Kai Hu

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About

Kai is a PhD candidate at the School of Architecture, South China University of Technology, with a strong foundation in urban planning and the integration of artificial intelligence into urban contexts. He has two years of professional experience as an urban planner and was a visiting student at the MIT Media Lab, where he collaborated with the City Science group.

Kai's research focuses on developing innovative tools for urban planning, including case-based design system and human-centered agent-based model for urban simulation. As the principal contributor to the CityFlow project, he is spearheading the creation of a low-code development platform powered by large language models. This platform empowers urban researchers to design expert workflows and craft data-driven solutions to tackle complex city challenges.

Education

South China University of Technology, PhD student of Architecture — Sept 2021 – present

- **Doctoral Dissertation Proposal:** Digital Smart City: An Advanced Case-based Design System Integrated with Expert Workflow and LLM Retriever

Massachusetts Institute of Technology, Visiting student at the MIT Media Lab — Oct 2023 – Oct 2024

- **Projects:** CityFlow, Graph RAG as Human Choice Model, Travel Agent

South China University of Technology, Master of Architecture — Sept 2016 – Jun 2019

- **Master Thesis:** The Application of GAMA Simulation Model in the Updating of Campus Pedestrian System
- **Course:** Architecture Design and Thoery, Simulation and Design of Outdoor Thermal Environment

Huazhong University of Science and Technology, Bachelor of Architecture — Sept 2011 – Jun 2016

- **Course:** Urban Design Theory and Method, Construction Design, Architecture Monographic Study and Design

Experience

Researcher, MIT City Science Group, Cambridge, USA — Oct 2023 – Oct 2024

- Initiated CityFlow and Graph RAG as Human Choice Model Project
- Contributed to Travel Agent Project
- Delivered a talk at MASS.552 City Science course

Architect, Shenzhen Urban Transport Planning Center, Shenzhen, China — Jul 2019 – Jul 2021

- Participated in the urban design of Shenzhen Futian Free Trade Zone.
- Participated in the urban design around Jiangmen high-speed Railway Station

Architectural Intern, Atelier Z+ Architectural Studio, Shanghai, China — Jul 2018 – Sept 2018

- Participated in the design of City Square in Lingang New City Port

UI Designer (part time), Squarance.com, Wuhan, China — Sept 2016 – Jun 2017

- Participated the design of the website.

Teacher (part time), Dian Shi studio, Wuhan, China — Sept 2014 – Jun 2016

- Taught design tools and software skills.

Skills

Languages: Chinese(Native Speaker), English (IELTS 7.5)

Design: Sketchup, Rhino, Grasshopper, QGIS, CAD, Adobe Software (PS, AI, AE, ID)

Coding: Python (Pytorch), Javascript (React, Next.js), GAMA Platform, Linux

Projects

CityFlow Platform 2024-present

Major Contributor, Project Leader

- Created a low-code environment that enables urban analysts to develop and test city models.
- Developed an AI assistant that assists module builder in coding urban algorithms.
- Built an open platform and research community for urban scientists.

TravelAgent: Generative Agents in the Built Environment 2024-present

Major Contributor, Supervised by prof. Kent Larson, Massachusette Institute of Technology

- Created a novel simulation platform that models pedestrian navigation and activity patterns across diverse environments.

Tropical Future Urbanism in the Age of Digital Intelligence Workshop, Tongji University 2024

Teaching Assistant, Supervised by prof. Yubo Liu, South China University of Technology

- Created an interactive web simulation tool.
- Taught the theory of generative agents.

Graph RAG as Human Choice Model 2023-2024

Major Contributor, Supervised by prof. Kent Larson, Massachusette Institute of Technology

- Built a Data-Driven Simulation Framework with LLM Agents to enhance the contextual understanding and accuracy of the generated behaviors with a small amount of data,

Human-AI Collaborative Planning for Incremental Urban Transformation 2023-2024

Major Contributor, Supervised by prof. Kent Larson, Massachusette Institute of Technology

- Created an index system to provide an overall assessments of life-work synergy in the community.
- Developed a tool to help decision makers intricate analyses, incremental optimization, and improved communication across diverse interest groups.

Evolvable Case-based Design System 2022-2023

Major Contributor, Supervised by Supervised by prof. Yubo Liu, South China University of Technology

- Created an AI support system for urban morphology generation with specific indicators in the conceptual stage.

Computational Art & Tech Workshop, Hefei University of Technology 2022

Teaching Assistant, Supervised by prof. Qiaoming Deng, South China University of Technology

- Identified and clustered urban morphology using pretrained VGG and k-means algorithm.
- Generated a certain type of urban morphology with PIX2PIX model.
- Optimized the thermal performance of generated results using genetic algorithm.

Agent-based Model for SCUT Pedestrian System 2018-2019

Major Contributor, Supervised by prof. Yubo Liu, South China University of Technology

- Collected and analyzed the activity data of university crowd
- Designed an algorithm to simulate pedestrian flow in university based on GAMA platform.
- Designed an algorithm to calculate the traffic flow from surveillance video.

Interactive Simulation Platform 2017-2018

Major Contributor, Supervised by prof. Yubo Liu & prof. Qiaoming Deng , South China University of Technology

- Built an interactive simulation platform inspired by MIT CityScope Project.
- Trained machine learning algorithms to evaluate thermal and accessibility performance in real time.

Publications

- Noyman, A., Hu, K., & Larson, K. (2024). TravelAgent: Generative Agents in the Built Environment. arXiv preprint arXiv:2412.18985.
- Atchade, P., Mora, A., Alonso-Pastor, L., Grignard, A., Noyman, A., Izquierdo, L., Adornetto, C., Hu, K., Fernandez, F., Rahnama, H. and Church, M. (2024). Humanized Agent-based Models: a Framework. Authorea Preprints.
- Liu, Y., Zhang, Z., Hu, K., & Deng, Q. (2023, July). Graph Constrained Multiple Schemes Generation for Campus Layout. In The International Conference on Computational Design and Robotic Fabrication (pp. 125-138). Singapore: Springer Nature Singapore.
- Liu, Y., Li, H., Deng, Q., & Hu, K. (2023, July). Diffusion Probabilistic Model Assisted 3D Form Finding and Design Latent Space Exploration: A Case Study for Taihu Stone Spacial Transformation. In The International Conference on Computational Design and Robotic Fabrication (pp. 11-23). Singapore: Springer Nature Singapore.
- Liu, Y., Hu, K., & Deng, Q. (2024). Evolvable case-based design: An artificial intelligence system for urban form generation with specific indicators. Environment and Planning B: Urban Analytics and City Science, 51(8), 1742-1757.
- Liu, B., Liu, Y., Deng, Q., & Hu, K. (2023). A study on daylighting metrics related to the subjective evaluation of daylight and visual comfort of students in China. Energy and Buildings, 287, 113001.
- Deng, Q., Li, X., Liu, Y., & Hu, K. (2023). Exploration of three-dimensional spatial learning approach based on machine learning–taking Taihu stone as an example. Architectural Intelligence, 2(1), 5.
- Liu, Y., Ji, M., Deng, Q., & Hu, K. (2021). Physical Connectivity as Enabler of Unexpected Encounters With Information in Campus Development: A Case Study of South China University of Technology. Frontiers in Psychology, 12, 635012.

Exhibitions

- Research exhibited at the 2022 China International Furniture Fair (CIFF 2022) in Guangzhou
- Research exhibited at the 9th Bi-City Biennale of Urbanism/Architecture (UABB 2023) Qianhai Sub-Venue at Shenzhen.