Obblivignes KanchanadeviVenkataraman

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EDUCATION

North Carolina State University

Doctorate of Philosophy in Computer Science — August 2025 - Expected May 2029
GPA: 4.00/4

Master of Science in Computer Science — August 2023 - May 2025
GPA: 3.97/4

Bachelor of Science in Computer Engineering — August 2020 - May 2023
GPA: 4.00/4

SKILLS

Languages & Tools | Python, MATLAB, C, C++, Java, LaTeX, Git, Bash, SLURM
Libraries & Frameworks | PyTorch, Scikit-Learn, Pandas, Plotly, Numpy, Matplotlib, Keras, Scipy, Electron JS, React.JS
Machine Learning | **Classical** (Classification, Clustering, Tree-based methods), **Deep** (UNet, Diffusion, LiteLLM, GPT)
Data Science | Data Preprocessing, Data Visualization, Statistical Analysis, Monte Carlo Simulations, Predictive Modeling

WORK EXPERIENCE

Graduate Teaching Assistant - Automated Learning & Data Analysis | NC State University — January 2026 - Present
- Held office hours for **60 students** to understand material, complete assignments, and build a real-world machine learning project.
- Managed grading for all student coursework, including assignments, quizzes, and exams.

Graduate Teaching Assistant - Software Engineering | NC State University — August 2025 - December 2025
- Mentored **60 students in two lab sections** collaborate to complete assignments, and build a full-stack development application.
- Held office hours to help students with questions or concerns they have regarding course material and project issues.

CV/ML Graduate Research Assistant (GRA) | NC State University - MAP Lab & GIS Lab — September 2024 - Present
- Built end-to-end data pipelines for super-resolution microscopy using **Python (NumPy, Pandas, Scikit-learn)**, applying clustering, classification, and regression to extract actionable biological insights.
- Generated 500k+ physics-informed Monte Carlo simulations, boosting model accuracy by 25% and training efficiency by 40% with **feature engineering and custom normalization**.
- Developed and fine-tuned **deep learning models** (**PyTorch: U-Net, Attention U-Net, Conditional Diffusion**), doubling image quality in super-resolution denoising, and up to **50% better** denoising performance compared to baseline models.
- Improved model generalization **by 50% from baselines** through hyper-parameter tuning, cross-validation, and statistical evaluation
- Partnered with cross-functional teams to integrate **AI/ML workflows** into biology and materials science research, accelerating experimentation and interdisciplinary innovation.

Software Engineering AI GRA | NC State University - Dr. Bowen Xu's Lab [Link] — January 2024 - May 2024
- Presented, trained, and evaluated the performance of an existing deep **just-in-time SE code-comment consistency checker** technique among existing datasets such as Microsoft's CodeXGlue.
- Integrated the tool into SEEDGuard GitHub repository, providing video-guided tutorials and Docker images for easy deployment.

Distributed Systems RA | NC State University - Dr. Ruozhou Yu's Lab [Link] — January 2023 - August 2023
- Conducted **microservice-based distributed application benchmarking** by implementing a comprehensive Kubernetes cluster, utilizing Raspberry Pis, an Apache Cassandra database, Flask, Jaeger, and Opentelemetry.
- Trained several machine learning models and achieved a **96% R2-score** using Random Forest models
- Presented all findings using data visualization techniques in a comprehensive report.

PROJECTS

Computer Vision (Applying SpecUNet and SA-SpecUNet Towards Spatial SMLM) — August 2025 - Present
- Applied SpecU-Net to generate **100k+** Gaussian- and Perlin-based Monte Carlo single-molecule spatial simulations
- Trained SpecU-Net to achieve significant improvements in super-resolution denoising performance compared to existing tools

Multi-AI Agent System (SIMBA: Single-molecule Imaging with Multi-agent Bot Assistant**)** — June 2025 - Present
- Led a multi-agent desktop app to perform spectroscopic analyses, image denoising, single-molecule localization, and other tasks
- Utilized **Electron JS and React JS** for front-end integration and utilized **GPT-4o and LiteLLM** for backend integration
- Significantly improved scientific analysis workflow by seamlessly integrating microscopy tasks (denoising, localization, analysis)

Computer Vision (Applying SpecDiffuse for Accurate Spectroscopic SMLM) — May 2025 - Present
- Adapted conditional diffusion, physics-informed model with U-Net backbone on SR denoising for spectroscopic analysis
- Outperformed conventional U-Net (SpecU-Net) and SA-SpecU-Net by **25+% on several metrics** for super-resolution denoising
- Enabled accurate biological analysis by simulating **400k+** 16-bit images (**~25GB**) for robust GPU-based training and inference

Computer Vision (Applying SA-SpecU-Net for Accurate Spectroscopic SMLM) — November 2024 - Present
- Integrated spatial attention component into SpecU-Net to capture specific latent representations for better contextual understanding
- Outperformed conventional U-Net (SpecU-Net) by **~25% on several metrics** in image quality for super-resolution denoising
- Enabled accurate biological analysis by simulating **400k+** 16-bit images (**~25GB**) for robust GPU-based training and inference

Computer Vision (Framework for Accurate SMLM Spectroscopic Analysis) [Link] — September 2024 - December 2024
- Improved image resolution by **~70%** from conventional denoising methods by developing a U-Net-based model in MATLAB (SpecU-Net) to denoise spectroscopic single-molecule localization images
- Increased prediction precision by ~**70%** and accuracy by ~**50%** through generating **100k+** physics-informed Monte Carlo simulation datasets and creating comprehensive evaluation metrics
- Migrated SpecU-Net pipeline from MATLAB to Python using PyTorch, achieving **5x GPU acceleration** on training and inference

PUBLICATIONS

- *Mao, H., Liu, Y., **KanchanadeviVenkataraman O.**, Shahid, M. A., Laplante C., Xu, D., Song, K., Zhang, Y. (2025). Framework for Accurate Single-Molecule Spectroscopic Imaging Analyses Using Monte Carlo Simulation and Deep Learning. Analytical Chemistry, 97(30), 16250-16258.*