

Zilin Dai

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SUMMARY

Graduate student focused on foundation model pretraining and efficient retrieval for large-scale datasets. Interested in combining world models with large foundation models to enable generalizable, efficient behavior and real-world deployment on robotic and autonomous systems. Open to exploring diverse directions in robot learning.

EDUCATION

Harvard University, Cambridge, MA

- **Computational Science and Engineer** M.E., *Full Fellowship by Amazon Robotics* August 2025 – May 2027*

Worcester Polytechnic Institute (WPI), Worcester, MA

- **Computer Science** B.S., GPA: 3.97 August 2021 – May 2025

Related Courses:

- Machine Learning, Principles of Autonomy and Decision Making, Generative AI, On-Device Deep Learning, Deep Learning, Digital Image Processing, Algorithms, Operating Systems, Modeling and Data Analysis, Human-Computer Interaction, AI for Robotics, Introduction to Robotics, Principles of Physics-Mechanics, Object-Oriented Programming

SELECTED PUBLICATIONS

Yi Yang, Xiang Fei, Lehong Wang, Chenhao Li, **Zilin Dai**, Henry Kou, Howie Choset, Lu Li. *DeformX: A Versatile Co-Simulation Framework for Deformable Linear Objects*. Submitted to IROS 2026.

Zilin Dai, Lehong Wang, Fangzhou Lin, Yidong Wang, Zhigang Li, Kazunori D Yamada, Ziming Zhang, Wang Lu. *A Language Anchor-Guided Method for Robust Noisy Domain Generalization*. Submitted to TMLR.

Zilin Dai*, Fangzhou Lin*, Rigved Sanku*, Songlin Hou, Kazunori D Yamada, Haichong K. Zhang, Ziming Zhang. *A Strong View-Free Baseline Approach for Single-View Image Guided Point Cloud Completion*. Arxiv.

Xinlu He, Yiwen Guan, Badrivishal Paurana, **Zilin Dai**, Jacob Whitehill. *Interactive Real-Time Speaker Diarization Correction with Human Feedback*. Submitted to ICASSP 2026.

Lehong Wang, **Zilin Dai** et. al. *From Flat to Form-Fitting: A Computational Geometry Approach to 3D Conformal Electronics Design and Rapid Prototyping*. IEEE International Conference on Automation Science Engineering (CASE) 2025.

Zilin Dai*, Yijia Wu*, Haotian Liu, Lehong Wang, Markus P. Nemitz. 2024. *Vision-based FDM printing for fabricating airtight soft actuators*. IEEE International Conference on Soft Robotics 2024 (Oral Presentation).

Zilin Dai*, Lehong Wang*, Markus P. Nemitz. 2024. *Fully FDM-Printed Soft Hand Exoskeleton*. IEEE International Conference on Robotics and Automation (ICRA): Emerging Technologies in Smart Exoskeleton Systems 2024.

Zilin Dai, Andrew McReynolds, Jacob Richard Whitehill. 2023. *In Search of Negative Moments: Multi-Modal Analysis of Teacher Negativity in Classroom Observation Videos*. International Conference on Educational Data Mining 2023.

EXPERIENCE

Research Student under Prof. Yilun Du, Harvard University, MA January 2026 – Present

- Leading a research project on **compositional world models for long-horizon robot manipulation**, studying how structured latent representations can improve prediction, planning, and policy learning in multi-stage tasks.

AI for Drug Discovery Intern, Pfizer, Cambridge, MA June 2025 – Dec 2025

- Led pretraining multi-modal Mamba and Transformer-based protein language model with domain-specific tokenizer, performed distributed training across internal HPC and AWS for scalable and fast training iteration.
- Built a high-throughput retrieval pipeline for clustered antibody datasets, shrinking per-sample access from intractable runtimes to milliseconds, enabling real-time training and analysis. Workflow and code deployed with containers and automated experiment tracking, improving reproducibility and reducing setup time for new runs.

Co-Op: AI for Drug Discovery, Pfizer, Cambridge, MA September 2024 – Dec 2024

- Accelerated and optimized antibody sequence search and global alignment through protein large language models.
- Building protein vector store database through LlamaIndex and proposed germline filtering mechanism for acceleration.

Research Assistant under Prof. Howie Choset, Carnegie Mellon University, PA July 2024 – September 2024

- Developed software for transforming 2D PCB design onto arbitrary high curvature 3D surface for 3D printing.
- Implemented proposed circuit mapping framework on aerosol jet additive manufacturing machine to reserve properties.

Research Assistant under Professor Ziming Zhang, WPI, MA December 2023 – June 2024

- Optimized the recurrent neural network architecture to resolve vanishing gradient problem through integration with Brownian-Bridge diffusion model. Implementing text-to-image AI on large-scale datasets for synthetic identity generation for face recognition training.

- Explored the use of pre-defined Extreme Value Distribution in self-supervised learning to avoid dimension collapse.

Research Student under Prof. Feng Tian, *Harvard University @ BIDMC* September 2023 – May 2024

- Incorporating GPT to create embeddings for scRNA sequencing and text data for gene functionality prediction and unsupervised cell clustering.
- Visualization of single cell sequencing bioinformatics data using Seurat packet in RStudio.

Research Assistant under Professor Markus P. Nemitz, *WPI, MA* April 2023 – December 2023

- Designed a closed-loop FDM printing system optimized for real-time detection and remediation of permeability-related defects and formulation of a software architecture capable of executing layer-wise defect detection and correction.
- Prototyped and developed a design of parameterized soft pneumatic assistive exoskeletons that is printable via standard FDM for personalized, reliable assistive devices that are affordable and easy to make.

R&D Co-Op, *Olympus Corporation of the Americas, Westborough, MA* January 2023 – July 2023

- Developed new and incorporated machine learning models to differentiate between human tissue, endoscope, and stones with laser spectral data, enabling smart features for the medical device; currently achieving nearly 100% sensitivity and specificity on all testing data under different data collection conditions.
- Implemented data logger processor program with tkinter and seaborn to filter and visualize data from thermocouples.

Research Assistant under Professor Jacob Richard Whitehill, *WPI, MA* May 2022 – January 2023

- Proposed and implemented an automatic and semi-automatic negativity filter and a classroom emotions analytics system using Speech Emotion Recognition, Google Cloud NLP APIs, and face emotions detection on OpenCV.
- Utilized Pandas and NumPy to achieve an AUC score of 83.3% with semi-automatic system on ~1000GB datasets.

INTELLECTUAL PROPERTY

Dongsheng Dai, Lynn Shan, **Zilin Dai**. 2024. **Circular RNAS and Preparation Methods Thereof**. International Publication Number: WO 2024/051842 A1

Dongsheng Dai, Lynn Shan, **Zilin Dai**. 2024. **Circular RNAS for Expressing Urate Oxidase, and Preparation Methods and Uses Thereof**. International Publication Number: WO 2024/051842 A1

AWARDS/HONORS

Amazon Fulfillment Technologies and Robotics Day One Fellowship September 2025
MIT Math Prize for Girls October 2021
American Mathematic Competition: National top 5% January 2021

SELECTED PROJECTS

AI Agent for Alzheimer's March 2025 – Present

- Developing an AI-driven framework through CrewAI that aligns multi-modal sensor and health record data to enable early detection of Alzheimer's disease.

AI Bomberman Bot January 2024 – March 2024

- Devised an algorithm combining A* and reinforcement learning for path-planning of a simulated character to earn higher score and escape from the world map. Interactive features and full graphics are provided.

Speaker Recognition System July 2023 – Aug 2023

- Implemented and modified SpeechBrain into a real-time speech activity and speaker recognition system based on PyTorch with user interface to process identification every second based on existing voice samples; system achieved 86.7% accuracy.
- Enabled a client-server data transfer pipeline to accelerate the speech processing speed from ~1.5 seconds to ~0.14 second.

Multi-thread Sport Scheduling System September 2022 – October 2022

- Programmed a multi-threaded sports park simulation system that schedules sports from multiple users concurrently using C.
- Implemented multiple mutexes and condition variables to protect shared resources and prevent race conditions.

SKILLS

Programming Languages: Python (most proficient), Java, C, C++, R, Shell Scripting

Machine Learning: PyTorch, Distributed Training (HPC), TensorFlow, HuggingFace Transformers, CrewAI

Data Processing & Analysis: SQL, Pandas, NumPy, MATLAB, Data Visualization (Matplotlib, Seaborn)

Tools & Platforms: Git, ROS2, Conda, Miniforge, Pixi, Docker, Linux, AWS, Google Cloud Platform