# Wenhao Zhang

*PhD student at National University of Singapore*

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## Research Interests

Machine learning; Human-building interaction; Reinforcement learning; Energy efficient control; Indoor thermal comfort

## Education

**National University of Singapore** — Singapore
*PhD in Built Environment* — *Jan 2024 – Present*
Supervisors: Prof Clayton Miller, Prof Stefano Schiavon.

**University College London** — London, UK
*MSc Smart Buildings and Digital Engineering* — *Sep 2022 – Sep 2023*
Supervisor: Dr Rui Tang. *Degree: Distinction (Rank: 1/44).*

**University of Nottingham** — China & UK
*BEng Hons Architectural Environment Engineering* — *Sep 2017 – Jul 2021*
Supervisor: Dr Zhiang Zhang. *Degree: First-Class Honours (Rank: 3/67).*

## Honors and Scholarships

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| NUS Research Scholarship (National University of Singapore) | 2024 |
| UCL Best Overall Degree Mark Award (University College London) | 2023 |
| DesignBuilder Award (DesignBuilder Software Ltd.) | 2023 |
| Dean's Scholarship (University of Nottingham) | 2021 |
| Head's Scholarship (University of Nottingham) | 2020 |

## Publications

**Recommender Systems and Reinforcement Learning for Building Control and Occupant Interaction: A Text-mining Driven Review of Scientific Literature**
**Wenhao Zhang**, Matias Quintana, and Clayton Miller.
*Energy and Buildings, 2024.* (Preprint)

**Reinforcement Learning in Building Controls: a Comparative Study of Algorithms Considering Model Availability and Policy Representation**
Ziyan Wu, **Wenhao Zhang**, Rui Tang, Huilong Wang, and Ivan Korolija.
*Journal of Building Engineering, 2024.* (Link)

**Energy Efficient Operation Optimization of Building Air-conditioners via Simulator-assisted Asynchronous Reinforcement Learning**
**Wenhao Zhang**, and Zhiang Zhang.
*IOP Conference Series Earth and Environmental Science, 2022.* (Link)

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| **Research Projects** | **HEATS: Heat Exposure, AcTivity, and Sleep Field Study** |

Mentors: Prof Stefano Schiavon (UC Berkeley)    Jan 2024 – Present
    Prof Clayton Miller (National University of Singapore)
    Dr Thomas Parkinson (The University of Sydney)

This field study aims to investigate the effects of cumulative heat exposure on sleep and physical activity among a cohort of working-age Singaporeans. In this research, the preparatory tasks for the field study were managed. Moving forward, the collected data will be analyzed, and reinforcement learning-based Just-in-Time Adaptive Intervention (JITAI) models will be developed to enhance sleep quality in response to heat exposure.

**Comparative Study of Model-Based and Model-Free Reinforcement Learning Control Performance in HVAC Systems: A Case Study**

Mentor: Dr Rui Tang (University College London)    May 2023 – Jan 2024

This research conducts the comparison of model-based and model-free reinforcement learning control strategies in HVAC systems. It focuses on analyzing their performance in terms of energy efficiency and indoor comfort. Results indicate both strategies significantly outperform traditional controls, with model-free showing greater resilience to disturbances.

**Deep Reinforcement Learning for Energy-Efficient Control of Variable Refrigerant Flow HVAC Systems**

Mentor: Dr Zhiang Zhang (University of Nottingham)    Sep 2019 – Jun 2020

Developed an energy efficient operation strategy for VRF system during the cooling season for a case office and achieved energy savings of up to 16.1% as well as improved thermal comfort compared to a rule-based control strategy.

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| **Employment** | **DesignBuilder Software Ltd.**    London, UK |

Technical Writer (Contrator)    Aug 2023 – Jan 2024

Develop DesignBuilder Scripting Basics training content covering EMS and Python Scripting for runtime, pre and postprocessing of simulations along with DesignBuilder API.

**China Academy of Building Research**    Shanghai, China

Energy Consultant (Full-time)    Oct 2021 – Aug 2022

Participated in developing building energy simulation software (PKPM), and the design of ultra-low energy buildings with information technology.

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| **Skills** | **Programming** |

Proficient in: Python (scikit-learn, Gym, TensorFlow, Word2Vec, NLTK).
Familiar with: C#, MATLAB, Modelica.

**Languages**

Chinese (Native), English (Proficient).