Jiashen Ren

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Jiashen Ren GaAs9000

Education

ZheJiang University *Sep. 2022 – May 2026*
BS in Electrical Engineering

- **Coursework:** Data Mining (CS412), Digital Systems With FPGA (ECE385), Programming Methods for ML (ECE364), Linear Algebra (MATH257), Probability with Engineering Applications(ECE313), Optimization (ECE490), Trustworthy machine learning (CS442, in Progress), Embodied Artificial Intelligence (ECE498AI, In Progress)

University of Illinois at Urbana-Champaign *Sep. 2022 – May 2026*
BS in Electrical Engineering

Research Experience

SRTP Research: Constraint-Oriented Neural Networks for Power System Decomposition and Optimization *Haining, China*
Feb. 2025 – Present
Instructor: Prof. Qingchun Hou (ZJU-UIUC Institute, Zhejiang University)

- **Motivation:** Traditional solvers face real-time bottlenecks in complex power system optimization, while standard neural networks fail to guarantee physical feasibility, limiting their use in safety-critical applications.
- **Core Objectives:** To develop a scalable, physics-informed deep learning framework. This involves two parts: 1) Designing a novel constraint satisfaction layer inspired by Physics-Informed Neural Networks (PINNs) to ensure outputs strictly adhere to linear constraints (e.g., power flow equations). 2) Training a Graph Neural Network (GNN) to intelligently decompose the large-scale power grid by predicting boundary flows, thus transforming the original problem into multiple, parallelizable subproblems.
- **Personal Contribution:** Designed and implemented a novel physics-constrained neural network architecture. Currently developing the GNN-based decomposition and prediction model, and validating the integrated framework on IEEE standard test systems to address the scalability and real-time challenges of the large-scale ACOPF problem.

Summer Research: DiffSinger-based Voice Enhancement and Synthesis *Hangzhou, China*
Instructor: Prof. Zhou Zhao (College of Computer Science, Zhejiang University) *Jun. 2023 – Aug. 2023*

- **Motivation:** Traditional voice synthesis methods have limitations in audio quality and generation speed. Diffusion models offer new technical approaches for voice synthesis, requiring deep understanding of their working principles and implementation mechanisms.
- **Learning Outcomes:** Successfully reproduced the DiffSinger model, mastered the complete pipeline of diffusion probabilistic models converting noise to Mel-spectrograms, and understood how shallow diffusion mechanisms improve audio quality and accelerate generation.
- **Personal Contribution:** Conducted in-depth study and reproduction of different diffusion model components from the paper, including noise scheduling and denoising networks. Assisted in experimental result analysis, manually annotated and evaluated generated audio quality, and compared model outputs with human evaluation for validation.

Publications

Haoyu Zhu, Yao Zhang, **Jiashen Ren**, Qingchun Hou. *T-SKM-Net: Trainable Neural Network Framework for Linear Constraint Satisfaction via Sampling Kaczmarz-Motzkin Method.* In Proceedings of the AAAI Conference on Artificial Intelligence (AAAI), 2026.

Projects

ECE385: FPGA Handwriting Number Recognition *GaAs9000/ECE385*

- **Hardware-Accelerated Neural Network:** Designed and implemented a 3-layer MLP network (1024-32-10) entirely at the RTL level in SystemVerilog, converting a PyTorch model to a Q7.24 fixed-point format with custom MAC units for real-time inference.
- **End-to-End System & IP Design:** Engineered an FSM-based data pipeline to manage real-time image capture (OV7670), processing, and display, integrating self-developed IP cores for VGA control, I2C communication, and memory management.
- **Timing Closure & Optimization:** Successfully achieved timing closure at a 50MHz clock frequency through logic and resource optimization, guaranteeing the system's stability and real-time recognition capability on the target FPGA.
- **Technologies Used:** SystemVerilog, PyTorch, FPGA, Intel Quartus

ECE 364: Rock, Paper, Scissors Image Classification

- **Model Implementation:** Implemented a ConvNeXtV2 model for image classification, utilizing FCMAE for self-supervised pre-training and an ASAM optimizer for fine-tuning. Achieved 100% accuracy on both the validation and test sets.
- **Comparative Analysis:** Evaluated different CNN architectures, progressing from a ResNet baseline to the ConvNeXt series. Conducted ablation studies to compare the effectiveness of components like Batch Normalization (BN) vs. Layer Normalization (LN).
- **Model Visualization:** Analyzed the model's learning process using GradCAM heatmaps to visualize its focus. Observed that the model's attention gradually shifted from background details to relevant hand features during training.
- **Technologies Used:** PyTorch, PyTorch Lightning, ConvNeXtV2.

Technologies

Languages: Python, SystemVerilog, C

Machine Learning: PyTorch, PyTorch Lightning, NumPy, Pandas

Hardware & Embedded Systems: FPGA, Intel Quartus, RTL Design

Developer Tools: Git, GitHub, Linux

Honors and Awards

National Silver Medal, The China International College Students' Innovation Competition, *2023*

- **My Role:** Defined the core application scenario (emergency medical delivery) for the team's multi-agent drone scheduling platform, which utilized a patented optimization framework.

Honorable Mention, The Mathematical Contest in Modeling (MCM), *2024*

- Applied mathematical and computational modeling to solve complex real-world problems.

Third-Class Academic Excellence Award, ZJU-UIUC Institute, *2022-2023*

Outstanding League Secretary, Zhejiang University, *2022-2024*

Teaching Experience

Teaching Assistant for **MATH241 (Calculus III)** Sep. 2025 - Dec. 2025
Teaching Assistant for **MATH285 (Introduction to Differential Equations)** Jan. 2025 - May 2025