Taehoon Hwang

taehoon.h@columbia.edu | linkedin.com/in/taehoon-hwang | taehoonhwang.net

Education

Columbia University — New York, NY
B.S. in Computer Science; GPA: 3.98 / 4.33 — *Aug. 2025 – Present*
Relevant Courses *Computer Science Theory, Programming Languages and Translators, Introduction to Databases, Projects in Computer Science, Theory ML Interaction, Natural Language Processing*

Purdue University — West Lafayette, IN
B.S. in Computer Science, Minor in Mathematics; GPA: 4.00 / 4.00 — *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, Unsloth, 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%p 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 Apr. 2020 – Jun. 2021

Seoul Science High School *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 orchastrator 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 Jan. 2025 – May 2025

Purdue University *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 Jan. 2024 – May 2025

Purdue University *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.

ICPC 2023 ECNA Regional Participant Sep. 2023
Purdue University *West Lafayette, IN*
- 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

Hello World Hackathon Participant Sep. 2023
Purdue University *West Lafayette, IN*
- 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

ML@Purdue Club Member Mar. 2023 – May 2025
Purdue University *West Lafayette, IN*
- 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.

Compute Infrastructure Manager Nov. 2021 – Feb. 2022
Seoul Science High School *Seoul, South Korea*
- 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.

Published Author on Neural Network Fundamentals Sep. 2021 – Mar. 2022
Barun Books Co.,Ltd *Seoul, South Korea*
- 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

Artificial Intelligence Lecturer May 2021 – Apr. 2023
Seoul Science High School *Seoul, South Korea*
- 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

Artificial Intelligence Club President Mar. 2021 – Feb. 2023
Seoul Science High School *Seoul, South Korea*
- 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

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

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, Unsloth, trl, vLLM