Pranath Reddy Kumbam

+1(352)665-0809 kumbam.pranath@gmail.com pranath-reddy pranath-reddy Google Scholar
Work Authorization: H-1B (Cap-Exempt)

Education

University of Florida Gainesville, Florida
*Master of Science, Computer Science - **GPA: 4.0/4.0*** *Aug 2022 - May 2024*
Relevant Coursework: Analysis of Algorithms, Applied Machine Learning Systems, Natural Language Processing

Birla Institute of Technology And Science, Pilani (BITS Pilani) Hyderabad, India
Master of Science, Physics & Bachelor of Engineering, Electrical and Electronics Engineering *Aug 2016 - Jul 2021*
Relevant Coursework: Machine Learning, Neural Networks and Fuzzy Logic, Probability & Statistics

Technical Skills

Languages and Developer Tools: Python, C, C++, Swift, MATLAB, SQL, Erlang/OTP, LaTeX, Linux, Docker, Git
Frameworks and Libraries: PyTorch, Qiskit, Keras, TensorFlow, Pydantic AI, Scikit-learn, NLTK, NumPy, Pandas, OpenCV

Experience

NASA Office of Data Science and Informatics **Apr 2025 – Present**
Computer Scientist III
- Currently contributing to the development of a multimodal foundation model for Mars surface analysis.
- Developing novel LLM sycophancy mitigation techniques for open-ended scientific research workflows.
- Developed an automated knowledge graph of foundation-model research, built from papers with every fact traced to its source, to give AI agents grounded access to the literature.

Computer Scientist II
- Automated the discovery of high-quality NASA-SMD GitHub repositories, improving code discoverability and reducing manual curation for the Science Discovery Engine, NASA's unified search portal for open science data and code.
- Led the design and development of the initial prototype of a modular agentic AI-based code search system for NASA's Accelerated Knowledge Discovery (AKD), a multi-agent scientific research system.
- Developed a STAC metadata mapping AI agent for NASA's Commercial Satellite Data Acquisition (CSDA) program, supporting satellite metadata standardization for Airbus and Pixxel.
- Developed and automated Apache Airflow pipelines for processing Maxar commercial satellite imagery, integrating AWS S3 and DynamoDB for file ingestion, metadata management, processing state tracking, and workflow orchestration.

The University of Alabama **Aug 2024 – Apr 2025**
Deep Learning Research Assistant
- Collaborated on the NSF-funded DeepLense project, developing deep learning models to analyze strong gravitational lensing data under the guidance of Dr. Sergei Gleyzer.
- Developed a physics-informed foundation model for gravitational lensing using large datasets, enabling multi-task downstream applications.

Google Summer of Code (GSoC) **May 2023 - Aug 2023**
Open Source Developer
- Developed a Python-based novel image super-resolution pipeline for enhancing astrophysical images, utilizing a conditional diffusion model and advanced denoising algorithms implemented in PyTorch.

Samsung Research **Jul 2021 – Feb 2022**
Software Engineer
- Contributed to the migration of the Neural Processing Unit (NPU) compiler codebase, focusing on data transformation operations, as part of the transition between two distinct Exynos chipset generations.
- Debugged compiler issues to ensure integration of neural network intermediate representations (IR) and developed automation scripts in Python, reducing workflow runtime for pre-silicon validation testing.

Google Summer of Code (GSoC) **Mar 2021 – Sep 2021**
Mentor
- Developed equivariant neural network-based domain adaptation models to enable generalization of classifiers from simulated to real-world astrophysics data.
- Mentored student developers on applying deep learning to simulated lensing data to search for dark matter signatures.

Samsung Research **Sep 2020 – Jun 2021**
Student Trainee
- Optimized data transformation operations in the NPU firmware and reduced operations runtime by 41.7%.
- Developed end-to-end tracing pipeline solution that enabled hardware teams to identify performance bottlenecks faster.

European Organization for Nuclear Research (CERN-HSF) **May 2020 – Aug 2020**
Student Developer
- Developed an open-source Python framework to detect dark matter signatures in strong gravitational lensing images.
- Improved PyAutoLens simulation pipelines for accurate representation of dark matter substructure in astrophysical models.

Publications

Journal Articles

- H. Parul, S. Gleyzer, **P. Reddy**, and M.W. Toomey. *"Domain Adaptation in Application to Gravitational Lens Finding."* The Astrophysical Journal, 990:47, Aug. 2025.
- **P. Reddy**, M.W. Toomey, H. Parul, and S. Gleyzer. *"DiffLense: A Conditional Diffusion Model for Super-Resolution of Gravitational Lensing Data."* Machine Learning: Science and Technology, 5(2024):035076, Sep. 2024.
- S. Alexander, S. Gleyzer, **P. Reddy**, M. Tidball, and M.W. Toomey. *"Domain Adaptation for Simulation-Based Dark Matter Searches with Strong Gravitational Lensing."* The Astrophysical Journal, 954:28, Aug. 2023.
- **P. Reddy** and A.B. Bhattacherjee. *"A hybrid quantum regression model for the prediction of molecular atomization energies."* Machine Learning: Science and Technology, 2(2021):025019, Feb. 2021.
- A. Mishra, **P. Reddy** and R. Nigam. *"Baryon density extraction and isotropy analysis of cosmic microwave background using deep learning."* Machine Learning: Science and Technology, 1(2020):045012, Oct. 2020.

Conference and Symposium Proceedings

- A.A. Salunke, M. Anand, **P. Reddy**, M.W. Toomey, and S.V. Gleyzer. *"RP-DLens: Closed-Loop AI Agents for Parsimonious Scientific Machine Learning in Dark Matter Gravitational Lensing."* AAAI Fall Symposium Series, 2026.
- S.R. Mereddy, **P. Reddy**, M.W. Toomey, and S. Gleyzer. *"D4-Equivariant Hybrid Quantum–Classical Learning for Strong Gravitational Lens Classification."* AAAI Fall Symposium Series, 2026.
- **P. Reddy**, S.U. Syed, P. Thamminedi, S. Harish, I. Perera, and B.J. Dorr. *"Exploiting Explainability to Design Adversarial Attacks and Evaluate Attack Resilience in Hate-Speech Detection Models."* Proceedings of the International AAAI Conference on Web and Social Media, 19(1), 1038-1050, Jun. 2025.

Workshop Papers and Posters

- A. Ojha, **P. Reddy**, and S. Gleyzer. *"Trace–Answer Compatibility Emerges at Depth and Mediates Prediction in Diffusion Language Models."* DiffuLM Workshop, NeurIPS, Dec. 2026.
- A. Batra, K. Gaur, **P. Reddy**, M.W. Toomey, and S. Gleyzer. *"Lens-LeJEPA: Learning the Right Invariances for Strong Gravitational Lenses."* RPS Workshop, NeurIPS, Dec. 2026.
- P. Balani, **P. Reddy**, M.W. Toomey, and S. Gleyzer. *"Pooling Discards Resolution-Invariant Structure: An Architecture and Ablation Study on Darcy Flow."* Machine Learning and the Physical Sciences Workshop (ML4PS), 2026.
- S.R. Mereddy, **P. Reddy**, M.W. Toomey, and S. Gleyzer. *"Bilinear C_4-Covariant Spectral Neural Operator for Scientific Field Surrogates and Gravitational Lensing."* Machine Learning and the Physical Sciences Workshop (ML4PS), 2026.
- K. Gaur, **P. Reddy**, M.W. Toomey, and S. Gleyzer. *"Polar Coordinate Prior for Self-Supervised Strong-Lens Representations."* Machine Learning and the Physical Sciences Workshop (ML4PS), 2026.
- K. Gaur, **P. Reddy**, M.W. Toomey, and S. Gleyzer. *"VELA: Stationary Latent Targets for Label-Efficient Strong-Lensing Representations."* Machine Learning and the Physical Sciences Workshop (ML4PS), 2026.
- **P. Reddy**. *"Selective Memory Retention for Long-Horizon LLM Agents."* Continual Adaptation at Scale: Towards Sustainable AI Workshop, ICML, Jul. 2026.
- D. Srivastava, **P. Reddy**, M.W. Toomey, and S. Gleyzer. *"HEAL-PINN: Physics-Informed Swin Transformer for Dark Matter Studies for Sparse Lensing Data."* Machine Learning and the Physical Sciences, NeurIPS, Dec. 2025.
- H. Sayed, **P. Reddy**, M.W. Toomey, and S. Gleyzer. *"FlowLensing: Simulating Gravitational Lensing with Flow Matching."* Machine Learning and the Physical Sciences, NeurIPS, Dec. 2025.
- J. Rishi, **P. Reddy**, M.W. Toomey, and S. Gleyzer. *"Lens-JEPA: Physics Informed Joint Embedding Predictive Architecture for Gravitational Lensing."* Machine Learning and the Physical Sciences, NeurIPS, Dec. 2025.
- A. Duplinskii, **P. Reddy**, M.W. Toomey, and S. Gleyzer. *"From Simulation to Survey: Benchmarking Super-Resolution for LSST-like Lensing Data."* Machine Learning and the Physical Sciences, NeurIPS, Dec. 2025.
- **P. Reddy**, M.W. Toomey, H. Parul, and S. Gleyzer. *"DiffLense: A Conditional Diffusion Model for Super-Resolution of Gravitational Lensing Data."* Machine Learning and the Physical Sciences Workshop, NeurIPS, Dec. 2024.
- H. Parul, M.W. Toomey, **P. Reddy**, and S. Gleyzer. *"Domain Adaptation in Application to Gravitational Lens Finding."* Machine Learning and the Physical Sciences Workshop, NeurIPS, Dec. 2024.
- A. Ojha, S. Gleyzer, M.W. Toomey, and **P. Reddy**. *"LensPINN: Physics Informed Neural Network for Learning Dark Matter Morphology in Lensing."* Machine Learning and the Physical Sciences, NeurIPS, Dec. 2024.
- **P. Reddy**, S. Gleyzer, M.W. Toomey, and M. Tidball. *"Domain Adaptation for Simulation-Based Dark Matter Searches with Strong Gravitational Lensing."* Machine Learning and the Physical Sciences Workshop, NeurIPS, Dec. 2022.
- S. Alexander, S. Gleyzer, H. Parul, **P. Reddy**, M.W. Toomey, E. Usai, and R. Von Klar. *"Decoding Dark Matter Substructure without Supervision."* Machine Learning and the Physical Sciences, NeurIPS, Dec. 2020.

Projects

Framework for LLM-based Real-time Flood Detection | *Advisor: Dr. Zhe Jiang* **Aug 2023 - Dec 2023**

- Leveraged the OpenAI API to extract location data from user queries for real-time satellite image retrieval and integrated a UNet-based flood segmentation PyTorch model to facilitate an accessible and efficient flood monitoring system.

Deep Learning for Alzheimer's Disease Detection | *Advisor: Dr. Corey Toler-Franklin* **Aug 2022 – Dec 2022**

- Developed unsupervised domain adaptation techniques for Alzheimer's detection from MRI data and achieved state-of-the-art accuracy on the challenging OASIS-1 dataset, contributing to robust medical imaging techniques.

Achievements

- Selected for a Spotlight Talk at the AAAI Fall Symposium Series 2026 for work on closed-loop AI agents for scientific machine learning in gravitational lensing.
- Gold Reviewer Award, ICML 2026 (recognized among the top reviewers based on area chair ratings).
- Invited to represent ML4SCI at the GSoC 2024 Mentor Summit, Google Sunnyvale, recognizing my open-source contributions.
- One of 350 Apple WWDC 2020 Swift Student Challenge winners chosen from a pool of applicants from 41 countries.

Academic Service

- **Journal Reviewer:** *Machine Learning: Science and Technology* (2023, 2024); *Classical and Quantum Gravity* (2024); *Physica Scripta* (2024).
- **Conference Reviewer:** ICWSM 2025; ICML 2026 (Gold Reviewer); NeurIPS 2026, AAAI 2027
- **Workshop Reviewer:** ICML'26 SCALE Workshop, NeurIPS 2026 (RPS, Sim2Science), ML4PS 2026
- **Workshop Organizing Committee:** 2nd ESA–NASA Workshop on AI Foundation Models for Earth Observation.
- **Hackathon Organizer and Judge:** IRDTA DeepLearn Hackathon (2024, 2025, 2026).