Xinwei Zhuang

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Research Emphasis

Energy and Environment: AI for sustainable energy transition; Building stock analysis; Urban building energy modeling; Energy conservation and projection; Ventilation and daylighting optimization

Computation: Machine learning; Data science; Network science; Computer vision; Computer graphics

Education

Massachusetts Institute of Technology — Cambridge, United States
IvyPlus Exchange Scholar, Department of Urban Studies and Planning — Sept 2024 – Present

University of California, Berkeley — Berkeley, United States
Ph.D. candidate in Architecture **GPA: 3.95/4.00** — Aug 2020 – Present
Dissertation: Performance-driven morphogenesis for urban neighborhood energy resilience

Bartlett School of Architecture, University College London — London, United Kingdom
M.S. in Architectural Computation **GPA: 70.5/100 (Distinction)** — Sept 2016 – Nov 2017
Dissertation: Space frame optimization with spectral clustering algorithm

Edinburgh Napier University — Edinburgh, United Kingdom
B.S. in Civil Engineering **GPA: 79.7/100 (First Honor)** — Sept 2012 – May 2016
Dissertation: Influence of Particle Loss on Soil Behaviour

Experience

Lawrence Berkeley National Lab — Berkeley, United States
Research assistant — May 2022 – Present
- Decarbonizing Energy through Collaborative Analysis Routes and Benefits
- Multi-scale Energy Conservation Measurement (ECM) evaluation and projection for U.S. residential and commercial building sectors, provide policy insight for ECMs and regulations

Robotic Plus — Shanghai, China
Software developer — March 2020 – July 2020

Architecture Studio — Shanghai, China
Architectural designer — Aug 2018 – Mar 2020

China Shanghai Architectural Design & Research Institute Co. Ltd — Shanghai, China
Research assistant — Nov 2017 – Aug 2018
- Energy consumption control and optimization for commercial buildings with neural network, a part of 13th national 5-year project

Invited Talk

March 2025 AI for sustainable energy transition
Guest lecture at University of California, Berkeley

Dec. 2024 The role of architecture in the urban energy landscape
Guest lecture at the Manchester Urban Institute, University of Manchester, UK

Nov. 2024 Decomposing and Recomposing of the urban energy environment with building archetype and urban building energy modeling
Guest lecture at Foster + Partner, UK

June 2023 Performance-driven architectural design with deep learning
Invited talk at 33rd Young Scholar Forum, Nanjing University, China

May 2023 ZNE house case study and machine learning for building stock analysis
Invited talk at Center for the Built Environment (CBE), USA

Awards

2024 Advance Humanity through Science: $10k graduate student research grant
Lau Just Climate Futures: $35k research grant
2023 Eric T. Andresen Memorial Scholarship (ASHRAE): Research in energy conservation
2021 Golden Gate Chapter Scholarship (ASHRAE): Research contributing to the energy sector
2017 Alistair Turner Prize (Bartlett School of Architecture): Best master's dissertation
2016 Shanghai Distinct Graduate Award (Shanghai Municipal Education Commission)
2015 Edinburgh Napier Scholarship (Edinburgh Napier University)

Publication

* equal contribution

1. (Under Revision) **Zhuang X.**, Lyv G. and Caldas. L (2024) Mass Simulation for Rapid and Accurate Solar Energy Potential: A Vector-Based Approach, in submission to *Solar Energy*.

2. Lyv G., Chen X., **Zhuang X.**, Duarte C. and Schiavon S. (2024) Integrating Symbolic Neural Networks for Advanced Modeling in Building Physics: A Study and Proposal. https://arxiv.org/abs/2411.00800

3. **Zhuang X.**, Chu X., Liang, J., Zhu P., Gonzalez, M. and Caldas, L. (2024) Across scales: Hierarchical Urban Graph for Neighborhoods Partition and Decentralized Energy Autonomy, in *2024 Conference on Association for Computer Aided Design in Architecture (ACADIA)*, Calgary, Canada. [paper]

4. **Zhuang X.***, Huang Z.*, Zeng W., and Caldas L. (2023) MARL: Multi-scale Archetype Representation Learning for Urban Building Energy Modeling, workshop on Computer Vision Aided Architectural Design (CVAAD), at *International Conference on Computer Vision (ICCV)*, Paris, France. DOI: 10.1109/ICCVW60793.2023.00171

5. **Zhuang X.***, Huang Z.*, Zeng W., and Caldas L. (2023) Encoding Urban Ecologies: Automated Building Archetype Generation through Self-Supervised Learning for Energy Modeling, in *2023 Conference on Association for Computer Aided Design in Architecture (ACADIA)*, Denver, United States of America. [paper]

6. **Zhuang X.**, Luo, N., Hong T. and Koenig, M. (2023) What can we learn from Honda Smart Home with high-resolution monitored performance data: A zero-net energy home in California, in *18th International IBPSA Conference and Exhibition* In Shanghai, China. DOI: 10.26868/25222708.2023.1315

7. Li F.* and **Zhuang X.*** (2023) Evaluating an Auto Decoder-based Generative Model for the Infomorphism Urban Planning Framework, in *18th International IBPSA Conference and Exhibition* In Shanghai, China. DOI: 10.26868/25222708.2023.1393

8. **Zhuang X.**, Ju Y., Yang A. and Caldas L. (2023) Synthesis and Generation for 3D Architecture Volume with Generative Modeling, in *International Journal of Architectural Computing*, Vol. 21, Issue 2: AI, Architecture, Accessibility, & Data Justice. DOI: 10.1177/14780771231168233

9. **Zhuang X.** (2022) Rendering sketches: Interactive rendering generation from sketches using conditional generative adversarial neural network, in *40th Education and research in Computer Aided Architectural Design in Europe (eCAADe).* In Brussels, Belgium papers.cumincad.org/cgi-bin/works/paper/ecaade2022_273

10. **Zhuang X.** and Caldas L. (2022) Prediction of Ventilation Performance in Urban Area with CFD Simulation and Conditional Generative Adversarial Networks, in *5th International Conference on Building Energy and Environment (COBEE).* In Montreal, Canada DOI: 10.1007/978-981-19-9822-5_15

11. **Zhuang X.** and Hanna S. (2020) Space Frame Optimisation with Spectral Clustering, *International Journal of Machine Learning and Computing* vol. 10, no. 4, pp. 507-512. DOI: 10.18178/ijmlc.2020.10.4.965