

Minji Lee

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RESEARCH INTEREST

As a deep learning engineer, I excel in the areas of computer vision, especially semantic segmentation of farming and agriculture images, performance modeling, and source code algorithm optimization. My research aims to bridge the gap between theoretical segmentation models and their practical applications through innovative design and implementation.

Currently, I am working as a researcher to utilize SAM (Segment Anything Model) developed by Meta, evaluating its validity as a foundation model in comparison to traditional models such as CNNs. This evaluation aims to validate the hypothesis that SAM is also effective in specific domains. To enhance my UAV-captured dataset, I have generated synthetic images of eastern red cedar trees using diffusion models, which are integrated into the evaluation process to benchmark model performance.

EDUCATION

- **Ph.D**, Technology (Candidate), Purdue University, West Lafayette, IN. May 2021 – December 2024 (Expected). Dissertation: *UAV-Based Eastern Red Cedar Semantic Segmentation with Custom SAM Model in MLOps*
- **Master of Science**, Computer and Information Technology, Purdue University, West Lafayette, IN. August 2019 – May 2021. Thesis: *Intelligent Self Adapting Robot Apparel To Adapt Comfort*
- **Bachelor of Fine Arts and Bachelor of Software Convergence**, Sejong University, Seoul, South Korea. March 2012 – February 2017.

EDUCATIONAL EXPERIENCES

- **Visiting Scholarship Student**, Purdue University, West Lafayette, IN, USA, June - August, 2016

INTERNSHIPS

1. **MLOps Researcher**, AI/BigData Solution Team, LG Innotek

Date and Location: July to August, 2023, Seoul, South Korea

Designed and revised the MLOps platform (InnoMLOps) for manufacturing model utilization, enhancing the production of core components for mobile devices, automotive displays, semiconductors, and smart products.

Developed an autonomous machine learning pipeline system as well as an AI model re-learning algorithm, resulting in a 2.1% improvement in model deployment efficiency.

Generated +1,200 synthetic datasets using a diffusion model noise, enhancing data quality and quantity for training.

Conducted research to compare and evaluate MLOps platforms such as AWS SageMaker, MLFlow, TFX, and Kubeflow, considering both business processes and performance metrics.

2. **Research Aide**, Mathematics and Computer Science Lab, Argonne National Laboratory

Date and Location: May to August, 2022, Lemont, IL

Created an Ansible script for the NVidia Nano node platform, enabling students and scientists to develop edge-to-cloud software pipelines. This facilitated collaboration and innovation in geographical data analysis and research.

Utilized the script to explore the capabilities of machine learning and deep learning for intelligent sensor designs, thereby facilitating experimentation and advancing the Sage Project.

3. **Research Aide**, Mathematics and Computer Science Lab, Argonne National Laboratory

Date and Location: May to August, 2021, Lemont, IL (Virtual)

Implemented integration of Node-RED into the IBM cloud computing platform and web portal inside of Docker managed by Kubernetes.

Analyzed geographical and meteorological data from local conditions and events, facilitating real-time data collection in diverse environments wildfires, heat waves, and storms.

POSITIONS

- **Teaching Assistant**, Computer and Information Technology, Purdue University, West Lafayette, IN. August 2024 - Current.

Assisting students with understanding core concepts in C programming, including sorting algorithms, recursion, pointer manipulation, and data structures.

Providing support for programming assignments and projects across multiple operating systems such as Linux using VMware for virtualization and multi-environment setups.

- **Research Assistant**, M2M Lab and K-SW Software Program, Purdue University, West Lafayette, IN. August 2019 - July 2024.

Primarily assisted undergraduate/graduate visiting students with all stages of their research, including setting up the research environment, defining problem statements, identifying gaps in literature, structuring papers, providing insights on academic writing and publication standards, offering feedback to improve clarity and coherence. The details are as follows:

- **Political Compass Evaluation of ChatGPT: Assessing Consistency Bias in Generated Responses**, M2M Lab, Purdue University, West Lafayette, IN. June 2024 - Current.

Collected compass datasets to analyze the consistency of ChatGPT's responses to political bias prompts, focusing on progressive and libertarian views, using the ChatGPT 4.0 Political Compass plugin.

Revealed that ChatGPT's bias, as measured by the standard deviation, is higher for the economic left-right dimension (≈ 0.78) compared to the social libertarian-authoritarian dimension (≈ 0.29).

Published in the proceedings of an IEEE conference at the 2024 IEEE First International Conference on Artificial Intelligence for Medicine, Health and Care (AIMHC).

- **Resolution Free Human Image Generation and Control**, K-SW Software Program, Purdue University, West Lafayette, IN. January - June 2024.

Utilized publicly available COCO datasets to perform generative facial generation, enhancing image quality and diversity through advanced algorithms such as Variational Autoencoders (VAEs).

Developed a Diffusion Transformer (DiT) model combined with Patch n' Pack to create high-resolution images of people, trained on a vast dataset comprising real-world images containing individuals.

- **Deploying a Sustainable Deep Learning Pipeline for Poison Ivy Image Classification**, K-SW Software Program, Purdue University, West Lafayette, IN. March 2023 – June 2023.

Collected Poison Ivy datasets throughout the seasons—early, mid, and late summer—as poison ivy's appearance varies significantly by month due to the lack of publicly available datasets.

Utilized Segment Anything Model (SAM) for segmentation and analysis, followed by data preprocessing and augmentation.

Developed a classification model and constructed a pipeline using Kubeflow to streamline the process.

Published in the proceedings of an IEEE conference at the 9th International Conference on Mathematics and Computers in Sciences and Industry (MCSI).

- **Safe Route Recommendation based on Crime Risk Prediction with Urban and Crime Data**, K-SW Software Program, Purdue University, West Lafayette, IN. August 2022 – January 2023.

Conducted innovative research on safe route recommendations, integrating urban and crime data to predict road risks in Chicago.

Developed an advanced machine learning model that uses Gaussian Kernel Density Estimation (KDE) to estimate crime densities and assess crime severity, and implemented a novel approach to assign risk scores to roads, optimizing route safety through the Dijkstra shortest path algorithm.

Published in the proceedings of the IEEE 9th International Conference on Big Data Computing Service and Applications.

- **Program Coordinator with IITP**, K-SW Software Program, Purdue University, West Lafayette, IN. March to August 2020

Collaborated with IITP Korean Government mentors to manage, tutor, and instruct Korean and Purdue undergraduate students in research classes and lab sessions virtually due to the pandemic.

Developed and delivered curriculum content tailored to the needs of international students, fostering an inclusive and supportive learning environment.

- **Research Advisor**, K-SW Software Program, Purdue University, West Lafayette, IN. December 2019 to February 2020

Advised international students on navigating their research projects and career paths, offering guidance on academic planning, research methodologies, and professional development.

Provided hands-on instruction in data analysis techniques, equipping students with the skills needed to effectively analyze and interpret complex datasets.

Taught programming skills and concepts such as C during lab sessions, facilitating students' understanding of key topics and enhancing their practical coding abilities.

SKILLS

- **Mathematics:** Proficient in algebra, calculus, and statistics, with the ability to analyze and interpret complex mathematical models and familiarity with mathematical optimization techniques and probability theory.
- **Python3:** Certified and proficient in Python programming language, with experience in developing applications, scripts, and data analysis tools using libraries such as NumPy, Pandas, and Matplotlib.
- **PyTorch:** Proficient in deep learning, adept at debugging dependency issues to ensure seamless implementation across diverse OS, with experience in building and training neural networks for computer vision.
- **Docker:** Highly proficient in Docker containerization, with extensive experience in packaging applications and their dependencies into lightweight, portable containers. Skilled in optimizing the deployment process to ensure seamless, efficient management across diverse environments.
- **Kubernetes:** Competent in collaborating with Kubernetes to orchestrate containerized applications, enhancing scalability and reliability. Experienced in setting up and managing Kubernetes clusters to facilitate robust, fault-tolerant systems across multiple hosts.
- **GPU and CUDA:** Skilled in leveraging NVIDIA GPUs for high-performance computing, with experience in using CUDA for parallel programming and accelerating computational tasks. Proficient in optimizing deep learning models to achieve faster training and inference on GPU architectures.

PUBLICATIONS

1. **Title:** *Political Compass Evaluation of ChatGPT: Assessing Consistency Bias in Generated Responses* presented at IEEE 9th International Conference on Mathematics and Computers in Sciences and Industry (MCSI)

Date and Location: August 22-24, 2024, Rhodes Island, Greece

Coauthors: Eric T. Matson

2. **Title:** *Deploying a Sustainable Deep Learning Pipeline for Poison Ivy Image Classification* presented at the 2024 IEEE First International Conference on Artificial Intelligence for Medicine, Health and Care (AIMHC)

Date and Location: February 5-7, 2024, Laguna Hills, CA

Coauthors: Wonjun Park, Sumin Cho, Subin Kim, Jiyeon Lee, Jack Mahedy, and Nebey Gebresalssie

3. **Title:** *Prediction based Auto-Pilot Interface for Drone to Object Chasing using Historical TSPI Data* presented at the 2023 23rd International Conference on Control, Automation and Systems (ICCAS)
Date and Location: October 17-20, 2023, Yeosu, South Korea.
Coauthors: Shinhyoung Jang, Byeonghwi Park, Juheon Jeong, Jack Mahedy, Nebey Gebreslassie, and Eric T. Matson
4. **Title:** *Safe Route Recommendation based on Crime Risk Prediction with Urban and Crime Data* presented at the IEEE 9th International Conference on Big Data Computing Service and Applications
Date and Location: July 17-20, 2023, Athens, Greece
Coauthors: Daye Kim, Juwon Baek, Jihu Yang, Hyun Roh, Heewon Jeong, Bryanna Ruiz, and Eric T. Matson
5. **Title:** *Ehdnet: Enhanced human detection network for search and rescue* presented at the 2022 IEEE 46th Annual Computers, Software, and Applications Conference (COMPSAC)
Date and Location: June 27-July 1, 2022, Torino, Italy
Coauthors: Seungoh Han, Ah-Young Nho, Wei Teng Kwan, Benjamin Paglia, Jacob Visniski, Eric T. Matson, and Minsun Lee
6. **Title:** *Feasibility of Measuring Shot Group Using LoRa Technology and YOLO V5* presented at the 2022 IEEE Sensors Applications Symposium (SAS)
Date and Location: August 1-3, 2022, Sundsvall, Sweden
Coauthors: Sanghyun Park, Dongheon Lee, Jisoo Choi, Dohyeon Ko, Zack Murphy, Nowf Binhowidy, and Anthony Smith
7. **Title:** *Cost-Effective Solution for Fallen Tree Recognition Using YOLOX Object Detection* presented at the 2022 Sixth IEEE International Conference on Robotic Computing (IRC)
Date and Location: December 5-7, 2022, Naples, Italy
Coauthors: Hearim Moon, Eunsik Park, Junghyun Moon, Juyeong Lee, Doyoon Kim, Minsun Lee, and Eric T. Matson

INVITED KEYNOTES, TALKS, AND PRESENTATIONS

- **PMRI Workshop**

Date and Location: June 25-26, 2024 in West Lafayette, IN, 47907

Presented research at the Purdue Military Research Institute (PMRI) Symposium to US and Korean military personnel.

Included a demonstration of using SAM for semantic segmentation, underlining its efficacy in military applications of computer vision and geographical data analysis.

Mentored military service on the practical applications of the confusion matrix, emphasizing its role in evaluating the performance of machine learning models.

Conducted seminars on various topics, including machine learning, deep learning, confusion matrices, computer vision, and statistics, providing students with a comprehensive understanding of these subjects. Facilitated lectures that covered advanced topics such as UAV (Unmanned Aerial Vehicles), UAS (Unmanned Aircraft Systems), antenna networking, and Explainable AI, enabling participants to grasp the latest technological advancements.

- **IITP Career Talk Workshop**

Date and Location: Dec 15-16, 2023 in Seoul, South Korea, 04535

Invited by the IITP to deliver a talk aimed at motivating undergraduate students to pursue advanced academic and professional opportunities.

Shared insights on the journey to becoming a master's and Ph.D. student, emphasizing the importance of setting clear academic goals, building a strong research portfolio, and selecting the right graduate programs that align with their career aspirations.

Provided practical advice on how to secure internships in the United States, which included tips on networking, crafting effective resumes and cover letters, and leveraging university resources and career services.

Highlighted the benefits of gaining international experience and how it can enhance their academic and professional growth.

Certifications

- **The Recreational UAS Safety Test (TRUST)**

Completed the FAA's official safety test for recreational drone pilots, demonstrating knowledge of key safety practices, regulations, and airspace rules for operating unmanned aerial systems.

- **Neural Networks and Deep Learning (Coursera)**

Earned certification from the online course taught by Andrew Ng, covering foundational concepts of neural networks, backpropagation, and techniques to train deep learning models effectively.

- **EBEC Programming in Python (Purdue)**

Completed a specialized course at Purdue University focused on programming in Python, gaining proficiency in writing efficient code, data manipulation, and problem-solving using Python.

LANGUAGE PROFICIENCY

- **Korean:** Native proficiency. Extensive academic and professional use.
- **English:** Fluent. Professional working proficiency with academic publications and conference presentations.
- **Japanese:** Intermediate proficiency. Practical conversational and business communication.

[CV compiled on September 30, 2024]