

# Taehoon Hwang

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## EDUCATION

### Columbia University

B.S. in Computer Science; GPA: 3.98 / 4.33

New York, NY

Aug. 2025 – Present

**Relevant Courses** Computer Science Theory, Programming Languages and Translators, Introduction to Databases, Projects in Computer Science, Operating Systems I, Theory ML Interaction, Natural Language Processing

### Purdue University

B.S. in Computer Science, Minor in Mathematics; GPA: 4.00 / 4.00

West Lafayette, IN

Aug. 2023 – May. 2025

**Relevant Courses** Linear Algebra, Probability, Discrete Mathematics, Computer Architecture, Data Structures, Statistical Methods, Competitive Programming I & II, Foundations of Deep Learning, Data Mining & Machine Learning, Introduction to Artificial Intelligence

## EXPERIENCE

### Research Assistant

Sep. 2025 – Present

Columbia University

New York, NY

- Working on fine-grained advantage computations for reinforcement learning to improve GRPO methodologies

### Artificial Intelligence Research Intern

May 2025 – Aug. 2025

Asteromorph

Seoul, South Korea

- Worked with fine-tuning and hosting LLMs (>200B parameters) on multi-GPU servers using vLLM and llama.cpp
- Developed an LLM fine-tuning framework by writing kernel code with PyTorch, Unslloth, and Hugging Face
- Deployed a parallel LLM fine-tuning scheduler and metric dashboard using Ray, Grafana, Prometheus, and Docker

### Teaching Assistant

Jan. 2025 – May. 2025

Purdue University

West Lafayette, IN

- Held office hours and lab sessions for students in Discrete Mathematics and Programming in C courses
- Reviewed and conducted problem solving sessions for discrete mathematics on first order logic, set theory, etc
- Answered students' questions during lab sessions on UNIX systems, file IO, dynamic memory allocation, etc

### Research Assistant

Jan. 2024 – Dec. 2024

Purdue University

West Lafayette, IN

- Engineered demand forecasting pipeline integrating probability curves with LSTM encoding for enhanced accuracy
- Optimized inference storage by achieving a reduction of >99% compared to traditional deep learning models
- Conducted latent space analysis and illustrated composite encoding of demand features using LSTM models

### Machine Learning Intern

Sep. 2023 – Aug. 2024

Quantum Research Sciences

West Lafayette, IN

- Employed ML algorithms and statistical techniques to deploy software for the United States Air Force
- Produced Monte Carlo simulations to test and tune quantum algorithms for inventory management
- Developed end-user interface for data analytics in quantum inventory management software

### Student Researcher

Mar. 2022 – Dec. 2022

Seoul Science High School

Seoul, South Korea

- Explored enhancements in real-time landmark tracking algorithms using machine and deep learning
- Improved Google MediaPipe performance by reducing untracked frames by 91.7% through U-Net segmentation
- Designed a versatile multi-headed software solution adaptable to various hardware specifications

### Research Assistant

May 2021 – Dec. 2021

Sungkyunkwan University

Seoul, South Korea

- Engaged with research team to boost open set recognition in ResNet models by 9% via latent space manipulation
- Developed and deployed a remote automated testing and optimization framework for models using PyTorch
- Presented research findings at the Korean Science High School R&E Conference

**Student Researcher***Seoul Science High School*

Apr. 2020 – Jun. 2021

*Seoul, South Korea*

- Investigated topics on advertisement classification and recommendation using OCR and clustering algorithms
- Refined k-means clustering to enhance classification accuracy, adapting to the temporal dynamics of user interests
- Demonstrated algorithm adaptability to temporal features through rigorous testing and analysis

**PROJECTS****Stack Rotation**

May 2025 – Aug. 2025

- Developed full-rank fine-tuning LoRA methodology with PyTorch using stochastically sampled rotation matrices
- Achieved SOTA-comparable performance when compared to LoRA variants such as DoRA, VeRA, and HiRA
- Constructed parallel fine-tuning orchestrator using Ray, Grafana, Prometheus, and Docker

**Rotationally Equivariant Spatio-temporal Prediction**

Feb. 2025 – Apr. 2025

- Developed spatio-temporal predictive models with rotational equivariance to adapt to out-of-distribution inputs
- Constructed training infrastructure using PyTorch Lightning and distributed high-performance computing nodes
- Compared methods for equivariance using steerable wavelet filters, G-CNNs, and equivariant attention modules

**Financial Anomaly Detection with Modified Benford's Law**

Jan. 2025 – Mar. 2025

- Suggested novel alteration of Benford's Law applicable to stock return data based on the Student-Lévy process
- Proved algorithm utility with real-life stock data and demonstrated 60% improvement over conventional methods
- Utilized new algorithm to detect financial anomalies in stock returns based on fitted location-scale t-distributions

**WUMT: Wavelet U-Net Motion Transformer**

Jul. 2024 – Mar. 2025

- Investigated spatio-temporal encoding methods of videos using discrete wavelet transforms and NAFNet blocks
- Utilized 4D motion tensor computations and predictions with transformers for U-Net latent space operations
- Built training infrastructure with PyTorch Lightning and leveraged Docker and MLFlow for streamlined research

**RL Wildfire Optimization**

May 2024 – Dec. 2024

- Utilized Convolutional DQN models to optimize firefighting efforts and evacuation routes with wildfires
- Developed complex wildfire simulation incorporating population density, terrain, weather, and crowd dynamics
- Theorized dynamic custom action and state space utilizing one-hot encoding and action masks

**Contextual-Diffusion**

Feb. 2023 – Aug. 2023

- Improved cohesion and features of Stable Diffusion model output utilizing spacial context from LLMs
- Developed pipeline incorporating Mask-RCNN models as translation layers between LLMs and Stable Diffusion
- Generated and annotated image segmentation datasets for supervised learning of Mask-RCNN models

**Minimax-based Animal Shogi AI**

Mar. 2021 – Nov. 2021

- Programmed an Animal Shogi bot using a minimax algorithm with alpha-beta pruning in C++
- Implemented interactable game GUI and cross-language translation mechanism with Python
- Demonstrated bot with live play-testing at school festival to 350+ students and faculty

**ACTIVITIES****Purdue Hackers Club Member***Purdue University*

Jan. 2025 – May 2025

*West Lafayette, IN*

- Participated in weekly 'hack' sessions and developed projects involving full-stack web development.
- Developed website for course scheduling at Purdue with Next.js, MongoDB, and Python among team of 3.

**Purdue IGDC Club Member***Purdue University*

Jan. 2024 – May 2025

*West Lafayette, IN*

- Participated in various in-person game development sessions with other club members.
- Developed game with Unity centered around creating gravitational wells to enduce fast-paced gameplay.
- Gave feedback on other games being developed and participated in play testing.

<b>ICPC 2023 ECNA Regional Participant</b>	Sep. 2023
<i>Purdue University</i>	<i>West Lafayette, IN</i>

- Ranked in the Top 20 in Purdue's ICPC participant selection contest
- Lead team of 3 in the ICPC East Central North America regional contest among 5 other Purdue ICPC teams
- Solved problems utilizing competitive programming techniques such as dynamic programming and backtracking

<b>Hello World Hackathon Participant</b>	Sep. 2023
<i>Purdue University</i>	<i>West Lafayette, IN</i>

- Led a team of 4 in a 24-hour hackathon driving project development and collaboration
- Built a software pipeline utilizing LLMs to deliver personalized dietary text feedback to users
- Built a full-stack web app with a React front-end and ExpressJS back-end integrating MongoDB RestAPIs

<b>ML@Purdue Club Member</b>	Mar. 2023 – May 2025
<i>Purdue University</i>	<i>West Lafayette, IN</i>

- Engaged in club discourse on AI and ML topics for research and software development.
- Participated in paper reading and workshops on various topics, such as transformers, GNNs, etc.

<b>Compute Infrastructure Manager</b>	Nov. 2021 – Feb. 2022
<i>Seoul Science High School</i>	<i>Seoul, South Korea</i>

- Allocated funding and purchased a multi-GPU cloud computing server for deep learning model training purposes.
- Managed and tested training infrastructure for research by setting up various software such as job managers.

<b>Published Author on Neural Network Fundamentals</b>	Sep. 2021 – Mar. 2022
<i>Barun Books Co.,Ltd</i>	<i>Seoul, South Korea</i>

- Authored a 160-page book on neural networks covering backpropagation, gradient descent, and parallelization
- Distributed to 13 retailers, selling 300+ copies in the first year
- Ranked as a top 4 entry in the "Weekly Top Releases" by the second-largest South Korean book retailer

<b>Artificial Intelligence Lecturer</b>	May 2021 – Apr. 2023
<i>Seoul Science High School</i>	<i>Seoul, South Korea</i>

- Presented 8 deep learning-focused lectures to an audience of 200+ students and faculty
- Delivered lectures on topics including linear algebra, conventional neural networks, and transformers
- Conducted 10 additional interdisciplinary volunteer lectures focused on mathematics and artificial intelligence

<b>Artificial Intelligence Club President</b>	Mar. 2021 – Feb. 2023
<i>Seoul Science High School</i>	<i>Seoul, South Korea</i>

- Authored 4 different entry exams on mathematical deep learning and essays on model selection
- Curated literature and project content with paper readings and specialized datasets
- Supervised and managed the acquisition of a multi-GPU deep learning server for club research and projects

## HONORS & AWARDS

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### Dean's List

*Columbia University, 2025*

### Purdue Office of Undergraduate Research Grant

*Purdue University, 2024* \$ 500

### Dean's List & Semester Honors

*Purdue University, 2023 & 2024 & 2025*

### Excellence Award in the Gifted School Research Conference

*Pohang University of Science & Technology, 2022*

### Top Award for R&E Research in Computer Science

*Seoul Science High School, 2022*

### Azure AI Fundamentals Certification

*Microsoft, 2022*

### Top Award for Independent Research on Computer Science

*Seoul Science High School, 2021*

## TECHNICAL SKILLS

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**Languages & Frameworks:** C/C++, Express.js, Flask, HTML/CSS, Java, JavaScript, Python, React, x86 Assembly

**Dev & Research Tools:** Docker, Git/GitHub, IntelliJ, LaTeX, MLflow, Overleaf, PyCharm, Slurm, VS Code

**Libraries:** Keras, NumPy, OpenCV, Pandas, PyTorch, Scikit-learn, TensorFlow, Transformers, Unislot, trl, vLLM