable value creation, sustainability

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## Bio

Ando is a part-time graduate student in Public Administration at Renmin University of China, with a focus on urban infrastructure and sustainable development. At the same time, Ando is currently working at KPMG China as Assistant Manager of Risk Consulting services, mainly providing ESG, decarbonization and green supply chain related consulting services to enterprises and government organizations.

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## Spatial Optimization of Park Green Spaces by an Improved Two-Step Optimization Model from the Perspective of Maximizing Accessibility Equity

No.  
6427

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## Abstract

As a type of public land, park green spaces (PGSs) carry the daily recreation and social communication of urban residents, and the inequity of their space accessibility has been widely confirmed. However, the optimized suggestions based on evaluations of accessibility and equity in previous studies cannot guide actual planning effectively because the reasonable locations and scales of construction of PGSs were difficult to accurately identify. This study first constructed two equity objective functions: the minimum standard deviation (SD) and the minimum Gini coefficient (GC) in accessibility; then an improved two-step optimization method considering location-allocation was adopted to maximal accessibility equity (MAE) for optimizing the spatial layout of PGSs and doing comparisons of these two objectives for further analysis. The results showed that the improved method based on covering the accessibility blind area and preserving the existing PGSs could optimize the location selection and rationally determine the area. The two objective functions were both effective for optimization, but the GC minimization is more advantageous than the SD for achieving the MAE. The accessibility value increased significantly in a higher proportion of regions, and the overall accessibility median increased by 0.0445. It is worth mentioning that the MAE optimization would lead to a new imbalance between supply and demand in some regions. This indicated that the strictly restricted area standard may lead to the oversupply of PGSs in some areas, while the improvement of equity might not mean the improvement of accessibility. The proposed optimization framework could achieve the optimal layout of PGSs on the goal of MAE. Our findings also could provide inspiration for the equity allocation of other types of public facility lands and support decision-making for government departments regarding management and planning.

## Keywords

park green spaces; spatial accessibility; maximal equity; two-step optimization model; Gini coefficient

## Bio

I am a graduate student from Hubei University, committed to urban green space planning and spatial equity research.

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# Research on Low Carbon Spatial Allocation of Courier Outlets from the Perspective of Behavior Guidance - Taking Nankai District of Tianjin as an Example

No.  
6408

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## Abstract

As an intermediary between supply and demand, courier outlets are closely linked to the supply-side transportation and distribution behavior and the demand-side sending and receiving behavior. The carbon emissions associated with such facilities are mainly transportation carbon emissions, which are composed of carbon emissions from road transportation on the supply side and carbon emissions from residential travel on the demand side, and are an important part of urban carbon emissions. In recent years, such carbon emissions have shown high growth and high potential for carbon reduction, while the related spatial planning still lacks a targeted low-carbon allocation method. The theoretical transmission framework of "spatial planning-behavior-carbon emission" is constructed based on the perspective of behavior guidance, and more than 200 courier outlets in Nankai District of Tianjin are used as the research objects, with the behavior of residents sending and receiving couriers and related urban delivery behavior as the focus of the study, using questionnaire data, field research and POI data to investigate the spatial and temporal correlation between supply and demand side behavior and their respective carbon emissions. The spatial and temporal correlation between supply and demand behaviors and their respective carbon emissions is investigated by using multiple regression models to verify the correlation between spatial configuration and the behaviors of both sides, transportation carbon emissions and travel carbon emissions, and analyze the mechanism of spatial planning guidance; considering the demand of residents, logistics and delivery costs, and carbon control and emission reduction targets, a targeted and low-carbon spatial configuration method of courier outlets is explored to guide the low-carbon behaviors of both sides. Through correlation analysis, the spatial configuration of the courier outlets is optimized from three aspects: spatial layout, planning site selection and distribution methods, in order to achieve the goal of reducing total carbon emissions and improving carbon efficiency of facilities. In the spatial layout, under the constraint of the principle of "supply and demand competition", the supply-side transportation achieves the optimal path distribution, and the demand-side sending and taking express delivery makes residents choose green travel as much as possible to achieve the minimum sum of carbon emissions of acquisition and transportation; in the planning site selection, under the premise of meeting the differentiated needs of residents for the number, type and capacity of outlets, etc. Through the reasonable location of the outlets to reduce congestion on the roads and surrounding areas in the process of transportation and loading and offloading, reduce carbon emissions from congestion due to logistics operations and weaken negative externalities; distribution mode, the common distribution mode of "frequency division multiplexing", the government or a third party to integrate transportation and distribution resources to improve the efficiency of logistics operations and reduce the unreasonable transportation carbon emissions caused by the constraints of competition from multiple parties, and thus improve carbon efficiency.

## Keywords

low carbon; behavior guidance; courier outlets; spatial configuration; Tianjin

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## Bio

Master's degree student, studying at the School of Architecture, Tianjin University, main research direction is low carbon urban planning

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### Coastal city learning model; reflecting climate change adaptation measures with other cities.

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No.  
6405

## Abstract

As the impact of climate change on coastal cities becomes clearer, cities are developing new strategies to deal with the impact of this change, according to recent publications on water-related assessment studies, as well as following the results of the H2020 Marie Curie project SOS Climate Waterfront and its spin-offs (Sanders 2020) (Sanders et al 2021). This development is reinforced in view of the various reports that have appeared recently; whereby the expectations

for global climate change and sea level rise becomes clearer and the need for adaptation measures gains ground compared to mitigation measures as the priority (Deltares 2018a 2018b 2021) (IPCC 2020) (Van de Meulen 2020). With this increasing threat, its clear that small and large coastal cities will look for measures that will specifically help in their own situation to move along with the climate change effects, so that the lives of their inhabitants and thus their cultural phenomenon can be conserved or will not be drastically changed, but can change with the changes (Deltares 2019) (Murphy 2022) (Roo 2011) (Van Bergen 2021). In order to encourage cities to support each other in this development, to learn together how choices can be adapted and communicated with their citizens and stakeholders, and how the related changes to these choices can become cost-efficiently, a model has been developed with which cities can compare each other's situation in the light of their worked-out measures; a model that covers both hard built environmental and more fluid cultural measures and what is in-between, large and small-scale, expensive and cheap measures. Existing models have been used for generating this model (WUR 2019) (Deltares 2022) (Hendriksen 2022) (Lin 2020) (Van Bergen 2019), and relevant case-studies as well (Berkens 2014) (Dal 2021) (Hooimeijer 2022) (Mispelblom 2019) (Van Bergen 2019). The model is tested on the six cities from the H2020 Marie Curie SOS Climate Waterfront programme: Lisbon of Portugal, Rome of Italy, Thessaloniki in Greece, Gdansk in Poland, Stockholm of Sweden and Amsterdam in the Netherlands. Each of these cities their coastal circumstances and actual adaptation measures taken and those that are in consideration, were given a place in the model and involved parties were asked for reflection, in order to process their recommendations into a first guide to using the model, as a contribution to the European scale for all comparable coastal situations.

## Keywords

climate change, coastal cities, adaptation measures, comparable model.

## Bio

Being a coastal civil engineer, with a PhD in Sustainable Urbanism (Delft University of Technology) and a MBA in Organisational development (Erasmus University Rotterdam), the enormous growth of cities in these times that climate-change in special will have an impact on coastal zones, creates my continuous travelling to speak about my experiences, to walk with the people through their countries, and nowadays too to write novels on these themes.

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## Significance of different phases of BIM implementation towards sustainable construction project management

No.  
6407

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## Abstract

The existing paper is going to be developed for reviewing for understanding BIM advantages in architecture, engineering, and construction. There are various types of construction methods that are in use globally; Among them, each authorized firm is implementing new, cutting-edge strategies to acknowledge the building plan is finished within time and with minimal environmental impact. Some of the most innovative approaches to construction monitoring and management include the use of (BIM). The current study will demonstrate the profits of BIM in the building

industry which might provide sustainability to various construction companies. The research data was based on both the qualitative and quantitative methods, as well as the snowball sampling technique, in this case. Quantitatively, 164 survey responses were collected from UK construction industry professionals; and qualitatively, a case study of St. Helens and Knowsley hospitals was chosen because it was most relevant to this research. The SPSS software was utilised to analyze the provided quantitative responses. The study is going to discuss all four phases of the BIM method. On the other hand, different applications and their positive results are also going to be presented with different demonstrations and virtual presentations via different figures and tables. The problem statement of the study is developed by addressing all the various angular aspects related to BIM and its sustainability achieving capability. The results of using BIM in various building projects are discussed, as are the possibility that the results may stimulate the attention of various new construction companies adopting BIM into their construction operations. The current study might be extremely helpful for all the construction strategists to understand the current quality and usefulness of the technology to upgrade that according to the possible best results.

## Keywords

Building Information Modelling, construction monitoring, construction project management, construction strategies.

## Bio

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## Sustainable planning for the Olympic Legacy. The Turin 2006 Winter Olympic Games case study.

No.  
6403

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## Abstract

The Olympic legacy, whether temporary or transitory, can manifest itself before, during or after the Games. It can quickly disappear after the event if efforts are not made to keep it alive through, for example, cultural programming, new environmental legislation, public awareness programming or new wider applications. In recent years, the Olympic legacy and the planning of the Olympic legacy have become increasingly important in the choice of host cities. The importance that has allowed many cities such as London, Sydney, and Tokyo, to develop an entity in charge of the planning and management of the post-Olympic legacy. In addition, sustainability and planning have become two key elements for Olympic success. The intangible possibility of training and involving new profiles in the territory proves to be fundamental to being able to manage the Olympic structures in the post-Olympic period. However, cities will have to overcome the biggest challenge: considering sustainability as a holistic element. Olympic legacy

planning requires great respect for the sustainability of the processes involved in organizing the Olympic event. As global mega-events, the Olympic Games represent a specific historical moment reflecting the globalized world's visions. For this reason, the universal dimension of the Olympic event and the increasing size of the event has, over the years, introduced new concerns for the environment's protection. The overestimation of Olympic works and mega projects has introduced new concerns and criticisms regarding respect for the environment. However, the Rio de Janeiro Charter of 1992, the introduction of Agenda 21, and the collaboration with UNEP in 1994 made it possible to set up a specific commission on sport and the environment in 1995. Thus, in 1996, the environment was finally added to the Olympic Charter as a third pillar. Subsequently, through the new guidelines on sustainable planning, the International Olympic Committee is promoting a message aimed at promoting sustainable practices in relation to climate change and in consideration of climate vulnerabilities. Through the case of the Turin 2006 Olympic Games, the contribution tends to offer an overview of the co-participation actions induced by the creation of the territorial structure "Cabina di Regia". Through the qualitative interviews conducted in della Sala's doctoral study (2022) with leading members of the organising committee, the elements of environmental sustainability and sustainable strategic planning of the event will be analysed. The EIA of the Turin 2006 Olympic programme is the first experiment at the national level of applying an EIA (environmental assessment) process to a works programme. The sample shows a homologation of the trend in the recognition of EIA as an intangible element in the programming of the 2006 Turin Olympics. Finally, the interviewees will reflect on the lack of a specific programme for strategic environmental assessment in the post-Olympic period.

## Keywords

OLYMPICS GAMES, LEGACY, SUSTAINABILITY, URBANISM, ENVIRONMENT

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## Bio

A research fellow at University of Bologna since 2022, he conducts his research in the fields of human geography, sport, spatial policy and environmental education. Research Associate at the Barcelona Centre for Olympic Studies, the Sports Research Institute of the Autonomous University of Barcelona and the interdepartmental research centre of the University of Turin OMERO - Research Centre for Urban Studies.

Her research interests are particularly directed towards the following areas of study:



i. Mega-events, Olympics, territorial transformations and local development. ii. Industrial and cultural heritage. iii. Education for sustainability and local development. iv. Heritage and memory. v. Social inclusion and integration. vi. Geographical description and cartographic representation of environmental issues. vii. Sports organisation and territorial practice.

He currently focuses his research on the theme of sport and territorial policies in contemporary societies.

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## Investigating the effect of school proximity to green space on students' satisfaction using Google POI

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No.  
6404

### Abstract

**Introduction:** This study examines the effect of the proximity of schools to green spaces on students' satisfaction using Google POI data in schools and green spaces in district 8 of Tehran, Iran. **Aim:** It also aims to investigate and analyze web data in the form of Point-of-Interest (POI) data generated by Google users based on the rating of Google users. **Materials and Methods:** In this research, first, all schools were classified into six groups based on users' scores. Then, the distance of each group of these schools within a radius of 250 meters with the adjacent green space was measured and analyzed. After that, the distance between schools and green spaces, the surveys were done using the network analysis method and calculating the common area between schools and green spaces. **Result:** The results show .32 of schools with zero score have the largest common area with green space, approximately .03 of the total area of the study area, .02 of the schools with a score of 5 have the second place, the shared area with green space is about .98 of the total area of the study area and %1.76 of schools with a score of 2 have the lowest common area with green space, about %5.85 of the total area of the study area and the closest access between schools and green spaces was examined with network analysis. The highest values of access belonged to schools with a score of zero. **Conclusion:** This study led to a quantitative and detailed investigation of the common level of schools and green spaces on the satisfaction and scoring of students. The findings of this study can be used to increase students' satisfaction and site selection of new schools and improve the quality of education in the future.

### Keywords

Green space, School, proximity, Google point of interest (POI) data, Students

### Bio

Greetings and courtesy and respect Hope you feel good

I am Fatemeh Rajabi, a master's student from Shahid Rajaee Teacher Training University, from Tehran, Iran. I am interested in GIS topics related to urban planning and artificial intelligence, and I am currently working on voluntary geographic information topics, especially various urban applications of Google Point of Interest.

# Study of key influential factors of culvert deterioration: A data driven approach

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## Abstract

Culverts play an important role in the infrastructure system because culvert failures can directly put the traveling public in jeopardy. However, culverts are often small in size and are installed beneath the ground, which makes them having lower priority in the infrastructure maintenance process. This study applied data analytics and statistical testing methods to the culvert data in the United States Federal Highway Administration culvert database to analyze and determine the factors that have significant impact on culvert deterioration and conditions. GIS and agent variable techniques are also implemented in the data acquiring and feature engineering process. Main contributions of this study include: 1) It provides a better understanding of which environmental and physical factors have more influence on culvert conditions, and this information can be used in both culvert design and maintenance processes; 2) It introduces geospatial information into culvert deterioration analysis, which is a wider perspective compared to existing studies; 3) It gives insight to similar studies aim at other infrastructures.

## Keywords

Culvert condition, infrastructure deterioration, data driven, GIS, statistical testing

## Reference

Gao, C. and Elzarka, H. (2021) "The use of decision tree based predictive models for improving the culvert inspection process," *Advanced Engineering Informatics*, 47, p. 101203. Available at: <https://doi.org/10.1016/j.aei.2020.101203>.

Mizumoto, A. (2023). Calculating the relative importance of multiple regression predictor variables using dominance analysis and random forests. *Language Learning*, 73(1), 161-196. Mohammadi, Rashidi, Malekzadeh & Tiwari (2023). Evaluating various machine learning algorithms for automated inspection of culverts

Qi, J., Smith, M., & Barclay, N. (2022, March). Empirical Data-Based Condition Prediction for Stormwater Pipelines with Machine Learning. In *SoutheastCon 2022* (pp. 316-322). IEEE. Sezen, H. (2022). Rehabilitation and repair methods for culvert structures. In *Bridge Safety, Maintenance, Management, Life-Cycle, Resilience and Sustainability* (pp. 1361-1366). CRC Press.

## Bio

Dr. Ce Gao, PhD graduated from the University of Cincinnati, Ohio, United States, is now the deputy dean of the School of Civil and Architectural Engineering, Guangzhou City Construction College, focusing on the application of big data and machine learning in the field of civil engineering, especially infrastructures management systems.

# Identifying the Urban spatial environmental factors affecting insomnia and their synergies based on multi-source big data

No.  
6426

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## Abstract

Under the pressure of modern city life, more and more residents are facing serious health problems, especially insomnia. Most of the previous researches explored the relationship between sleep quality and population characteristics, environmental pollution exposure and green space exposure, but ignored the influence of urban spatial elements on sleep quality. In addition, the lack of detailed spatial distribution data also brings some difficulties to the identification of potential risk factors for insomnia. Therefore, we obtained insomnia cases with spatial location attributes from social media platforms from 2013 to 2017, used descriptive spatial statistical analysis to explore the differences in spatial distribution of insomnia cases, and adopted step-by-step regression to identify the physical space and socio-economic factors affecting sleep quality. The results showed that insomnia cases were mainly concentrated in some densely populated old communities, business centers and colleges and universities. From a single type of variables, population and economic attributes and spatial structure characteristics have a greater impact on insomnia cases. According to the results of stepwise regression, with the addition of different types of variables in turn, the influence of street quality and architectural form characteristics gradually weakens, and the negative influence of the elderly on insomnia cases gradually increases, which indirectly indicates that the imperfect consideration of potential risk factors will lead to the deviation of impact estimation. It is worth noting that young people are an important group of insomnia. Excessive employment pressure and the surrounding population density increase the probability of insomnia, while scattered commercial facilities, more parks and green space and open space environment are conducive to alleviate insomnia. These conclusions help us to understand the impact of urban spatial environment on sleep quality, and provide some inspiration for the planning of healthy cities.

## Keywords

multi-source big data; Insomnia; Temporal and spatial characteristics; Multilevel linear regression; Wuhan

## Bio

Graduated from Wuhan University and working at Hubei University.

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## Spatiotemporal evolution and driving forces of PM2.5-related mortality in Chinese cities

No.  
6410

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## Abstract

Creating a healthy environment and safeguarding people's health are not only key tasks in improving ecological and environmental quality, but also the core aims of synergizing the reduction of pollution and carbon emissions as well as sustainable development. Based on the latest satellite-based PM<sub>2.5</sub>, LandScan population distribution, GBD disease mortality, and Global Exposure Mortality model, this study accounts for the PM<sub>2.5</sub>-related premature deaths and economic losses in China from 2000 to 2021. The spatial effects and influence mechanisms with related factors are concluded by the usage of bivariate spatial autocorrelation and spatial Durbin model. We find that: (1) China's PM<sub>2.5</sub> health burden continues to increase from 2000 to 2019, which ischemic heart disease and mortality rising are the main causes, and health effects mitigated under COVID-19 epidemic control. (2) The number of PM<sub>2.5</sub>-related premature deaths in Chinese cities shows a deterioration-then-improvement evolution and an east-west divergence distribution. (3) PM<sub>2.5</sub> health effect in Chinese cities is influenced by a combination of geographic distance and socioeconomic factors. The spatial Durbin model reveals that the increase of population density and fiscal expenditure will aggravate the health burden, while increasing per capita GDP, medical service level, vegetation level, and wind speed will alleviate the health burden. The decomposition of spatial effects show that population density and medical service level have both direct and indirect spatial effects.

## Keywords

PM<sub>2.5</sub>; health burden; spatial heterogeneity; socioeconomic determinants;

## Reference

Burnett, R., Chen, H., Szyszkwicz, M., Fann, N., Hubbell, B., Pope III, C.A., Apte, J.S., Brauer, M., Cohen, A., Weichenthal, S. and Coggins, J., 2018. Global estimates of mortality associated with long-term exposure to outdoor fine particulate matter. *Proceedings of the National Academy of Sciences*, 115(38), pp.9592-9597.

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## Bio

I'm a currently Ph.D candidate at Tsinghua University, China and gained my Master's degree and Bachelor's degree at Sun Yat-sen Universtiy, China. My research focuses on carbon emissions, air pollution attributed health burden, and sustainable development. I have published peer-reviewed papers in *Chinese Science Bulletin*, *Geographical Research*, and *Scientia Geographica Sinica*.

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# Spatial Equality of Recreational Opportunity and Recreational Environment of Urban Park

No.  
6411

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## Abstract

Ensuring a reasonable distribution and equitable supply of urban parks is one of significant challenges that urban planners and policy makers need to address to promote sustainable urban development. Taking Singapore as an example, this paper constructs an evaluation system for the spatial supply of urban park recreation services, which focuses on the recreational opportunities and recreational environment of regional parks, community parks and urban parks in general. The study uses locational entropy, spatial autocorrelation analysis, Lorenz curve and Gini coefficient to compare the differences of spatial equality of urban park recreation services. The results show that the spatial equality of recreational environment from the quality perspective is higher than that of park recreational opportunities from the quantity perspective for the same level of Singapore parks. The spatial equality of overall recreational opportunities and recreational environment of urban parks are similar to the corresponding spatial equality of community parks, respectively. The spatial equality of regional parks' recreational opportunities and recreational environments is much lower than the corresponding spatial equality of community parks. Compared with regional parks, community parks in Singapore play a more important role in improving the overall spatial equality of urban parks. The spatial supply evaluation system of urban park recreational services and the research results constructed in this paper can provide theoretical ideas and policy recommendations for park planning and decision making in compact cities with small land areas.

## Keywords

recreational service; urban parks; recreational opportunity; recreational environment

## Bio

I am a doctoral student from Tianjin University, and a joint doctoral student at the National University of Singapore. The research content I focus on is mainly recreational service and carbon sequestration services of ecosystem.

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## A framework of digital nomad experiences as revealed through means-end chain analysis

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No.  
6412

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## Abstract

Digital nomadism is a product of the increased mobility in post-modern society, which connects tourism, life, and work together to form a unique social and cultural experience different from traditional tourism, life, and work. However, the patterns of digital nomad experience and its potential influence have not been fully disclosed. Therefore, using Dali, China as a case study,

this paper uses the laddering interview and means-end chain approaches to deconstruct the digital nomad experiences in Dali. Based on 41 semi-structured interviews, four sets of digital nomad experiences are distinguished based on two dimensions of mobility and value hierarchy: (1) pragmatic fixed experience induced by economic affordability, slow life, environmental amenity, and climate mildness; (2) pragmatic mobile experience induced by mobile office; (3) symbolic fixed experience induced by collective activities and humanistic connotation; (4) symbolic mobile experience induced by mobile office and epidemic control. This paper proposes a two-dimensional framework of digital nomad experience and uses spatial capital theory to reveal the complex interaction and intrinsic mechanism between mobility and fixedness in the context of digital nomadism, which has unique implications for the sustainable development of tourist destinations in the post-recession era.

## Keywords

Digital nomad, Means-end chain, Dali

## Bio

My name is Weifeng Su and I am a Ph.D. student in Tourism Management at Nankai University. My research centers around mobility, urban-rural interaction, and tourism-driven rural gentrification. I have a preference for qualitative and mixed research methods, with critical research taking a large portion of my publications. I welcome any opportunities for academic exchange and collaboration.

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## Infrastructure in Chengdu-Chongqing Economic Circle: Multi-dimensional Analysis

No.  
6413

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## Abstract

Chengdu-Chongqing economic circle is an important engine for high-quality development in western China. And the infrastructure is its short board, according to A Master Plan for the Chengdu-Chongqing Economic Circle issued by the Central Committee of the Communist Party of China and the State Council in 2021. It is the practical need to make up for the shortcomings in the development of Chengdu-Chongqing economic circle that to explore the development level of urban public infrastructure, to identify the key factors affecting its development, and to clarify its multi-dimensional effects based on the social welfare. And it is also the inevitable requirement to promote the development of Chengdu-Chongqing economic circle and to improve the high-quality development in China. Firstly, an evaluation index system for the development of urban public infrastructure system is constructed to comprehensively evaluate the development of urban public infrastructure in Chengdu-Chongqing economic circle with social welfare as the guide. On this basis, its spatial characteristics and spatio-temporal evolutionary trajectory are explored through the spatial analysis tool of the software ArcGIS10.6. Secondly, an attribution analysis is conducted through the GTWR model to identify the key factors. Finally, the multi-dimensional effects of the urban public infrastructure system in the Chengdu-Chongqing economic circle are analyzed by the fixed-effects model selected by F-test and Hausman Test. The results are as follows.1) The development level of urban public infrastructure in the Chengdu-Chongqing economic circle is relatively low, but continues to improve steadily between 2016 and 2020, and the

development prospect is positive, with Chengdu and Chongqing leading the other cities. Urban public infrastructure in the Chengdu-Chongqing economic circle has a random distribution pattern in space, without forming significant hot and cold spots, and the head city has no radiation effect. 2) The development of urban public infrastructure system can be significantly improved by government management, while the promotion effect of industrial structure and urbanization rate is relatively weak, of economic level is extremely weak, and population density and resource background have some negative effects. 3) The transportation infrastructure has a significant positive economic effect. The social effect of medical infrastructure is significantly positive. The education infrastructure has a significant positive economic effect and a negative environmental effect. The environmental infrastructure has significant positive environmental and social effect. The energy infrastructure has no significant effect. And the communication, post and telecommunications infrastructure has a significant and positive effect.

## Keywords

Chengdu-Chongqing economic circle; urban public infrastructure; spatio-temporal pattern; comprehensive effect

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## Bio

Ziming Wang is a doctoral student in the School of Architecture and Urban Planning Chongqing University, majoring in resources and environment, with research interests in regional development, urban public infrastructure, and high-quality development.

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## Review of the Vitality of Urban Public Spaces

No.  
6414

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## Abstract

With China’s urban construction entering a new phase, the focus of urban development has shifted from optimizing existing infrastructure to renewing and developing existing public spaces. However, cities still encounter several challenges that impact their urban vitality, including a lack of high-quality public space and insufficient space quantity. Thus, this paper reviews the vitality of urban public space. It analyses the research hotspots of urban vitality based on a semi-systematic literature review method. It summarizes the theoretical research on the vitality of urban public space and sorts out the influencing factors from the perspectives of society, the environment, and users. It also concludes the mainstream quantitative and evaluation methods and compares their advantage and shortages. The results show that scholars dominantly focus on the investigation of the correlation mechanism of urban vitality under the human-centred perspective. The utilization of emerging big data technologies to quantify urban vitality is an emerging research method. The research hotspots include the discussion of urban vitality evaluation models and correlation mechanisms from a human-centred perspective. This paper comprehensively rethinks the characteristics and evaluation system of the vitality of public space through a multi-theoretical perspective, which contributes to acknowledging the dynamic relationship between users, the urban environment, and vitality. This paper intends to provide designers with optimal design strategies to construct a vigorous urban space.

## Keywords

urban vitality, public space, quantification of vitality

## Bio

Wei is a second-year PhD candidate, which current research focuses on sustainable campus, sufficient building design, campus carbon sink, passive building design, space perceptions and

urban vitality. Previously, she was educated at the University of Melbourne, the University of Adelaide and majored in architecture design.

With a great passion for energy-sufficient and low-carbon design, and firmly insist on human-centred design principles to improve students' well-being by providing optimal strategies for building design, environmental design and implementing green technologies on campus. Throughout Wei's career, she has participated in both research and design projects that related to current campus retrofitting, and campus perception experiment in China.

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## Unequal traveling: how school district system and school district housing characteristics shape the duration of families commuting

No.  
6415

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### Abstract

In many countries, governments have responded to the growing demand for educational resources through school district systems, and there is substantial evidence that school district systems have been effective in promoting inter-district and inter-school equity in educational resources. However, the scarcity of quality educational resources has brought about varying levels of education among different school districts, making it a common choice for many parents to buy a house in the school district where a quality school is located, and they are even willing to bear huge commuting costs for this purpose. Moreover, this is evidenced by the fact that parents of families in school districts with quality education resources have longer average commute lengths and longer average commute distances than parents in average school districts. This "unequal traveling" under the influence of the school district system is more common in school districts at the primary level of education. This further reinforces the differential hierarchy of educational resources and raises issues of inequitable educational public services, education-led residential segregation, and gentrification of school district housing. Against this background, this paper takes Nanjing, a famous educational city in China, as a case study, and selects the school districts where the top 10 public elementary schools are located. The aim of the research, the article identifies the Spatio-temporal behavioral trajectory dataset of these high-quality school district households by using spatial vector data, decrypted cell phone signaling data, and census data. Then, by constructing the "House-School-Work (HSW)" commuting pattern of the population in the school district where the high-quality educational resources are located, the article identifies the school districts with the proportion of long employment commuters based on the classification of the HSW commuting pattern of the population, and analyze the inner mechanism and law of this unequal commuting from six dimensions, including the centrality of school district location, functional diversity, and accessibility. The results reveal that the "unequal commuting" of Nanjing's high-quality school districts under the influence of the school district system occurs mainly in the peripheral areas of the city, and the schools matched with these high-quality school districts are mostly branches of prestigious schools in the built-up areas of the city's core. At the same time, the centrality of school district location and functional diversity cause the most significant influencing elements of unequal commuting in high-quality school districts. Based on the research findings, this paper proposes strategies for optimizing the spatial layout of high-quality educational resources and corresponding transportation policy measures.

### Keywords

School-district system, High quality school district, Commuting pattern, Unequal traveling

## Bio

GEYANG XIA received the B.S. degree in Landscape Architecture from Zhejiang University, Hangzhou, China, in 2015 and the M.S. degree in Urban design from The Chinese University of Hong Kong, in 2017. He is currently working toward the Ph.D. degree in Urban planning with School of Architecture, Southeast University, Nanjing, China. His research interests include Urban big data application spatiotemporal behavior of urban population.

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# 7. Spatial methods

## A psychoacoustic approach for the diagnostic of urban soundscapes

No.  
6502

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### Abstract

This research presents a comprehensive psychoacoustic quantitative and qualitative modelling approach and protocol for the diagnosis of urban soundscapes. It involves 3D acoustics and psycho-acoustics sensors and a range of multidimensional sound sensors that favour the restitution of biological, geophysical, and anthropogenic sounds in an urban environment. A series of 2D and 3D visualisations support realistic representation and perception of the different soundscapes represented. The complementary data processing and visualisation interfaces support analysis of sound morphologies across multiple spatial and temporal dimensions. It is complemented by an in-situ qualitative evaluation of human perceptions that supports a cross-comparison of quantitative and perceived soundscapes. The potential of this modelling framework has been experimented with in the municipality of Sidi Bou Saïd in Tunisia and shows the possible operationalization of such a dual approach, making it possible to qualify soundscapes in a rich historical urban environment. The findings highlight specific soundscape patterns, similarities across different places, the role of time and the positive and negative relationships that emerge between soundscapes and activities, and the way they are perceived by different categories of humans acting in the environment. The framework offers a novel perspective for urban planners and decision-makers in the management and planning of urban spaces through the integration of the soundscape dimension. Supporting material: <https://www.geomatics-cc-mah.com/city> The work has been partly published but novel interfaces will be presented as well as a series of qualitative in-situ evaluations and cross-comparison with quantitative measurements.

### Keywords

Environmental acoustics — Urban heritage — Soundscape — Psychoacoustics — Urban studies

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## Bio

1- Mohamed Amin HAMMAMI has a PhD in Geomatics from the “Université de Bretagne Occidentale” (UBO), France, carried out at the French Naval Academy Research Institute (IRENav). he’s a lecturer in Computer Department, Deanship of Preparatory Year and Supporting Studies, Imam Abdulrahman Bin Faisal University, Dammam, Saudi Arabia. He has a multidisciplinary profile between signal processing, acoustics, It, music and art. 2- Christophe Claramunt is a professor of computer science at the Arts et Métiers Institute of Technology and Naval Academy Research Institute. He’s acting as one of the deputy directors of the ISblue Interdisciplinary Graduate School for the Blue Planet whose objective is to push back the frontiers in marine science, marine technology and ocean innovation. He was previously a senior lecturer in computing at the Nottingham Trent University and a senior scientist in GIS at the Swiss Federal Institute of Technology. Since September 2022, he has been on research leave at the Swiss Federal Institute of Technology and from April 2023 at the Okinawa Institute of Science and Technology on a Theoretical Science Visiting Program. His research is oriented towards theoretical and pluri-disciplinary aspects of geographical information science.

# Urban ecosystem services: assessment pathways for regulating, institutional and cultural value

No.  
6507

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## Abstract

Urban green infrastructure (GI) and protected areas (PAs) particularly are providing an extraordinary set of ecosystem services, but ecological and so-cial compounds of urban livability contradict each other because of limited space and various demands of stakeholders. Definitions of regulating (R), in-stitutional (I) and cultural (C) values were invented to conduct a comparative spatial analysis of ecosystem services (ES). Three case-study PAs within Moscow were assessed and mapped through on-site surveys of ecosystem degradation, public interviews, analytic hierarchy process, qualitative and quantitative analysis of legislative acts, modelling of 5 key ES. Large green core of Izmaylovo park tends to retain less disturbed ecosystems, especially black alder forests on floodplains, and provide regulating services at slightly larger extent (E-S = +1.1). Fragmented and deteriorated river valleys are strongly exposed to human pressure which resulted in the relatively low ES supply (E-S = -3.9). Izmaylovo park tends to retain less disturbed ecosystems, especially black alder forests on floodplains, and provide regulating services at a slightly larger extent than cultural ones (E-S = +1.1, possible values vary from -20 to +20). Despite the higher connectivity of habitats Iz-maylovo and Tyoply Stan PAs are still vulnerable to severe adverse trans-formations. Gaps of spatial planning defined as zones of insufficient and excessive regulations of human activities were revealed, whereas the first type strongly prevails (I-R = -1.9 within Setun valley). Devised constellation of methods may be used to assess the ES of protected areas in other cities and GI patches, as well as their costs.

## Keywords

urban planning, green infrastructure, spatial analysis, environmental management, nature conservation

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Trzyna, T. et al: Urban Protected Areas: Profiles and best practice guidelines. Best Practice Protected Area Guidelines Series, No. 22. IUCN, Gland, Switzerland. XIV. 110 p. (2014)

## Bio

I am a young PhD in geography and ecology defended on December 2022. My thesis has been devoted to the ecosystem services, including the cultural ones, of fragile protected areas (PAs) in the urban fringe. Moreover, the livability assessment across urban fringe districts has been conducted in my master's study through mapping several compounds (e.g., air and noise pollution, proximity and quality of green areas) and AHP analysis. Currently, I and my PhD supervisor are preparing two articles focused on the legislative transformations of land use within urban PAs. My published articles in English are devoted to various research fields – urban planning and livability, GIS applications, environmental policy and management, and ecosystem services. My professional experience corresponded with my scientific aspirations, whereby I was able to use some raw data on PAs and operate on open-access spatial data, topo base maps, Red Lists data, Strava Global Heatmap data, Open Street Map, etc., using PostGIS spatial databases. It was challenging to reconcile my academic and professional activities and to connect with colleagues from Russian institutions, Australia, Germany, the UK, the USA, and Serbia. Currently, I am preparing to take up a postdoctoral position at Aston University, Birmingham, UK.

No.  
6511

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### The impact of Lean practices in improving the construction production for a better waste management towards sustainability

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## Abstract

As the importance of sustainable development grows, several industrial sectors, including the building and construction industry, are under growing pressure to enhance their environmental performance. The idea of lean manufacturing has been shown to be beneficial in lowering waste streams and raising overall productivity. As a result, a significant number of research have been carried out to investigate the correlation between the decrease in waste and the enhancement of environmental performance. To explore the evolution of integrating lean to obtain green advantages, detailed literature research is carried out. This study focuses on understanding the implementation and investigation of lean methodology in improving construction productivity and the impacts of waste management towards sustainability. For this study, four success indicators (ie., Lean, Productivity, Waste Management and Sustainability) were used. Based on that, a conceptual model was drawn with productivity and waste management acting as mediating variables in between Lean and Sustainability. The methodology has concentrated on various analyses of research philosophy, research techniques, research strategies, and research design so that researchers may readily choose the method of data collection. In this research, the mixed method is used along. The five-point Likert scale is used to create a quantitative questionnaire for quantitative data collection. To obtain data from construction professionals such as project managers, architects, contractors, researchers, and so on, the survey employs the snowball purposive sampling approach. The survey received 206 replies, the majority of which came from the United Kingdom, and served as the foundation for many statistical data analysis approaches that assisted in the formulation of study conclusions. My research uses a qualitative case study of a UK packaging manufacturing SME to improve sustainability. The suggested constructs' reliability and validity were assessed using Cronbach's alpha and CFA. Structural Equation Modelling (SEM) investigation examined how productivity and waste management affect lean and sustainability. The findings indicate that waste management and lean have a considerable beneficial influence on sustainability. It is also well acknowledged that uncertainty in Waste Management



has a positive impact on the link between Lean and Sustainability. Similarly, the negative impact of Productivity on Sustainability is negligible. This study answers the research questions and makes suggestions for future research using current literature and results from analysis and case studies.

## Keywords

Lean construction, waste management, lean methodology, productivity, sustainability, structural equation modelling and confirmatory factor analysis

## Reference

## Bio

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## The Research on urban/ suburban Cultural Ecosystem Service Demand and Supply Spatial Distribution: A Case study from Shanghai, China

No.  
6509

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## Abstract

In the urban ecosystem affected by the economy, the demand for cultural ecosystem services has greatly increased, and the imbalance of CES supply and demand has appeared. This paper integrated multi-source data to analyze and visualize the spatial differences in CES demand and supply capacity between Shanghai urban center and suburbs. Based on the geo-tagged photo data, the spatial distribution differences of the four types of CES demand, Recreation & tourism services (RTS) demand, Aesthetic services (AS) demand, Heritage & cultural services (HCS) demand, and Spiritual & religious services (SRS) demand, were analyzed. Residents and tourists had a strong demand for recreation and tourism, and the spatial agglomeration effect was the most obvious. Overall, CES demand was more concentrated in urban centers, while the spatial distribution of suburbs was relatively discrete. At the same time, CES near the Huangpu River was overused in urban center and suburbs. Using the bivariate Moran's I method to test that there was a significant positive spatial correlation between CES demand and CES supply capacity in urban center, CES supply had a positive external impact on CES demand, and the increase in CES supply capacity can promote the growth of CES demand.

## Keywords

Spatial correlation, Supply-demand balance, Regional differences, Recreation opportunity, Recreation potential, Geotagged photo data, Urban ecosystem

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## Bio

In the urban ecosystem affected by the economy, the demand for cultural ecosystem services has greatly increased, and the imbalance of CES supply and demand has appeared. This paper integrated multi-source data to analyze and visualize the spatial differences in CES demand and supply capacity between Shanghai urban center and suburbs. Based on the geo-tagged photo data, the spatial distribution differences of the four types of CES demand, Recreation & tourism services (RTS) demand, Aesthetic services (AS) demand, Heritage & cultural services (HCS) demand, and Spiritual & religious services (SRS) demand, were analyzed. Residents and tourists had a strong demand for recreation and tourism, and the spatial agglomeration effect was the most obvious. Overall, CES demand was more concentrated in urban centers, while the spatial distribution of suburbs was relatively discrete. At the same time, CES near the Huangpu River was overused in urban center and suburbs. Using the bivariate Moran's I method to test that there was a significant positive spatial correlation between CES demand and CES supply capacity in urban center, CES supply had a positive external impact on CES demand, and the increase in CES supply capacity can promote the growth of CES demand.

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## Spatiotemporal evolution of coordination and conflict of land use functions and influencing factors: a case study in Beijing, China

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## Abstract

Land use patterns significantly impact urban development by exerting production-living-ecological functions (PLEFs). The identification and analysis of PLEFs are essential to assess land use change, and the coordinated development of PLEFs is also a prerequisite for promoting efficient and sustainable land use. However, there is still a lack of scientific evidence and reliable quantitative analyses of PLEFs' fine-scale characterization and the spatial variability of their influencing factors. Therefore, this study takes Beijing, an area typical of rapid land use change, as a case, to explore the spatiotemporal evolution of the coupling coordination degree (CCD) of PLEFs and influencing mechanism by employing spatiotemporal data and spatial statistical models. To achieve this goal, this study (1) adopts an improved method for identifying PLEFs, and uses GIS tools to analyze the spatial and temporal patterns of PLEFs in Beijing from 2000 to 2020 on a 1km×1km grid, (2) uses a coupling coordination model to characterize the spatiotemporal characteristics of the CCD changes of the PLEFs, (3) employs geographically weighted regression (GWR) to detect the spatial differences in the strength and mode of the impacts of influencing factors on the CCD. The results showed that from 2000 to 2020, (1) the areas with high CCD gathered in the plain areas with high PF and LF, and the low CCD areas clustered in the mountainous areas with low PF and LF. (2) the EF presented a closer positive relationship with CCD in the plain areas, and the positive impact of PF and LF on CCD was more substantial than EF in the

mountainous areas. (3) the population and GDP factors had high-positive effects on CCD in the north and west mountain areas, while the altitude and slope factors negatively affected CCD in most areas of Beijing, except for a few areas in the southeast. Therefore, formulating a regional differentiation strategy to achieve the sustainable development of PLEFs in Beijing was crucial. This study can provide a reference for targeted land use protection and management policies in Beijing, and will promote sustainable development and the rational use of land resources.

## Keywords

Production-living-ecological Functions, Coupling Coordination Degree, Influencing Factors, Geographically Weighted Regression, Beijing

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## Bio

Lecturer, PhD candidate, main research interests are urban and rural planning theory and design, sustainable land development, and geospatial technology and methods.

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## Local spatial heterogeneity of Wheat Yields in Western Australia

No.  
6505

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## Abstract

There has been considerable research on the spatial heterogeneity of crop yields. However, there are few studies on the local spatial heterogeneity of crop yields and their indicators. Therefore, this study chose to study the characteristics of local spatial heterogeneity of wheat yields. According to the spatial distribution map and yields data of the main wheat-producing areas in Western Australia (WA) in 2022, combined with the data of meteorological elements that affect the growth and development of wheat, such as temperature, precipitation, lighting, radiation, etc., a spatial statistical model of wheat yields in WA was constructed. Furthermore, the downscaling prediction of wheat yield data was carried out through the high-resolution meteorological element data. Then we studied the local spatial differences on the 1km spatial resolution grid, compared and analysed the various indicator data of the spatial heterogeneity of different grids to explore which factors that affect these indicators, find out the optimal value and the best combination of indicators, and provide theoretical support for rational planning of wheat planting areas and adaptive management.

## Keywords

Local spatial heterogeneity, Wheat yields, Heterogeneity indicators, Spatial analysis

## Bio

I'm a PhD candidate majoring in GIS from Northwest A&F University, China. And now, I am a Visiting Research Associate at Curtin University, my research focuses on Geospatial Analysis, GIS, Climate Change and Agriculture.

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## **Abstract**

In recent years, the focus of China's urban development has shifted to urban regeneration, and renewal design should take into account the history and culture of the city, the living needs of citizens and the subsequent commercial development. The renewal unit system can flexibly integrate these requirements, and has been widely applied in the practice, and urban morphology methods has strong practicability in the division of urban plan-units. This paper attempts to use the analysis method of urban morphology to divide renewal units and explore the adaptability and expandability of urban morphology in the future development of China's cities. This paper adopts urban plan analysis, typology analysis, qualitative and quantitative combined analysis, and other morphological methods. In addition to basic morphological elements such as streets, plots and buildings, it also incorporates the unique historical relics, cultural heritage, social management system and housing property rights of Shuangta District, and studies its changes in scale and time. Finally, it obtains the unit division diagram from three perspectives of morphology, culture and people's livelihood, and conducts the superposition analysis to divide the plan units for protection and renewal of Shuangta District. The renewal units can serve as the basic unit and provide accurate and valuable basis for future strategic design, development contracting and transformation implementation.

## **Keywords**

Urban renewal, Urban Morphology, Renewal Unit

## **Reference**

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## **Bio**

Cheng is studying for a doctorate in architecture in The School of Architecture and Urban Planning of Nanjing University, mainly focusing on the theory and practice of urban renewal design, and she has participated in many urban renewal design projects in Nanjing and Suzhou.

# A Study on the Spatial Succession of Urban Center System Based on Spatial Syntax

No.  
6504

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## Abstract

The formation and morphological evolution of the urban center system is a long historical journey. In this process, the urban services industry appeared, accumulated, migrated, and split in a particular space, forming the urban center system. Many studies have been conducted to investigate the nature of city centers; space syntax theory provides a new perspective for urban morphology study through the quantitative modeling of urban space structure. The rapid expansion of the urban space scale became a very prominent feature of the urbanization boom China experienced in the twentieth century. During this long evolutionary process, along with the expansion of the urban scale and population and the diversification of center function, the urban center system's form changed, retaining characteristics of the historical eras in which the changes occurred. Based on the collation and analysis of historical maps, this article selected Nanjing's urban spatial form between 1910 and 2010 as a research object, and established an urban space model for each decade. Using space syntax theory and analysis methods, we performed quantitative analysis and comparative studies on the evolution of the Nanjing urban center system in different eras. In our analysis, we attempted to grasp the inherent operating mechanism of urban spatial structure under different social backgrounds and historical events, as represented by urban center system change. In this study, we found that periods of destruction and reconstruction during regime changes greatly impacted changes in street structure, but basically followed similar spatial development logic—a finding that has strong historical research value. Though most of the existing roads in the old Nanjing city were formed in the Ming and Qing Dynasties, the spatial structure was expanded in every period, leaving a distinct mark on the urban form. In particular, the “Capital Plan” made by the Republic of China in the 1930s and the new round of urban construction in the 1980s after reform and opening had a tremendous impact on the structure and morphology of Nanjing's center system. The results showed that the movement of the urban network's integration core accompanies the spatial transition of urban centers. The significant spatial overlap and dynamic synchronization between urban centers and the spatial integration core shows that changes of urban form strongly affect the generation and migration of urban center systems. Meanwhile, events that significantly influence urban spatial form in turn promote transformational changes in the structure and morphogenesis of center systems.

## Keywords

urban center system; urban form; Spatial Syntax; Spatial Succession

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## Bio

Haipeng Wang is a doctoral student in the Department of Urban Planning at the School of Architecture, Southeast University. His research interests include quantitative analysis and digital management of urban spatial form.

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## The Space for the Elderly: Aging-friendly Design Strategies for Informal Public Spaces in Old Town

No.  
6506

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## Abstract

At present, the global aging is gradually deepening, and Japan, Italy, Portugal, China and other countries have entered the "aging" society. However, the current urban spatial planning does not consider the use and needs of the elderly, which makes them the "forgotten people" in the urban planning process. In response, the field of urban planning has been calling for attention to the needs of the aging population since the beginning of this century. However, the current design of age-friendly spaces has mostly focused on social studies. As a result, there is a contradiction between the behavioral needs of the elderly and the supply of urban space. This problem is particularly evident in the old town, which is characterized by high density of population and space. In the old town, the "Double High Density" characteristic of population and spatial density corresponds to the "Double Old" phenomenon of population composition and spatial quality in the old town. Under this contradictory phenomenon, on the one hand, the behavior, and activities of the elderly people in the old town are characterized by strong spontaneous organization, community fixity and regularity, which require high environmental quality and facilities of urban space. On the other hand, the environmental quality of urban old city space is relatively low, and the public infrastructure is old. With the increase in residents' health level, the existing public space in the old city cannot accommodate the increasing number of elderly people and meet their activity needs. The elderly are forced to use the space on both sides of the pedestrian street, the plaza attached to the building, the parking lot and other informal public spaces, which have a single space, fixed function and low safety. Informal public space is the type of space needed for spontaneous activities formed by people in the city from the bottom up. In the context of the high cost and difficulty of urban renewal in old cities, informal public spaces have gradually become the main activity spaces for the aging population in the old town. In this regard, this paper takes informal public spaces in the old town as the object, aims at "ageing appropriateness". The study of an old town in Dalian, China. Firstly, this research adopts on-site research and semi-structured interviews to define the activity characteristics and needs of the elderly. Secondly, this study uses LBS data and fixed-point observation to analyze the spatial and temporal patterns and characteristics of the activities of the elderly. Finally, this study establishes an index system based on SPSS from four levels: location environment, traffic accessibility, facility quality and landscape elements to analyze the inner mechanism of the daily activities and spatial needs of the elderly. mechanism. Then, according to the weights of

different indicators, this study proposes targeted strategies in the four levels of environmental quality, convenient transportation, facility quality and green landscape respectively. To promote the all-age appropriateness and high-quality healthy development of urban space.

## Keywords

aging-friendly design, informal public space, old town , spatial analysis, sustainable cities

## Reference

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## Bio

Zhihan Zhang is a PhD candidate at the School of Architecture, Southeast University Her research focuses on digital urban design

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### The matching degree of supply and demand accessibility for emergency rescue service with social media data: A case study of heavy rainstorm disaster in Zhengzhou

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No.  
6508

## Abstract

With the development of digital technology, geospatial big data plays an increasingly significant role in urban safety governance. Social media data is a type of geospatial big data and contains a large number of information on disasters such as geospatial location of risks and message for help, which can provide strong support for emergency rescue. Based on this situation, this research analyzes the matching degree of supply and demand accessibility for emergency rescue service with the use of social media data and Gaussian two-step floating catchment area method (2SFCA). Taking the heavy rainstorm event in Zhengzhou in 2021 as a case study, this research collects related message for help from microblog and analyzes the spatiotemporal characteristics of emergency rescue demand. Then the matching degree of supply and demand accessibility for emergency rescue service is evaluated based on social media data. The research results are as followed: 1) there are spatiotemporal differences in the emergency degree of emergency rescue demand in the central urban area. The emergency rescue demand is mainly concentrated in the central urban area and has an obvious peak period; 2) the supply and demand accessibility for emergency rescue service represents certain spatial agglomeration characteristics in the whole urban area; 3) there is general spatial accessibility mismatch between supply and demand for emergency rescue service in the whole urban area. According to the research results, this

research proposes suggestions on the optimization of emergency rescue system and emergency management, including the allocation optimization of emergency rescue resources based on spatiotemporal characteristics of emergency rescue demand, the establishment of geospatial big data platform for emergency rescue, and the development of community emergency management for disaster prevention. The purpose of this research is to explore the application of geospatial big data in the emergency response and provide reference for the establishment of the efficient emergency rescue system based on geospatial big data.

## Keywords

geospatial big data; social media data; emergency rescue; supply and demand accessibility; Gaussian two-step floating catchment area method (2SFCA)

## Bio

2012.09-2017.07, College of Architecture and Planning, Yunnan University, Bachelor degree.  
2018.09-2021.06, College of Architecture and Urban Planning, Tongji University, Master degree.  
2022.09-present, College of Architecture and Urban Planning, Tongji University, Doctor degree.

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## Optimizing Urban Functional Land Use through Heuristic Tuning for Dual Low Carbon Targets at Regional Land Use Structure and Local Pattern Scale Optimization

No.  
6510

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## Abstract

As global climate change becomes more severe and concerns about environmental sustainability continue to grow, low-carbon city development has emerged as a global trend. Optimizing land use can significantly impact the carbon emissions of cities by influencing the structure and spatial patterns of land use. However, few studies have focused on optimizing the type of land use functions within cities under a dual low carbon emission orientation of structure and spatial scale. Therefore, this paper proposed a raster-based dual low carbon oriented multi-objective land use allocation (DLC-MOLA) optimization model, utilized both idea-point multi-objective linear programming (IMLP) and non-dominated sorting genetic algorithm II (NSGA-II) to optimize the two scales involve regional land use structure and local land use pattern in Wuhan's main urban area. The structure scale includes two objectives: minimizing carbon emissions and maximizing economic benefits, while the pattern scale considers three objectives: maximizing spatial compactness, maximizing spatial suitability, and minimizing spatial carbon emissions. The study designs 12 scenarios that consider both structural and spatial scales. The results indicate that (1) The estimated functional land use carbon emission index and quantitative structure results show that industrial land use has the largest share and the strongest relationship with carbon emissions. (2) The target values of all scenarios are significantly improved. Due to the minimization of carbon emissions at both scales, the EP scenario has the most significant reduction of 7.69%. (3) Unlike the previous situation of urban sprawl, the commercial land in the Jiangnan Road and Simenkou business districts, as well as the Baishazhou and Hanyang industrial parks, have formed a clear agglomeration.



## **Keywords**

Urban land use optimization, Dual low carbon scales, Multi- scenarios, Urban compactness

## **Reference**

## **Bio**

I am a graduate student from China University of Geosciences, and my research interests are in urban spatial optimization.

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## 8. Posters

### Enhancing Environmental Urbanism through Artificial Intelligence, Digital Twins, and Big-Data interplays

No.  
6608

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#### Abstract

The Architecture, Engineering, Construction (AEC) industry is under deep transformations entangled by a ubiquitous information technology revolution, driven by computers, algorithms, data and digital communication.

Instruments such as Parametric Modeling softwares, BIM (Building Information Modeling) interfaces, Geographic Information Systems (GIS) platforms and Artificial Intelligence (AI) applications, are already part of AEC's reality, helping architects, urbanists, decision makers to navigate over current complex challenges (e.g. climate change) exploring latent possibilities that can be only accessed via digital machines augmentation.

This powerful combination between digital machines and the human expertise offers the opportunity, for example, to better understand the implications of buildings over specific urban dynamics - such as environmental aspects and microclimate issues in cities - providing not only extra inputs for more sustainable design approaches but also, novel perspectives for integrated resilient urban futures.

In the respective context, it's important to consider that a holistic, integrated assessment of environmental effects in urban space does not only require the consideration of singular aspects of construction performances (energy consumption in buildings, for example) - the urban context must be also comprehensively examined in order to incorporate any given hypothesis, for instance, the positive cooling effects of intensive vegetation as a response for heat islands conditions in cities over time.

#### Keywords

digital, twins, big-data, environmental, urbanism, artificial-intelligence

#### Bio

Carlos Marchi is an architect and urbanist with an international dual graduation from Mackenzie University (Brazil) and Eindhoven University of Technology (the Netherlands). With more than 20 years of experience working over architectural and urban developments in Austria, Angola, the Netherlands, China, Brazil, Greece and Uruguay, his main focus is to explore potential intersections between spatial design, environmental architectonics and information technologies (big-data, digital twins and artificial intelligences). He holds a master's degree from the University of Applied Sciences of Vienna (Austria) in Urban Strategies and Advanced Architectures and an

MBA in General Management with triple international accreditation (AACSB, EQUIS, AMBA). He is part of the research group "Digital Gnomonics" organized by the respective departments - ATTP (TU Wien) and CAAD (ETH Zürich) – he also teaches and researches at the Institute of Architecture and Media (IAM) of Graz University of Technology (Austria) and develops specific projects (urban data science & data-driven-design) at Allower.org, organization founded by him in 2019.

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No.  
6602

## Analysis of the protective contribution of nature reserves to carbon pool—Taking Tai 'an City as an example

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### Abstract

Currently, carbon-fixing goal and forest protection have become important factors to be considered in urban planning and construction in China. Making use of nature reserves to protect forest resources and ecological environment is a boom, but whether these nature reserves have a sufficient role in promoting carbon pool remains to be further verified. We take Tai 'an City of China, which is rich in forest resources and has many natural reserves, as an example, and calculate the carbon pool of forest land according to the official database of forestry survey and land survey results. The method and parameters are according to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories. So the distribution map of forest carbon pool is obtained. A total of 48,54761 tons of carbon was in the city's forest carbon pool in 2019. By using ArcGIS spatial analysis tool, we find that the carbon pool per unit area of provincial nature reserves was more than that of municipal nature reserves. The carbon pool per unit area of core zone, buffer zone and experimental zone in nature reserve decreased successively, but all of them were significantly higher than non-nature reserve. This indicates the positive effect of promoting the management level of natural reserves. In general, the loss of carbon pool per unit area (from 2018 to 2019) in the nature reserves was less than the city's average, except for the Lashan Nature Reserve in Dongping. The results show that the nature reserve plays a positive role in protecting carbon pool, but we suggest strengthening the management in the future. From the core zone to the buffer zone and then to the experimental zone, the loss of carbon pool per unit area gradually increased, indicating that the strict management of forest protection has been gradually relaxed (across the space). There is a negative correlation between the loss of carbon pool per unit area and the total area of nature reserve. So properly expanding the spatial scope of nature reserves will play a positive role in protecting carbon pool. In the nature reserve, the shelterbelts in low mountains and hilly areas are where the carbon pool reduced the most, so it is necessary to be vigilant that they become new carbon source.

### Keywords

carbon pool, nature reserves, forest, city scale

### Bio

In 2015 I got my bachelor's degree in geographical science in Beijing Normal University. In 2018 I got my master's degree in human geography in Institute of Geographical Sciences and Natural Resources Research, Chinese Academy of Sciences. From the July in 2018 to the August in 2020,

I worked for Guangdong Urban & Rural Planning and Design Institute CO., LTD. During that time, I participated in 4 projects about urban ecological planning and design. From the October in 2020 to the May in 2021, I worked for Beijing Normal University Territorial Space Planning and Design Institute Co., LTD. From the September in 2021 until now, I studied as a Ph.D. candidate in human geography in Beijing Normal University. Now I focus on urban ecological space research. I have published 6 academic papers in total.

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## Public Perception of Adaptively Reused Buildings in Singapore: A Case Study of CHIJMES

No.  
6603

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### Abstract

Adaptive reuse is an increasingly common approach to conserving heritage buildings by discovering new uses for them. When the heritage building is adaptively reused, the building and its impact on society are transformed. Whether their heritage values need to be reassessed is a question worth examining. This study proposes a methodology that examines public perceptions of adaptively reused buildings and whether perception changes with time and the perceiver. The CHIJMES was selected as case studies. This paper uses social media data to analyze and summarize the heritage attributes and values perceived by locals and tourists. The non-parametric hypothesis test is used to determine if there were differences in people's perceptions across time. By analyzing social media data, this paper summarizes the eight heritage attributes perceived by locals and tourists when they visit CHIJMES. They are Monuments and Buildings, Building Elements, Interior Views, Landscape, Activity and Association, Gastronomy, History, and Economy. The study result indicates that there are significant differences in people's perceptions across time for Monuments and Buildings, Building Elements, Activity and Association, Gastronomy, History, and Economy. There are no significant differences in people's perceptions across time for Interior Views and Landscape. This study could provide insights for future heritage value reassessment work.

### Keywords

Perception; Adaptive Reuse; Social Media; CHIJMES

### Bio

Meng Zhang is a student and researcher focusing on architectural conservation, urban regeneration, and urban heritage. She received her Bachelor's degree in Urban and Rural Planning from Hebei Agricultural University in 2018. She continued her studies at Hebei Agricultural University and earned a Master's degree in 2022. She is a MA in Architectural Conservation student at the National University of Singapore. She was the recipient of the Tun Tan Cheng Lock Scholarship in Heritage Studies in 2023. She also received the Bronze Award at the 2022 China International Landscape Planning and Design Competition. Additionally, she received several awards at Hebei Agricultural University, including the Outstanding Postgraduate Award and Scholarship. Furthermore, she has contributed to several academic publications.

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# Analysis of the Influencing Factors of Vitality and Built Environment of Shopping Centers Based on Mobile-Phone Signaling Data(MSD)

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## Abstract

Nowadays, shopping centers not only provides commercial function but also serve as a public space. In this article, we take Nanshan district of Shenzhen as an example, based on the characteristics information of people activities provided by Mobile-phone Signaling Data(MSD), using the standard deviation ellipse method(SDEM) to classify the direction of people in shopping centers, and then applying the entropy weighting method(EWM) to analyze the vitality factors of shopping centers from three perspectives: visitors' density, revisit rate, and the average length of stay. Finally, we analyzed the influence factors of the surrounding built environment based on correlation analysis to discuss the results with field survey data. The results show that (1) shopping centers in Nanshan District are classified into wide-area type and geo-regional type according to the gathering of visitors. The shopping centers with high comprehensive vitality are basically wide-area type. (2) The factors influencing the vitality of shopping centers are different between wide-area type and geo-regional type. The vitality of wide-area type is mainly influenced by the traffic accessibility and whether they are located in adjacent to large public spaces such as squares and green public; the vitality of geo-regional type shopping centers is mainly influenced by the number of people within a 15-minute walking circle, and the high-vitality of geo-regional shopping centers are generally located in densely populated areas.

## Keywords

Mobile-phone Signaling Data(MSD); Shopping Centers; Visitor density; Revisit rate; Average length of stay

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### Evaluation of settlement environment in the residential areas from a perspective of residents' satisfaction: a case of Beijing

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## Abstract

As the degradation of settlement quality due to the increasing urban population becomes increasingly serious, the study of settlement environments based on sustainable development has attracted widespread attention worldwide. The quality of the settlement environment in residential areas is initial in enhancing the well-being of residents and the livability of cities, for it is a carrier of the people and the environment in cities. Therefore, conducting an in-depth and systematic study of the settlement environment in residential areas is necessary to provide references and suggestions for the optimal construction of future or existing residential areas. Currently, research on the evaluation of settlement environment in residential areas is of rich fruits, but most of them focus on specific aspects of the habitat and lack a holistic and systematic summary. In addition, the evaluation system is mainly dominated by the designer and neglects attention to the residents' experience. As a result, it can lead to a disconnect between design and actual needs, which is detrimental to the creation of a livable environment and a waste of resources. Therefore, this study first selects influencing factors for the evaluation of the settlement environment from the perspective of residents' needs, and then calculates the evaluation index weights through the Entropy-CRITIC method to establish the settlement environment evaluation system with residents' satisfaction as the measurement standard, and finally carries out practical verification in the Beijing settlements. The results show that the overall evaluation of the settlement environment in Beijing's residential areas was high, indicating that most residents were satisfied with the quality of the residential area. However, the indicators' values vary greatly but presented a similar trend between generations, showing the same satisfaction characteristics, especially in building elements and social needs. Therefore, the following suggestions are proposed for the optimization of the residential areas: firstly, the main focus should be on improving the quality of buildings, controlling the scale and dimension of buildings, improving the green livability of



residential buildings, enhancing the functional complexity and adaptability of residential buildings, and improving the level and capacity of management services. Secondly, pay attention to meeting the needs of neighborhood interaction and cultural construction, extending the spaces for interaction and activities for organizing social activities to enhance the cultural environment and atmosphere of the community. This study is a helpful exploration of how to incorporate the residents' satisfaction into the lifecycle construction of settlement environments in residential areas, and provide planning designers, residents and city managers with a better understanding of the content of residential habitat.

## Keywords

Residents' Satisfaction; Settlement Habitat; Evaluation System; Beijing

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## Abstract

Heavy metal pollution in soil, which is highly toxic and difficult to control, has become a global environmental problem. The content of Cr, Mn, Fe, Zn and Pb heavy metal elements in soil samples was determined by taking the lead-zinc ore collection area of Gangdese, Tibet. Soil hyperspectral data were collected, AT, FD, SD, AFD, ASD transformation was performed on the original spectral curve, and the optimal characteristic band was screened by Pearson correlation analysis. The soil heavy metal content inversion model was established by selecting RF, SVM, BPNN and PLSR, and the prediction effect of the model was evaluated by using a variety of accuracy indicators, and the optimal inversion model of each heavy metal element was discussed. The results of the study are as follows: (1) The Cr content value in the measured data of soil samples was relatively low overall, and the average Fe content value was the highest; The coefficients of variation are Zn>Pb> Mn>Fe> Cr from large to small, Cr is medium variation, Fe, Zn, Pb and Mn are all highly variant, and the spatial heterogeneity is extremely strong. (2) In terms of reflectivity characteristics, the soil samples in the study area had high reflectivity on the whole, the reflectivity was mostly distributed in 0.1-0.8, the maximum reflectance max=0.851, the minimum reflectance min=0.020, and the spectrum was abnormally obvious; In terms of band characteristics, the 350-700 nm band interval is the rising interval of sample reflectivity, but the rising slope of the spectrum is different. In terms of spectral curve characteristics, most samples showed a relatively wide and gentle reflectance curve in the range of 700-1200 nm, and a small decrease in reflectance around 1000 nm and 1830 nm tended. (3) The correlation between the spectrum and the heavy metal content of Cr, Fe, Mn, Zn and Pb in the soil after transformation was significantly improved, and the differential transformation effect of Cr was SD>FD>AFD>ASD after the transformation; The differential transformation effect of Fe is SD>AFD>FD>ASD; The differential transformation effect of Mn is SD>AFD>FD>ASD, but the correlation between the transformed spectral curve and Mn content is poor. The differential transformation effect of Pb is SD>AFD>FD>ASD; The effect of Zn differential transformation method is SD>AFD>FD>ASD; In general, the optimal characteristic bands of Cr, Fe, Zn and Pb are mainly distributed in the near-infrared to mid-infrared spectral range. (4) The optimal inversion model for Cr content is AFD-RF, R<sup>2</sup>=0.7539; the optimal inversion model for Fe content is AT-RF. R<sup>2</sup> is 0.7806, the prediction effect is good; for the inversion of Mn content in soil, the R<sup>2</sup> is less than 0.6, there is no optimal model; the optimal inversion model of Pb content is SD-RF, the model R<sup>2</sup> is as high as 0.8464; the optimal inversion model of Zn content is AFD-RF, R<sup>2</sup> is greater than 0.7, overall, it is speculated that it is affected by the number of modeling factors, and the RF model performs best among the four machine learning algorithms.

## Keywords

Ore concentration area; Heavy metals in soil; Measured hyperspectrum; Characteristic band; regression model

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## Sensing Multi-modal Mobility Patterns: A Case Study of Helsinki using Bluetooth Beacons and a Mobile Application

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### Abstract

Detailed understanding of multi-modal mobility patterns within urban areas is crucial for public infrastructure planning, transportation management, and designing public transport (PT) services centred on users' needs. Yet, even with the rise of ubiquitous computing, sensing urban mobility patterns in a timely fashion remains a challenge. Traditional data sources fail to fully capture door-to-door trajectories and rely on a set of models and assumptions to fill their gaps. This study focuses on a new type of data source that is collected through the mobile ticketing app of HSL, the local PT operator of the Helsinki capital region. HSL's dataset called TravelSense, records anonymized travelers' movements within the Helsinki region by means of Bluetooth beacons, mobile phone GPS, and phone OS activity detection. In this study, TravelSense dataset is processed and analyzed to reveal spatio-temporal mobility patterns as part of investigating its potentials in mobility sensing efforts. The representativeness of the dataset is validated with two external data sources – mobile phone trip data (for demand patterns) and travel survey data (for modal share). Finally, practical perspectives that this dataset can yield are presented through a preliminary analysis of PT transfers in multimodal trips within the study area.

### Keywords

Human mobility, Public transport, Multi-modal transport, Bluetooth beacon, Mobile phone

### Bio

Dr. Zhiren Huang received his Ph.D. degree in transportation engineering from Central South University in 2020. He is currently a postdoctoral researcher working with Prof. Jari Saramäki in the Department of Computer Science at Aalto University. His research interests include human mobility analysis, urban computing, and public transport network analysis. He has published related studies in well-known journals such as Transportation Research Part B/C, Sustainable Cities and Society, and IEEE Transactions on Intelligent Transportation Systems.

## Rapid Inversion of Heavy Metal Content in Urban Water Sediments Using Hyperspectral Data

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### Abstract

With the development of cities, heavy metal elements are continuously enriched in urban water sediments, and how to obtain heavy metal distribution information quickly, efficiently and

accurately is of great significance for urban heavy metal emission monitoring, urban ecological restoration and urban sustainable development. In this paper, the research on the inversion method and inversion model of Cu, Zn and Cd content based on hyperspectral is carried out by taking the polluted land of a city as the research object. The original reflection spectrum of soil samples was collected by ASD Field Spec 3 feature spectrometer, and five spectral transformations were performed on the original spectral data: first-order differential (FD), second-order differential (SD), reciprocal logarithm (AT), reciprocal logarithmic first-order differential (AFD), and reciprocal logarithmic second-order differential (ASD), combined with Pearson's correlation coefficient  $r$ , the characteristic bands related to the measured content of soil heavy metals were screened, and an artificial neural network (ANN) was established with the characteristic bands as independent variables. Support vector machine (SVM) and multiple stepwise regression (SMLR) three inversion models, the model accuracy is selected to select the coefficient of determination ( $R^2$ ), root mean square error (RMSE), mean absolute error (MAE) for evaluation. The results show that: (1) The original spectral data of soil can effectively highlight the original spectral characteristic information after different spectral transformations, and the dimensionality reduction effect of spectral data with different spectral transformation methods is different from the screening interval of the characteristic band. Among the five transformations, SD transformation has the best effect, with the largest number of characteristic bands, followed by FD and AFD transforms. The characteristic spectrum of the sample was distributed in the 350-2491nm band, the characteristic band screened by the three transformation processing methods of SD, FD and AFD covered the visible light to the near-infrared band, and the original spectrum and AT and ASD transformation only covered the visible light band and the near-infrared band. (2) Three machine learning inversion models, artificial neural network (ANN), support vector machine (SVM), and multiple stepwise regression (SMLR), can effectively realize the inversion of heavy metal element content in soil in urban contaminated land, and all three models show predictive ability, and most of the models have  $R^2$  greater than 0.6. (3) Different elements have different best inversion models. Among them, the best inversion model of Cu is SD-ANN model, the best inversion model of Zn is SD-SMLR model, the best inversion model of Cd is SD-SMLR model, and the model prediction effect of the three elements is the best fitting effect of SMLR model after Zn element transformed by SD. The research results realize the rapid and non-destructive inversion of heavy metal element content in urban polluted land, provide a technical method for dynamic monitoring of urban heavy metal emissions, and provide theoretical support for urban ecological environmental protection and sustainable development.

## Keywords

urban heavy metal monitoring; hyperspectral inversion; characteristic bands; content prediction; sustainable development

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## Spatial Distribution and Influencing Factors of Natural Tourism Resources in Batang Area

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## Abstract

The spatial distribution of natural tourism resources is affected by multiple factors such as geological structure, strata lithology and topography and geomorphology, so it is of great significance to accurately analyze the spatial distribution of natural tourism resources and their influencing factors in Batang area. In this paper, 575 natural tourism resource points in this area were selected and the spatial distribution and influencing factors of natural tourism resources in this area were quantitatively analyzed by using multi-scale geographically weighted regression model, kernel density analysis method and standard deviation ellipse. (1) The spatial distribution of natural tourism resources in the region is obviously different, and two high-density "core" areas appear in the central and western regions and the northern and eastern regions as a whole; (2) Based on the MGWR model, the topographic and geomorphological factors and river systems were analyzed, and through the regression coefficients of each influencing factor, it could be seen that the influence degree of influencing factors on the distribution of natural tourism resources was different in different regions; (3) Due to the difference in the distribution of lithology in various layers, the weathering capacity is different, and different scenery conditions are formed; (4) The distribution points of natural tourism resources are consistent with the direction of tectonic extension, and have the characteristics of aggregation and distribution along the fault structure. The research results provide a theoretical basis for the development and protection of natural tourism resources in this area, and provide a reference for the subsequent development of urban tourism.

## Keywords

natural tourism resources; city tours; spatial distribution characteristics; MGWR model

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## Pandemic led productivity challenges and how Lean and BIM can support AEC industry?

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## Abstract

The Covid-19 pandemic was an event that has caused devastating impacts on many aspects of societies. Aside from the health impacts, it also had profound effects on different areas of economy. The architecture, engineering and construction industry was one of the major fields that had suffered and continues to be deeply affected. Employee productivity is one of the major issues that had arisen as the consequences of the pandemic. This paper addresses the solutions of lean and BIM methods to handle pandemic related workforce productivity challenges in construction

industry by conducting mixed methods of research methodology. Quantitative survey questionnaire and qualitative case study approach were used in this article. Snowball sampling approach was used for collecting data from 138 experienced professionals working in AEC industry around the world for quantitative questionnaire survey and a case study was chosen to demonstrate qualitative research approach. Moreover, reliability analysis, KMO and Bartlett's test, Skewness and Kurtosis test, Correlation analysis were done regarding the quantitative method. The major technique to access the link between number of hypotheses is structural equation modelling (SEM). According to the results, lean and BIM solutions have better effects on workforce productivity with mediating factors such as reworking and health and safety. For a better understanding of the connections between each aspect, correlation analysis is also presented. Case studies using the qualitative research methodology further illustrate the value of BIM solutions in raising labor productivity. The findings of this paper identify lean and BIM solutions for pandemic related labor issues alongside with the assist of former research and case study analysis and also provide ideas for future research.

## Keywords

Lean Solution, BIM Solution, Rework, Health & Safety, Covid-19, Workforce, productivity.

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## Optimization of Residential Public Space by Introducing Intergenerational Solidarity Performance Evaluation Index

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6613

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## Abstract

Intergenerational solidarity is an effective measure for the elderly to realize aging at home under the advocacy of active ageing, and it is also the main sociological indicator to measure the livability of the residential areas. Some research has explored design strategies to improve the intergenerational solidarity performance of public spaces in residential areas, but no research has established a systematic evaluation model. In particular, considering the demographic trends of the expected population, the tradition of intergenerational mutual assistance and the issue of age segregation in the process of urbanization, there is an urgent need to establish an evaluation system tailored to China's conditions. Therefore, this paper aims to set up an evaluation index system on intergenerational solidarity performance in residential public spaces as the first step to the establishment of evaluation models. The study first extracts relevant impact factors to form a preliminary index library by analyzing and summarizing literature and practical cases related to age-integrated, multi-generational, and inter-generational community, and then modify the evaluation indicators through resident questionnaire investigation and expert surveys to obtain the final evaluation index set. Finally, an inter-generational solidarity model for residential public space design is proposed based on the evaluation index set. The outcome of this research established the foundation of the intergenerational solidarity performance evaluation model. On the



other hand, it can guide the reconstruction of public spaces in existing residential communities and the design of public spaces in urban level to promote interactions and mutual assistance among residents of different generations and create a livable and all-age-friendly city.

## Keywords

Intergenerational Solidarity; Residential Public Space; Evaluation Index; Design Model

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