XIAXIN SHEN

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EDUCATION

Ph.D. in Electrical and Computer Engineering, Princeton University *2027 (Expected)*
PhD candidate *Princeton, NJ 08544*
M.A. in Electrical and Computer Engineering, Princeton University *2024*
Princeton, NJ 08544
B.S. in Computer Information Technology, Purdue University *2022*
Graduated with highest distinction (GPA: 3.96 / 4.00) *West Lafayette, IN 47906*

RESEARCH EXPERIENCE

Neural Architecture Search (NAS) **April 2023 - Present**
- Implemented Deep Regression Component Analysis (DRCA), taking into account the asymmetric case and temporal sensitivity
- Applied Deep RCA to Deep Progressive and Regressive NAS for optimizing neural network architectures
- Developed Supervised Deep Interpolation (SDI), leveraging Deep RCA for supervised super-resolution image enhancement
- Adapted and implemented Deep Progressive and Regressive NAS for numerical datasets

UAV Ground Scanning System: Human Detection with Deep Learning **Jan 2021 - May 2022**
Team Leader in the IITP Technology Entrepreneurship Program
- Created LIAEHU dataset comprising low-altitude infrared aerial images for human detection
- Presented an UAV ground scanning system developed with an infrared camera mounted on the UAV to detect human both in the daytime and at night
- Built a warning system for sending real-time notifications with GPS information if the result from the ground scanning system triggers the warning
- Compared and analyzed the performance of several deep learning state-of-the-art models with the LIAEHU dataset including YOLOv3, YOLOv4, YOLOv5, YOLO X, MobileNetSSDv2, and EfficientDet with TensorFlow and PyTorch

RoboMal: Malware Detection for Robot Network Systems **Mar 2021 - Aug 2021**
Undergraduate Research Assistant
- Developed the RoboMal dataset using the controller files of the publicly available autonomous car with Gazebo-based simulation available at GitHub
- Created a total of 450 binary executable and linkable format (ELF) files with 232 malware files and 218 good software files by modifying gains and scalars and manipulating the proportional–derivative (PD) control structure by person
- Identifying the maliciousness of the code with an accuracy of 85% and precision of 87%

Attitude Control for Fixed-Wing Aircraft using Q-Learning **Jan 2020 - Nov 2020**
Undergraduate Research Assistant
- Applied algorithms Q-Learning proposed in 1989 to airplane simulator which is available at GitHub
- Utilized Python to work with high dimensional, non-linear and complex tasks with a simulated aircraft Cessna 172 in JSBSim
- Implemented the algorithm for airplane flight based on Q-Learning to make the airplane fly with the goal of maintaining a constant altitude
- Defined a Q-table with the size (states(168), actions(4)) by creating an encoding system by converting discrete action values to continuous values

AWARDS

- Gordon Y.S. Wu Fellowship in Engineering *2022*
- Best Session Paper Award in 2021 Springer IHCI (Session Name: Machine Learning for HCI) *2021*
- 3rd Place in the SAE Mobility Forward Challenge: AI Mini-Challenge Competition *2021*
- Award for Best Visualization in Purdue's 7th Annual ASA DataFest Competition *2021*
- National-wide: Top 40 and Finalist in the ITA Tech Challenge Programming Competition *2019*

TEACHING EXPERIENCE

- **ECE 115 Introduction to Computing: Programming Autonomous Vehicles** *2023 - 2025*
  Graduate assistant in instruction *Princeton University*
- **EGR 154 Foundations of Engineering: Linear Systems** *2024 -2025*
  Head TA *Princeton University*

COURSE PROJECTS

AI Alignment: Enhancing Truthfulness of LLMs **Sep 2023 - Dec 2023**
- Researched and prepared a comprehensive survey on the gap between knowledge and truthfulness in large language models
- Analyzed a shift in research from a focus on model capabilities to interpretability for correcting model misalignment.
- Highlighted advancements and proposed potential future research directions in the field

Multiscale Cryo-EM Reconstruction **Sep 2023 - Dec 2023**

- Replicated and validated findings from Residual Multiplicative Filter Networks (rMFNs) to enhance cryo-EM 3D reconstruction using a coarse-to-fine estimation approach
- Implemented rMFNs to overcome local minima challenges caused by high-frequency noise in cryo-EM 3D reconstructions
- Utilized synthetic data from protein structure PDB1OL5 to reproduce and analyze reconstruction results
- Generated and analyzed key metrics, including Fourier Shell Correlation (FSC) plots and multiscale reconstruction images, to evaluate the quality and resolution of the 3D maps

ControlLoRA++: Expanding Stable Diffusion with New Tasks and Datasets **Jan 2023 - May 2023**

- Developed ControlLoRA++, an extension of ControlLoRA, by integrating two additional tasks: scribble and HED
- Enhanced model diversity and alignment by training with new datasets, including COCO and Waymo
- Conducted a detailed analysis on model performance by evaluating the impact of the number of blocks and rank parameter
- Leveraged ControlNet and LoRA to optimize the training process, achieving efficient fine-tuning with a significantly reduced number of trainable parameters
- Contributed to the advancement of stable diffusion models by improving their fidelity with specific prompts and data, with code available on GitHub

LoNP: Efficient Fine-Tuning of Large Language Models **Jan 2023 - May 2023**

- Proposed and implemented LoNP, a novel framework that combines LoRA (Low-Rank Adaptation) and TextPruner for efficient, structured pruning and fine-tuning of large language models
- Applied the LoNP framework to RoBERTa and evaluated its performance on the PAWS-X dataset for sequence classification tasks
- Conducted experiments to analyze the impact of different model structures and the LoRA rank parameter on model performance, inference time, and trainable parameter rates
- Demonstrated that LoNP significantly reduces model size and accelerates inference while maintaining strong performance on downstream tasks

Synthetic Asset Decentralized Exchange (DEX) **Jan 2023 - May 2023**

- Engineered a decentralized application (Dapp) on the Ethereum testnet for the minting and exchange of synthetic assets
- Developed smart contracts in Solidity to manage a Collateralized Debt Position (CDP) system, utilizing Chainlink oracles for price feeds
- Implemented a DEX with a constant product formula to manage liquidity pools and facilitate peer-to-peer exchanges
- Integrated contracts with a web client, enabling users to mint, manage liquidity, and swap assets while ensuring robust validation checks

Bitcoin Client Implementation in Rust **Sep 2022 - Dec 2022**

- Developed a simplified Bitcoin client from scratch using the Rust programming language, focusing on core blockchain principles
- Implemented fundamental cryptographic data structures, including a Merkle Tree, and built the core blockchain with a Proof-of-Work (PoW) consensus mechanism
- Integrated a peer-to-peer (P2P) network using a gossip protocol for block and transaction propagation
- Designed a transaction mempool and a comprehensive state model to validate transactions and prevent double-spending

PUBLICATIONS

- **Xiaxin Shen**, Corbin Newhard, Miad Faezipour, and Smriti Bhatt. Smart monitoring and detection of ecg and breathing sound signals with deep learning. In *2022 IEEE International Conference on Engineering in Medicine and Biology Society (EMBC)*. IEEE, 2022
- David J. Richter, Lance Natonski, **Xiaxin Shen**, and Ricardo A. Calix. Attitude control for fixed-wing aircraft using q-learning. In *International Conference on Intelligent Human Computer Interaction (IHCI)*. Springer, 2021
- Upinder Kaur, Haozhe Zhou, **Xiaxin Shen**, Byung-Cheol Min, and Richard M. Voyles. Robomal: Malware detection for robot network systems. In *2021 IEEE International Conference on Robotic Computing (IRC)*. IEEE, 2021

SKILLS

- **Python:** Implemented data scraping, XML files parsing, data cleaning, data analytics, and model building with TensorFlow and PyTorch
- **C/C++:** Implemented data structure and algorithms by finishing about 150 problems at online judge system
- **Java:** Maintained a Java-based system using the technique of Mybatis, Maven, Spring MVC for knowledge mapping. Implemented parallel programming for operating system. Developed Android App: RLEAM Reader
- **Dynamic website development:** Implemented an e-commerce site with HTML, CSS, JavaScript, JQuery, PHP, MySQL
- **Latex:** Edited paper with IEEE/ ACM/ Springer formats
- **Git:** Version control especially for group projects
- **Tableau:** Visualized and analyzed data in Purdue's 7th Annual ASA DataFest Competition