Obblivignes KanchanadeviVenkataraman

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SKILLS

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

WORK EXPERIENCE

Graduate Teaching Assistant - CSC 326 Software Engineering | **NC State University** **August 2025 - Present**

- 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
- Graded assignments and proctored exams for all students

Graduate Research Assistant | **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 hyperparameter 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.

Graduate Research Assistant | **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.

Graduate Research Assistant | **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 and presented all findings using data visualization techniques in a comprehensive report.

RELEVANT PROJECTS

Applying SpecUNet Towards Spatial Single-Molecule Imaging Analysis **August 2025 - Present**

(Python, PyTorch, Scipy, Pandas, matplotlib, imago, h5py)

- Applied SpecU-Net simulation process to generate **100k+** Gaussian-based Monte Carlo single-molecule spectral simulations
- Trained Spec-UNet to achieve significant improvements in performance compared to existing denoising tools

SIMBA: Single-molecule Imaging with Multi-agent Bot Assistant **June 2025 - Present**

(Electron JS, ChatGPT, ReactJS, LiteLLM, Python, PyTorch, matplotlib, scipy)

- Led a multi-agent desktop app to perform spectroscopic analyses, image denoising, single-molecule localization, and other tasks
- Significantly improved scientific analysis workflow by seamlessly integrating microscopy tasks with built-in OpenAI GPT chatbot

SpecDiffuse for Accurate Spectroscopic Single Molecule Localization Microscopy

(MATLAB, Python, PyTorch, Scipy, Pandas, matplotlib, imago, h5py) **May 2025 - Present**

- Adapted existing **conditional diffusion model** with U-Net backbone on super-resolution denoising for spectroscopic analysis
- Outperformed conventional U-Net (SpecU-Net) by **~50% 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

SA-SpecUNet for Accurate Spectroscopic Single Molecule Localization Microscopy

(MATLAB, Python, PyTorch, SciPy, Pandas, Matplotlib, imago, h5py) **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

Framework Development for Accurate Single-Molecule Imaging Spectroscopic Analysis [Link]

(MATLAB, Python, PyTorch, SciPy, Pandas, matplotlib, imago, h5py) **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 existing SpecU-Net pipeline from MATLAB to Python, achieving **5x GPU acceleration** on training and inference process

EDUCATION

North Carolina State University **August 2025 - Present**
Ph.D. in Computer Science | *GPA: N/A*

North Carolina State University **August 2023 - May 2025**
M.S. in Textiles | *GPA: 3.94/4*

North Carolina State University **August 2020 - May 2023**
B.S. in Textile Engineering | *GPA: 4.00/4*

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.*