孔维康
WEIKANG KONG

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ABOUT ME

I am a fourth-year undergraduate student majoring in Urban Planning, looking forward to applying for a master's degree in 2024 fall and devoting myself to urban studies in the future. I have a solid foundation in mathematics and programming and a keen interest in conducting research and analysis related to various urban issues.

EDUCATION

Tongji University

Bachelor Candidate of Urban Planning (Cross-disciplinary Pilot Class) GPA: 4.55/5.00 Expected, June 2025

Minor in Mathematics (Hornor course program) September 2020 – July 2022

Massachusetts Institute of Technology IDSS

MicroMasters Program in Statistics and Data Science Certification Record May 2023 – May 2024

- **Relevant Coursework:** Machine Learning with Python, Data Analysis, Fundamentals of Statistics, Probability

RESEARCH EXPERIENCE

Stereoscopic urban morphology metrics enhance the nonlinear scale heterogeneity modeling of UHI with explainable AI

Supervisor: Prof. Jiawei Yao | Tongji University 06/2023 – 09/2023

- Proposed a set of Stereoscopic urban morphology metrics for a finer description of the 3D structure of cities.
- Utilized and compared several typical machine learning techniques (XGBoost, RFR, MLP, etc.) to predict urban heat island effect levels and employed interpretable analysis methods to explain the predictive outcomes.
- Collected data from open-source datasets, processed and analyzed across 20 different sampling scales to explore the most suitable research scale for various urban indicators.
- Paper published in the journal *Urban Climate*. DOI

Using GeoAI to Reveal the Contribution of Urban Park Green Space Features to Mitigate the Heat Island Effect

Supervisor: Prof. Jiawei Yao | Tongji University 01/2023 – 04/2023

- Took the interpretation analysis of the machine learning result as the main method.
- Collected data from 2,000+ urban green spaces within Shanghai through remote sensing satellite image.
- Compared several typical machine learning algorithms such as LR, RFR, XGBoost etc., and selected the best one for the regression of the cooling effect of green spaces.
- Employed SHAP method to interpret the regression result. Identified the most important factors affecting the cooling effect of green spaces and explained their mechanisms and extent of impact.
- Paper published in the proceedings of the eCAADe (Education and Research in Computer Aided Architectural Design in Europe) conference.

Research on the Influence of Spatial Factors on Pedestrian Flow in Neighborhood-Scale Public Spaces

Supervisor: Prof. Fan Yang | Tongji University 08/2021 – 03/2022

- Performed an experimental research approach that combines a deep learning model for image recognition.
- Recorded pedestrian videos for a total of 20+hours under different experimental conditions.
- Employed YOLOv5 and DeepSORT algorithm to identify pedestrian trajectories in different videos. Then trajectory clustering techniques (adapted from DBSCAN) were utilized to obtain several distinctive pedestrian flow patterns.
- Evaluated the trajectory deviation between the experimental group and the original group to reveal the impact of spatial factors on pedestrian flow.

AWARDS

- **The first prize** of the 10th International Architecture Design Competition for College Students of Teamzero Award(1/683)
- **The first prize** of Contemporary Undergraduate Mathematical Contest in Modeling (Shanghai Division)
- **Honorable Mention Prize** of Interdisciplinary Contest in Modeling

SKILLS

Languages: Chinese (Native), English (Fluent; TOEFL 101)

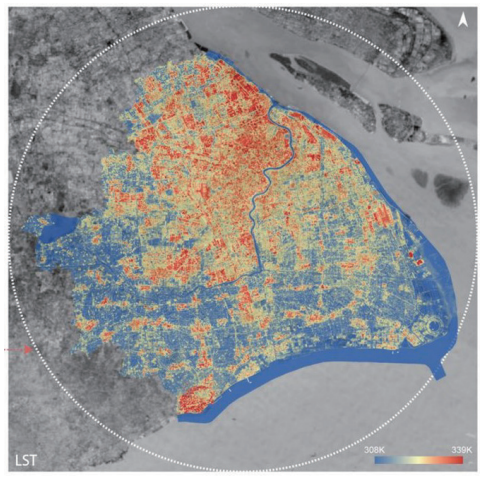
Computer Skills: Python, MATLAB, VB, ArcGIS, Grasshopper, Rhino, Adobe Illustrator, Adobe Photoshop

Stereoscopic urban morphology metrics enhance the nonlinear scale heterogeneity modeling of UHI with explainable AI

Urban Climate (currently under review)

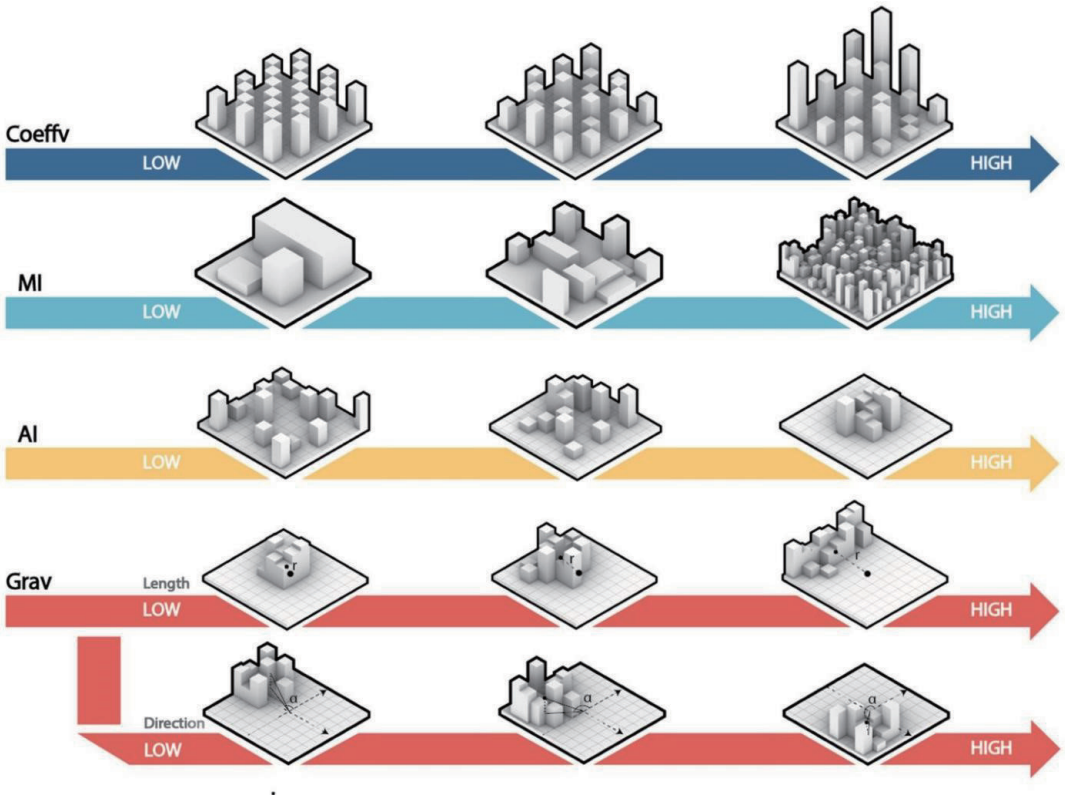
Yanting Shen, Weikang Kong, Xilong Chen, Fan Fei, Yiwen Xu，Chenyu Huang, Jiawei Yao*

Abstract



In urban heat island (UHI) effect modeling, traditional 3D morphological indexes often homogenize elements within units, leading to a loss of spatial detail. Here we introduce detailed stereoscopic urban morphology indices, including the Height Variation Coefficient, the Height Gravity Index, the Mixed Degree, and the Aggregation Degree, using urban building and vegetation height data to represent the 3D structures within urban units. We employed ensemble learning algorithms to explore nonlinear effects and statistical correlations across 20 buffer radii (100m to 2000m) related to the UHI effect. The integration of these inhomogeneous indexes substantially improved model accuracy, with XGBOOST achieving an R2 of 0.95. The optimal scale for calculating such indexes was found to be between 300m and 400m. Our findings suggest optimizing UHI mitigation by lowering the Building Height Coefficient in high-density areas and increasing it in low-density regions. Furthermore, we propose tailoring the Vegetation Height Coefficient for green spaces, advocating higher values for larger parks and lower values for smaller ones. This approach offers practical insights for mitigating urban heat effects through customized morphological strategies, emphasizing the importance of precise urban planning and environmental management.

Proposed a set of stereoscopic urban morphology metrics for a finer description of the 3D structure of cities. >



Utilized and compared several typical machine learning techniques to predict urban heat island effect levels and employed interpretable analysis methods to explain the predictive outcomes.

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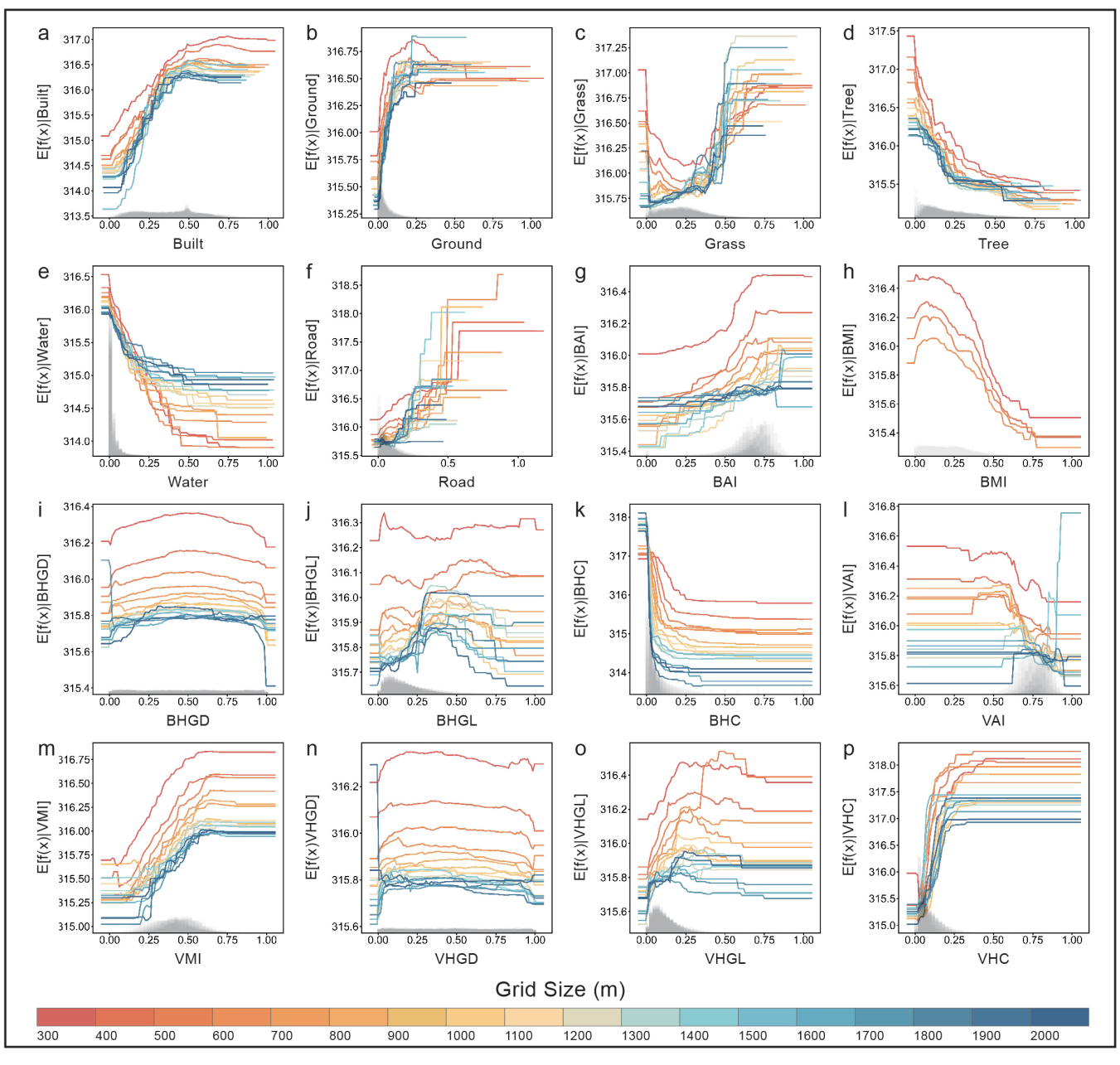


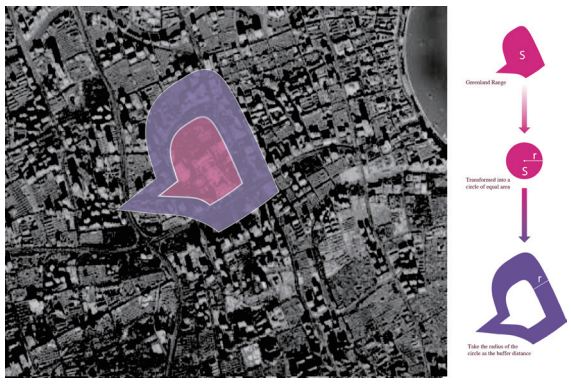
< Under different research scales, the influence of various urban indicators on LST exhibits significant variations in both magnitude and manner. Result also reveals the presence of certain threshold values.

Using GeoAI to Reveal the Contribution of Urban Park Green Space Features to Mitigate the Heat Island Effect

Proceedings of the 41st International Conference on Education and Research in Computer Aided Architectural Design in Europe (ECAADe)

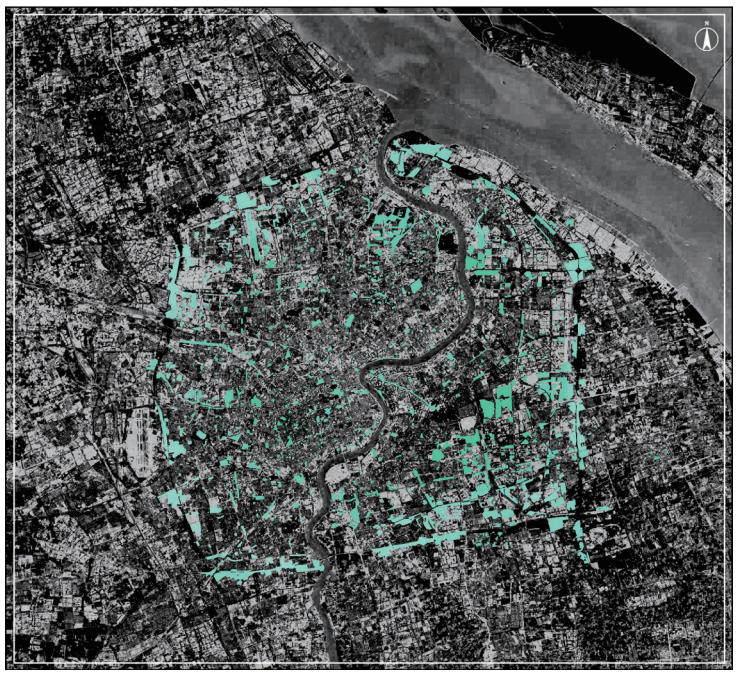
Yanting Shen, Weikang Kong, Xilong Chen, Fan Fei, Yiwen Xu，Chenyu Huang, Jiawei Yao*

Abstract



The rapid development of cities has intensified the urban heat island effect (UHI), and the deteriorating human living environment urgently needs to be alleviated. In this context, it is necessary to consider what benefits can urban green spaces bring to the urban environment. This study takes the green spaces within the Outer Ring of Shanghai as an example to explore the interaction between various characteristics of green parks and cooling effects. We extracted information on 2,118 major urban park green spaces through GIS, and obtained LST and NDVI data by inverting Landsat 8-OLI remote sensing images. Then, we further used SVM to label and identify underlying features of ground, water surfaces, grasslands, trees and so on to establish our own urban park database. In UHI analysis, we defined the buffer zone using the ERM method, and the temperature difference obtained was used as the dependent variable for cooling intensity. In terms of data analysis, scikit-learn and Shapley Additive Explanation revealed the contributions of various indicators of park green spaces to alleviating the UHI. Using GeoAI, we combine geographic spatial science and artificial intelligence interpretation analysis. we established a thermal comfort evaluation model for park green spaces. We found that the area, NDVI, and surrounding FAR of green spaces have a significant impact on cooling intensity, and other indicators such as area, NDVI, TP, and LP also have a certain effective range. This model will provide important directional recommendations for decision-makers in the initial planning and design of future urban park green spaces.

Collected data from 2,000+ urban green spaces within Shanghai through remote sensing satellite image. >



Compared several typical machine learning algorithms such as LR, RFR, XGBoost etc., and selected the best one for the regression of the cooling effect of green spaces.

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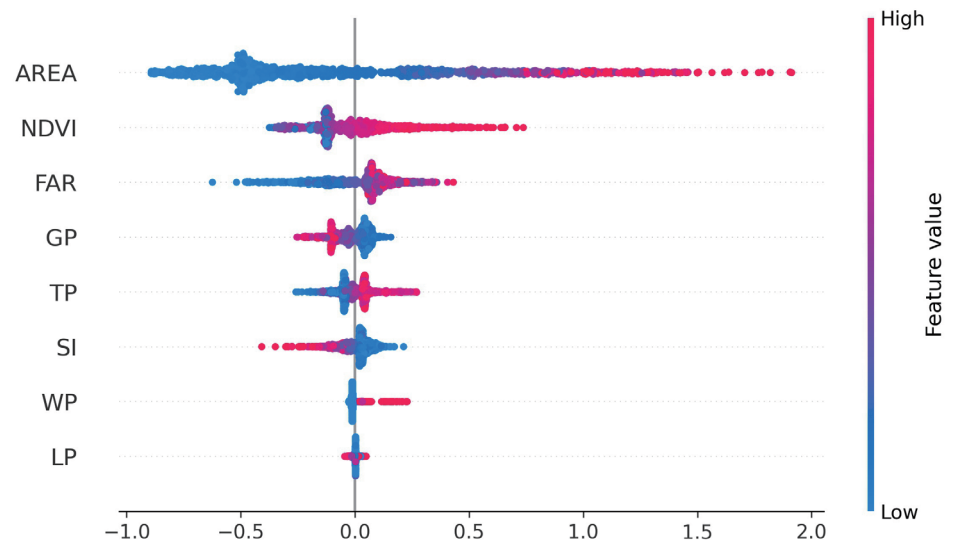

< Employed SHAP method to interpret the regression result. Identified the most important factors affecting the cooling effect of green spaces and explained their mechanisms and extent of impact.

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