Amitash Nanda

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EDUCATION

University of California San Diego — **Expecting June 2027**
Ph.D. in Electrical and Computer Engineering (Machine Learning and Data Science) - 3.7/4.0 — *San Diego, California*
Areas of Interest: Distributed ML, Generative-AI, Vision-AI, DNN/LLM Optimization, AI/ML Systems, Bioinformatics

University of California San Diego — **Sept 2021 - June 2023**
Master of Science in Electrical and Computer Engineering - 3.7/4.0 — *San Diego, California*
Coursework: Statistical Learning, Principles of AI, Linear Algebra, Computer Vision, Visual Learning, Data Science
Thesis: Novel Vision-AI Techniques for Morphological Discovery in Systems Biology

College of Engineering and Technology, Bhubaneswar — **Aug 2015 - May 2019**
Bachelor of Technology in Instrumentation and Electronics Engineering - 8.60/10.0 — *Bhubaneswar, India*

SKILLS

Languages/Database: Python, C++/Cuda, MATLAB, HTML/CSS, JavaScript, MySQL, MongoDB, Hadoop, Teradata
Frameworks: PyTorch, TensorFlow, Keras, Theano, NLTK, Fast AI, Spark, ONNX, YOLO, Django, Flask, MPI, Hydra
Libraries/API: Scikit-learn, Pandas, NumPy, Dask, SHAP, OpenCV, D3.js, Bokeh, OpenMP, TensorRT, PyTensor, REST
Tools: Anaconda, Jupyter, LaTeX, Nvidia cuDNN, GitHub, Bitbucket, Jenkins, Slurm, Grafana, Illustrator
Cloud/Technologies: AWS (SageMaker, EC2, Lambda), GCP, Azure, Docker, Kubernetes, Linux, ETL Tools, Hugging Face

EXPERIENCE

Lawrence Berkeley National Laboratory - NERSC — **June 2024 − Sept 2024**
Graduate Student Research Intern — *San Diego, California*

- Expanded the current state of load-balancing algorithms in AMReX by investigating the parallelization of a brute force algorithm, a novel hybrid load-balancing algorithm combining SFC and Knapsack, and an improved SFC bisection strategy using the painter's algorithm.

Teradata - Optimizer Development Team — **June 2023 − Sept 2023**
Software Engineer Intern — *San Diego, California*

- Enhanced performance of Teradata's Object File Storage (OFS) system in Native Object Storage (S3 for AWS).
- Improved query efficiency by leveraging OFS Primary Index for local aggregation and join capabilities.
- Designed and implemented an automated framework to generate queries simulating diverse scenarios of bad, mixed, and good data by inserting 1 billion rows into the OFS table.
- Benchmarked the results using performance metrics like Actual Cost and NOSFile read count to assess OFS PI table usage cost-effectiveness.

Teradata - Technology Innovation Office — **June 2022 − Sept 2022**
Research Intern (Machine Learning) — *San Diego, California*

- Accomplished predicting platform configuration resource usage by modeling Telemetry data from the TCA.
- Implemented multiple linear regression, gradient boosting, neural network techniques, and REST API.
- Integrated API for accessing data from Teradata Telemetry Collection Agent, analyzed the customer data, performed exploratory data analysis, and implemented a predictive model, predicting platform performance resource usage from configuration and did performance analysis.

Boolean Lab, University of California San Diego — **Sept 2021 − Present**
Graduate Student Researcher (Ph.D. Advisor: Dr. Debashis Sahoo) — *San Diego, California*

- Analyzing large biological datasets to identify Boolean relationships between genes in tissue across different species.
- Designing Computational Approaches with AI-driven engines to accelerate the application of AI and Data Science to pathology and drug discovery.

Accenture - Application Engineering R&D — **June 2019 − Aug 2021**
Software Engineer — *Bangalore, India*

- Researched and devised a state-of-the-art novel fault-tolerant chaos engineering-based robot software application.
- Contributed to backend development, implemented Gazebo-ROS functionalities, and deployed on AWS S3.
- Used the 3DEXPERIENCE platform from Dassault Systemes to create products and services using virtual experiences.

PROJECTS

Dynamic Load Balancing Algorithms for AMReX | *NERSC, LBNL* [Link]   **June 2024**
- Developed a novel hybrid load-balancing algorithm combining SFC and Knapsack, and an improved SFC bisection strategy using the painter's algorithm.
- painter's partition-based algorithm outperform the original SFC-based strategies across all tested cases. Additionally, combination algorithms outperform their single-algorithm counterparts and should be evaluated for potential use in production-scale simulations.

CHAI-KTQ: A Novel Framework for Scalable LLMs & Efficient Inference | *Boolean Lab, UCSD* [Link] **June 2024**
- CHAI Quant employs mixed-precision quantization for clustered attention heads, reducing Key-Value (K, V) cache size by up to 55% and improving latency by 40%, all while keeping accuracy deviations below 1%.
- CHAI Target focuses on targeted fine-tuning of sensitive layers identified through attention sensitivity analysis, ensuring robust predictions and reducing uncertainty in critical tasks.
- CHAI KD enables efficient knowledge transfer from large teacher models to lightweight student models, achieving speed gains of 3000 inferences/sec for 125M models with competitive performance on knowledge-intensive tasks like PIQA and RTE.

CPTQuant - Mixed precision post-training quantization technique for LLMs | *Boolean Lab, UCSD* [Link]**Nov 2023**
- CMPQ adapts the precision level based on canonical correlation analysis of different layers. PMPQ optimizes precision layer-wise based on their sensitivity to sparsity. TDMPQ modifies precision using Taylor decomposition to assess each layer's sensitivity to input perturbation.
- CPTQuant demonstrates up to 4x compression and a 2x-fold increase in efficiency with minimal accuracy drop compared to Hugging Face FP16.
- PMPQ demonstrates an 11% higher compression ratio than other methods for classification tasks, while TDMPQ achieves a 30% greater compression ratio for language modeling tasks.

Pruning of clients based on conformal prediction sets in a Federated setup | *Boolean Lab, UCSD* [Link]   **Nov 2023**
- Working on providing a practical approach to creating a framework for incorporating meaningful uncertainty quantification in a distributed and continual environment (both IID and Non-IID).

Communication Efficient Asynchronous Peer-to-Peer Federated LLMs | *Boolean Lab, UCSD* [Link]   **Nov 2023**
- Developed a secure, efficient, and privacy-preserving federated learning approach in a decentralized setting.
- Our results demonstrate a decrease in latency by 5X and a 13% increase in accuracy for serverless case.

Circadian-Rhythm-Driven-Alertness-Investigation | *Boolean Lab, UCSD* [Link]   **May 2023**
- Performed a study on how alertness is affected by different factors in life, including sleep, food, and exercise.
- Utilized modules in data processing (NumPy, Pandas, Scipy), data visualization (Bokeh, Plotly, Matplotlib, Seaborn), and data modeling (Scikit-Learn, XgBoost, LightGBM) and enhanced data interpretability using SHAP.

Tiny ML | *ACM/IEEE Design Contest, ICCAD* [Link]   **Sept 2022**
- Collaborated to design a lightweight, CNN-based deep-learning algorithm that discriminates life-threatening ventricular arrhythmias (reason for sudden cardiac death) from IEGM recordings and deployed on STM32 NUCLEO-L432KC.
- Obtained precision of 0.95, recall of 0.93, F-beta score of 0.94, memory occupation of 30KB, and latency of 6ms.

OrgaTuring: Accelerating Organoid Discovery with Vision-AI | *Boolean Lab, UCSD* [Link]   **May 2023**
- Devised a CNN-based Interpretable deep-learning model that classifies healthy and Crohn's disease organoid images.
- Implemented focal loss to handle class imbalance, and the DNN trained with DenseNet-121 achieved a testing accuracy of 89 %, AUC-ROC of 0.87. Incorporated model interpretability using SHAP and domain adaptation.
- Developing an AI-enabled real-time Camera mechanism to incorporate OrgaTuring for a variety of organoids.

Expression gradient of cancer suppressor gene using Vision-AI | *Boolean Lab, UCSD* [Link]   **Mar 2023**
- Introduced an original work for gland instance segmentation using Mask R-CNN and Yolo-v8 on colon tissue to diagnose colon cancer. Annotated first public U-shaped colon dataset.
- Mask R-CNN outperformed the models like SegNet, UNet, etc. with (F1, IOU) score (0.98, 0.97), (0.63, 0.46), (0.59, 0.42) for backgrounds, glands, and crypts respectively.
- Yolo-v8 model outperformed Mask R-CNN with mAP50 (0.937 and 0.748) for glands and crypt, respectively.
- Differentially expressed genes along crypts verified on 25 slides predicted 5000+ U-shaped glands.

Impact-of-Feature-Correlation-on-Feature-Importance-using-SHAP | *Dey's Lab, UCSD* [Link]   **Oct 2022**
- Conducted a detailed analysis to determine if Shapley interaction values effectively capture feature correlations and enhance feature ranking accuracy.
- This research focused on examining the correlation between blood pressure and various health behaviors like sleep, exercise, diet, and stress management.

Particle-Filter and Visual-Inertial SLAM | *ERL Lab, UCSD* [Link]   **Sept 2021**
- Implemented particle filter and visual-inertial SLAM using 2-D LiDAR scans, odometry, stereo camera measurements, extended Kalman filter, IMU from an autonomous car. Performed 2-D occupancy grid map and landmark mapping.

PUBLICATIONS

- Amitash Nanda, Md Kamal Hossain Chowdhury, Hannah Ross and Kevin Gott, "Exploring Dynamic Load Balancing Algorithms for Block-Structured Mesh-and-Particle Simulations in AMReX". Submitted to ACM PEARC, 2025.

- Amitash Nanda, Sree Bhargavi Balija, Debashis Sahoo, "CHAI-KTQ: A Novel Framework for Scalable LLM and Efficient Inference". Manuscript in preparation, 2025.

- Amitash Nanda, H M Zabir Haque, Debashis Sahoo, "Leveraging High-Performance Computing for Spatial Transcriptomic Identification of CDX2 Genes in Intestinal Crypts Using Deep Neural Network,". Manuscript in preparation, 2025.

- Nanda, A., Balija, B. & Sahoo, D, "CPTQuant - A Novel Mixed Precision Post-Training Quantization Techniques for Large Language Models". Preprint arXiv:2412.03599, arXiv, December 2024.[Link]

- Balija, B., Nanda, A., & Sahoo, D, "Building Communication Efficient Asynchronous Peer-to-Peer Federated LLMs with Blockchain". Published in Proceedings of AAAI Spring Symposium Series, May 2024. [Link]

- A. Nanda, D. Dang, D. Sahoo, "OrgaTuring: A Novel Deep Learning Framework to Classify Healthy vs. Diseased Colon Organoids", Ready for submission.

- Behroozikhah, M., Khandelwal, S., Nanda, A., Dang, D., Samantaray, A., Prabhudesai, A., & Sahoo, D, "Expression gradient of cancer suppressor gene found in colon crypt using Vision-AI", Ready for submission.

- Nanda, Amitash Advisor(s): Sahoo, Debashis;Lin, Bill, "Novel Vision-AI Techniques for Morphological Discovery in System Biology", Master Thesis, Open Access Publication UCSD, May 2023. [Link]

- A. Nanda, et al., "NeuCASL: From Logic Design to System Simulation of Neuromorphic Engines", Poster Presentation, 2021 Formal Methods in Computer-Aided Design, Yale. [Link]

- R. Vedula, A. Nanda, et al., "Computer Vision Assisted Autonomous Intra Row Weeder", ICIT (IEEE), 2018. [Link]

- R. vedula, A. Nanda, et al., "Plant Sustainability Monitoring Using Unmanned Aerial Vehicle", ICDSMLA 2019. [Link]

- A. Nanda, et al., "An Autonomous Robotics System for Collecting Fresh Fruit Crates for the betterment of the Post Harvest Handling Process", ICDSMLA 2019, Springer Lecture Notes. [Link]

- A. Nanda, et al., "An Autonomous Intelligent System to Leverage the Post Harvest Agricultural Process using Localization and Mapping", ICISSC 2021 Proceedings, Springer. [Link]

- A. Nanda, et al., "Real-Time Internal Inspection of Pontoons of Floating Roof Tank using a Mobile Robot", International Journal of Advanced Research in Computer Engineering & Technology (IJARCET), 2019. [Link]

AWARDS and RECOGNITION

International Conference on Learning Representations (ICLR) Oct 2024
- Serving as a Reviewer for the 2025 segment and reviewing three manuscripts.

AI in Health Conference, Rice University Oct 2023
- Presented a poster on colon crypt segmentation research.

Academic Data Science Alliance, UT San Antonio Oct 2023
- Invited for a lightning talk on AI for Disease Discovery research.
- Selected for the scholars-in-Training workshop.

LEADERSHIP/ EXTRACURRICULAR

Academic Data Science Alliance, UT San Antonio | *Poster Judge* Oct 2023
- Served as a judge for 4 posters in the "Learning and Doing Data for Good" event.

Summer Research Program, UCSD | *Mentor* Summer 2023
- Mentored high school students on integrating AI and Data Science into bioinformatics and assisted in designing an image analysis tool.

VIS 176 (16mm Filmmaking), UCSD | *Lead Actor* June 2023
- Served as the lead actor in the course's final project, shot with a 16 mm analog camera. Acquired skills in filmmaking, video editing, and production.

IEEE, UCSD Student Chapter | *Mentor* Fall 2022
- Mentored three groups of undergraduate students for quarterly projects in Software & Hardware co-design and AI/ML.

Google Developers Group - Bhubaneswar Chapter | *Lead volunteer* 2016-2021
- Organized workshops and study jams in Web-Development, Machine Learning, and IoT.