Devaganthan S S

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Research Interests

Federated Learning, Privacy, Optimization

Education

Mohamed Bin Zayed University of Artificial Intelligence (MBZUAI), Abu Dhabi *Aug 2024 - Jun 2026*
Master of Science in Machine Learning ***CGPA: 3.95/4.0***

Indian Institute of Technology (IIT), Madras *Aug 2019 - Jun 2024*
Dual Degree (Bachelor's+Master's) in Electrical Engineering; ***CGPA: 8.03/10***

Politecnico di Milano, Italy *Jan 2022 - May 2022*
Master's in Computer Science and Engineering (Semester Exchange)

Research Experience

Machine Learning Department, MBZUAI Abu Dhabi, UAE

Efficient Hyperparameter Tuning for DP-FL setting

Guide: Dr. Samuel Horvath and Dr. Praneeth Vepakomma *January 2025 – Present*

- Investigating methods to efficiently and smartly utilize the fraction of the overall privacy budget allocated for hyperparameter tuning in a DP-FL setting, aiming for minimal degradation in final model utility
- The current approach is to leverage convergence bounds in DP-FL to inform hyperparameter selection, and adapt the tuning approach proposed in "Hyperparameter Tuning with Rényi Differential Privacy" (Papernot et al.) to the federated setting

DP-FL: Differentially Private Federated Learning

Differentially Private Semi-paired Association Tests

Course Project | Guide: Dr. Praneeth Vepakomma *March 2025 – Present*

- Based on the algorithm proposed in "Unpaired Data Empowers Association Test" (Gong et al.), this project aims to develop a differentially private variant of Semi-paired association tests
- Identified components of the algorithm suitable for privatization and currently exploring the privatized release of kernel matrices using Matrix-Variate-Gaussian (MVG) mechanism as a baseline

Quantitative Reasoning for Text-Image Generation Models (T2I)

Course Project *Oct 2024 – Nov 2024*

- The work aimed at improving the quantitative understanding of T2I models. Thereby improving their ability to accurately generate images that align well with the quantitative descriptions like counts, size, and fractional representations of objects
- Contributed towards creating a Dataset for fine-tuning methodology that combines LoRA adaptation with Direct Preference Optimization (DPO) and curated an automated evaluation pipeline using VQAScore metric
- Our model fine-tuned on Stability's SDXL saw modest improvements on VQAScore over the baseline

Optimizing Energy Storage and Consumption with Reinforcement Learning

Undergraduate Research Internship | Guide: Dr. Martin Takac *June 2023*

- Collaborated and developed an RL-based approach for optimising energy storage and consumption from energy grids
- Used real-world data from Greece to validate the proposed methodology and provided open-source code implementation
- Created an optimal benchmarking solution by outlining a problem framework, formulating equations, and specifying initial conditions and constraints for evaluation. The optimal action values saw a cost savings of 27.39% in contrast to 11% saving by our best-performing RL algorithm

Computational Imaging Lab, IIT Madras Chennai, India

Extreme Low Light Stereo Image Enhancement

Dual Degree Thesis | Guide: Dr. Kaushik Mitra *Aug 2023 - June 2024*

- Collaborated with a team to publish extreme stereo-paired low-light images with ground truth, captured in both outdoor and indoor settings, including analysis and results on depth estimation, enhancement techniques, and benchmarking
- Leveraged SIRFormer, a transformer-based architecture, to enhance low-light images in sRGB space, and used Vanilla UNet for enhancement in both sRGB and RAW space across various exposure levels
- Performed model interpretability analysis on ACVNet model, employing GradCAM and Feature Ablation methods, using Captum Library

Key Coursework

Artificial Intelligence	**Mathematics**	**Miscellaneous**
Federated Learning	Optimization	Internet of Things
Modern Computer Vision	Probability and Statistics	Communication Systems
Deep Learning for Imaging	Multi-variable Calculus	Data Structures and Algorithm
Natural Language Processing	Numerical Linear Algebra	Advanced Computer Architecture
Advanced Speech Signal Processing	Detection Theory	Computational Neuroscience

Skills

- **Programming/Scripting Languages:** Python, MATLAB, C, C++, HTML | **Technologies:** Git, Linux, LaTeX
- **Frameworks/Libraries:** Flower, Opacus, PyTorch, Matplotlib, NumPy, OpenCV, Gekko

Course Projects

Information Retrieval System for Cranfield Dataset IIT Madras
Natural Language Processing *May 2023*

- Developed an Information Retrieval (IR) System using the Cranfield Dataset, employing the Vector Space Model
- Achieved a precision of 39%, recall of 29%, F-score of 30%, MAP of 69% and nDCG of 44%
- Improved the IR System by employing Latent Semantic Analysis (LSA) algorithm handling synonym and polysemy and also implemented a bottom-up approach for stop-word removal, explored and studied different similarity measures

Panoramic Stitching IIT Madras
Modern Computer Vision *Nov 2021 - Dec 2021*

- Developed an algorithm for stitching a panorama from overlapping photos by estimating a transformation by computing features using Speeded Up Robust Features algorithm (SURF) in both images and matching them to obtain correspondences
- A homography is estimated from these correspondences to stitch these in a common coordinate system
- Extended this algorithm to stitch multiple images

Miscellaneous IIT Madras
Computer Vision, Python Programming, Computer Organization| Course Assignments *Jan 2020 - July 2023*

- *Hybrid Images*: Created a hybrid image by blending a low-pass filtered version of a first image and a high-pass filtered version of another image. The resultant hybrid image is perceived differently at different distances
- *Circuit Solver*: Developed a Python Script that accepts a liner circuit as a .netlist file and outputs the Nodal Voltages and Current
- Implemented all instructions of the RV32I in Verilog set to make a *Synthesizable single-cycle CPU*

Professional Involvements and Extra-curriculars

President, The Problem Solving Club - MBZUAI *Sept 2024 - Present*

- Founded a club to foster a problem-solving culture at MBZUAI focusing on Math, Competitive Programming, Puzzles
- Organized a live, leaderboard-based problem-solving competition that attracted over 20 participants
- Handling a team of 5 with an annual budget of 10000 AED (2720 USD)

Academic Workshops

- Participated in the in-person workshop titled, "Reinforcement Learning: Recent Trends and Future Challenges" at IISc Banglore
- Attended Learning Theory Alliance Spring 2024 Mentoring Workshop centering on enhancing research Communication

Teaching Assistantship and Mentorship

- Aided Prof. Kaushik Mitra with conducting the course Modern Computer Vision
- Assisted the instructor in conducting a course to develop students' soft skills and general well-being
- Mentored and provided academic guidance to 2 first-year undergraduate students, as part of AcadBuddy Program, IIT Madras

Associate, Case Club - IIT Madras *Nov 2021 - Aug 2022*

- Was part of the Student Club aimed at fostering a problem-solving culture within the Institute
- Aided fellow students in their preparations for Consultation and Product Management roles

Sports Endeavours

- *Beginner Runner:* Completed three Half Marathons under 2:20 hrs, with a personal best of 1:56 hrs
- *Amateur Chess Enthusiast:* Peak Rapid *Chess.com* rating of 1322, Puzzle Rating of 2353