Haoyang Zheng

PH.D. STUDENT & APPLICANT

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Education

Purdue University, College of Engineering *West Lafayette, IN*

Ph.D. in Mechanical Engineering (advised by Prof. Guang Lin, GPA 4.0/4.0) *Jun. 2021 - May. 2025 (expected)*

Purdue University, College of Engineering *West Lafayette, IN*

M.S. in Mechanical Engineering (GPA 3.8/4.0) *Sep. 2019 - May. 2021*

Southwest University, School of Computer and Information Science *Chongqing, China*

B.Eng. in Automation (advised by Prof. Yong Deng, Rank 1/92) *Sep. 2014 - Jun. 2018*

Conference

[1] **Haoyang Zheng**, Wei Deng*, Christian Moya, Guang Lin*, "Accelerating Approximate Thompson Sampling with Underdamped Langevin Monte Carlo", *AISTATS 2024*;

[2] **Haoyang Zheng**, Hengrong Du, Qi Feng, Wei Deng*, Guang Lin*, "Constrained Exploration via Reflected Replica Exchange Stochastic Gradient Langevin Dynamics", submitted to *ICML 2024*.

Journal

[1] **Haoyang Zheng**, Yao Huang, Ziyang Huang, Wenrui Hao, Guang Lin*, "HomPINNs: homotopy physics-informed neural networks for solving the inverse problems of nonlinear differential equations with multiple solutions", *Journal of Computational Physics* (2024);

[2] **Haoyang Zheng**, Jeffrey R. Petrella, P. Murali Doraiswamy, Guang Lin*, Wenrui Hao, "Data-driven causal model discovery and personalized prediction in Alzheimer's disease", *NPJ digital medicine* (2022);

[3] **Haoyang Zheng**, Ziyang Huang, Guang Lin*, "A physics-constrained neural network for multiphase flows", *Physics of Fluids* (2022);

[4] **Haoyang Zheng**, Yong Deng*, Yong Hu, "Fuzzy evidential influence diagram and its evaluation algorithm", *Knowledge-Based Systems* (2017);

[5] **Haoyang Zheng**, Yong Deng*, "Evaluation method based on fuzzy relations between Dempster-Shafer belief structure", *International Journal of Intelligent Systems* (2018);

[6] Tian Bian, **Haoyang Zheng**, Yong Deng*, "Failure Mode and Effect Analysis based on D numbers and TOPSIS", *Quality and Reliability Engineering International* (2018);

[7] Likang Yin, **Haoyang Zheng**, Tian Bian, Yong Deng*, "An Evidential Link Prediction Method and Link Predictability Based On Shannon Entropy", *Physica A* (2017).

Research Experience

Argonne National Laboratory, Mathematics and Computer Science Division *Lemont, IL*

Givens Associate *May. 2023 - Jul. 2023*

- Investigated suitable hyperparameters for **proximal policy optimization (PPO)** models through centralized Bayesian optimization search.
- Integrate the DeepHyper framework with the **MPI program** to achieve parallel computing and improve exploration.
- The designed algorithm intelligently identified the critical hyperparameters and suitable selections for specific tasks.

Purdue University, School of Mechanical Engineering *West Lafayette, IN*

Research Assistant *Jul. 2019 - Present*

- Proposed reflected **replica exchange stochastic gradient Langevin dynamics** to avoid the over-exploration in high-temperature chains and improve sample efficiency;
- Introduced advanced **Thompson Sampling** methods using **underdamped Langevin algorithms** to improve the sample complexity from $\mathcal{O}(d)$ to $\mathcal{O}(\sqrt{d})$;
- Proposed **homotopy physics-informed neural networks** to solve the inverse problems of nonlinear differential equations with multiple solutions.
- Proposed a **data-driven causal model** described by ODEs to reveal **Alzheimer's disease** progression in different stages and provide accurate personalized disease progression predictions for patients.
- Proposed a **physics-constrained neural network** to predict sequential patterns and motions of multiphase flows with implicit and explicit physical constraints.

Teaching Experience

Purdue University, School of Mechanical Engineering *West Lafayette, IN*

Teaching Assistant *Aug. 2019 - May. 2021*

- Guided students through **hands-on lab tasks** in ME375 and ME475, ensuring understanding of key principles and safe practice.
- Conducted regular **office hours** to provide individualized support and address questions in homework and lab sections.
- Collaborated with instructors to **organize and execute in-class robot competitions**.

Skills

Programming Python (TensorFlow, PyTorch), MATLAB, R, C, Java

Research skills LaTeX, Origin Lab, EndNote, Visio, Notion

Achievements

Selected Honors

2017 **Finalist (0.5%),** Interdisciplinary Contest in Modeling *COMAP*

2016 **Special prize (2/3568),** International Mathematical Contest in Modeling *GMMCA*

Selected Awards

2018 **Pacemaker to Technological Innovation in Chongqing,** Awarded 10 college students every two years *Chongqing, China*

2018 **Outstanding undergraduates in Chongqing,** Awarded 1% of all college undergraduate students every year *Chongqing, China*

2015 **China National Scholarship,** Awarded 1% of all undergraduates in China *China*