Manav Doshi

doshimanav@gmail.com | linkedin.com/manav-doshi | mdoshi2612.github.io | github.com/mdoshi2612

Education

University of California San Diego, La Jolla, California, USA *[Sep 2024 - Present]*
Master of Science (M.S.) in Computer Science - Specializing in Artificial Intelligence
- **Key Courses:** Probabilistic Learning and AI, Large Model Reasoning, Statistical Natural Language Processing

Indian Institute of Technology (IIT) Bombay, Mumbai, India *[Nov 2020 - Aug 2024]*
Bachelors of Technology (with Honours) in Mechanical Engineering with a minor in AI Overall CPI: **9.12/10.00**
- **Ranked 9th** out of **250**+ graduating students in the department
- **Key Courses:** Deep Learning for Remote Sensing, Reinforcement Learning, Algorithms, Optimization, Advanced ML

Publications and Patents

- Siddartha Ganguly, **Manav Doshi** et al. *"An illustration of a quasi-interpolation driven technique for feedback synthesis"*; **Accepted** and **Invited for offline presentation** at the IFAC World Congress 2023 held in Yokohama, Japan
- Subrata Mitra, **Manav Ketan Doshi** et al. *"ScaleViz: Scaling Visualization Recommendation Models on Large Data"; Accepted to* PAKDD 2024 *(Pacific-Asia Conference on Knowledge Discovery and Data Mining 2024)*

Professional Experience

Scalability of Approximate Visualizations | *Adobe Research Lab* (May 2023 - Aug 2023)
Transforming data into insightful dashboards, performing inference under a budget for different datasets of 100Mn+ *records*
- Proposed various **novel metrics** to quantify deviations between original and visualizations produced after approximations
- Developed an end-to-end **Vis**ualization **Rec**ommendation **(VisRec)** pipeline to work on industrial **large-scale** datasets
- Profiled how visualization recommendation models are affected by noise addition in **statistical features** while sampling
- Engineered strategies to traverse **large discrete action spaces** with **10k+** actions being different statistics over columns
- Achieved a **90%** reduction in computation, saving over **45** hours by implementing an **RL Agent** to reduce inference time
- Reduced overestimation of Q values in Deep Q-Nets and improved **training stability** by programming a target Q-network
- Amplified training speeds by **30%** by Proximal Policy Optimization | Observed MSE Losses of 10^{-4} after **1000** episodes

Research Experience

Graduate Student Researcher | *4D CELL Lab, UC San Diego* (May 2024 - Present)
Guide : Prof. Johannes Schöneberg, UC San Diego Department of Pharmacology
Our mission is to accelerate the advent of 4D high-content screening in live tissues to influence human health positively.
- Leveraging modern deep learning techniques to extract phenotypic information from 4D Mitochondrial LLSM data
- Implementing image processing pipelines for petabytes of cellular 4D lattice light-sheet microscopy mitochondrial images
- Using self-supervised deep learning-based methods to automate drug discovery and disease readouts from live organoids
- Designing advanced 3D/4D cell segmentation algorithms for cellular structures in high-dimensional microscopy data

Composed Image Retrieval | (Aug 2023 - May 2024)
Guide : Prof. Biplab Banerjee, Center of Studies in Resources Engineering, IIT Bombay
Composed Image Retrieval is the extraction of images from a database by leveraging their intrinsic content attributes
- Introducing novel methods in image retrieval, leveraging zero-shot and few-shot capabilities of **OpenAI's CLIP models**
- Devising **NLP** methods to harmonize visual elements with textual prompts, seamlessly incorporating vision and language
- Engineering methods to strategically navigate around the **resource-intensive** task of manually labeling dataset triplets
- Training **Diffusion Models** by conditioning on embeddings of captions and images produced by **Neural Networks**

Quasi-interpolation for Feedback Synthesis | (Mar 2022 - Jan 2023)
Guide: Prof. Debasish Chatterjee, Systems and Controls Engineering, IIT Bombay
Introduction: *We aim to introduce a quasi-interpolation based approximation technique to furnish one-shot approximate unconstrained LQ feedback maps. Further research involves computation of feedback maps on constrained systems*
- Surveying literature on methods to obtain optimal feedback in LQR systems like **Hamilton-Jacobi-Bellman** formulation
- Implementing **deep ReLU neural networks** to obtain nonlinear approximations and generate control signal maps
- Implemented Quasi-interpolation schemes to obtain multidimensional feedback maps with **uniform error bounds**
- Analyzed inverted pendulum system by applying synthesised feedback and achieved errors less than order of 10^{-4} **rad**

International Aerial Robotics Challenge Mission 9 | (Oct 2021 - Sep 2022)
Unmesh Mashruwala Innovation Cell, IIT Bombay
Received a special mention at IARC, highlighting innovation and research aptitude in solving the problem statement
- Led an interdisciplinary team of **40**+ mutltifaceted students as a **Senior Machine Learning and Computer Vision** Engineer in the AeRoVe division of UMIC with the long-term objective of developing cutting-edge fully autonomous drones
- Achieved mAP of over **95% @IoU 0.5** by training deep neural networks like **YOLOv4** for mast detection and tracking
- Developed algorithms to augment positional and localisation accuracy using estimation techniques like **Kalman Filters**
- Decreased inference time of model by **5x** | Built **TensorRT engines** and deployed them on **Nvidia Jetson Xavier NX**
- Evaluated literature on object detection and tracking, particularly the **R-CNN**, Fast **R-CNNs**, **YOLOv3**, **YOLOv4**, **SORT** and **DeepSORT** to enhance localisation accuracy and ensure smooth flight of the drone while tracking objects

Pleural Effusion from Thoracic CT Scans | (Jan 2024 - Present)

Guide: Dr. Kshitij Jadhav, Koita Center for Digital Health, IIT Bombay

- Finetuned SAM integrating Low Rank Adaptation techniques to enhance the robustness of Pleural Effusion segmentation
- Obtained **dice scores of 0.95** on thoracic cavity segmentations using SAMed specialised for Medical Image Segmentation
- Spearheaded the reworking of the algorithm for Pleural Effusion detection tailored specifically for the PleTHora Dataset.

Key Projects

DRDO's UAV-Guided UGV Navigation Challenge | (Mar 2022)

Secured third place in DRDO's navigation challenge among 12 other IITs as a part of the 10th InterIIT Tech Meet

- Designed robust algorithms to assist in UGV navigation through snow covered terrains using **drone camera feedback**
- Developed python scripts using **Ardupilot firmware** to perform **road segmentation** using RGB and depth feed
- Implemented a **Stanley controller** from scratch to have the vehicle navigate across various tight turns and altitudes
- Used **OpenCV** and deep learning techniques like **YOLOv4-tiny** to calculate vehicle position and velocity vector

Foundations of Intelligent Learning Agents | (Aug 2022 - Nov 2022)

Guide : Prof. Shivaram Kalyanakrishnan, Department of Computer Science and Engineering, IIT Bombay

- Implemented ϵ-**greedy, UCB, KL-UCB** and **Thompson Sampling** algorithms to stochastic Multi-armed bandits
- Used **Value iteration**, **Linear Programming**, and **Policy iteration** to compute an optimal policy for an cricket MDP
- Guided a car through a obstacle filled parking lot using **SARSA** with Linear Approximation through **Tile Coding**

Visual Explanation for CNNs | (Jan 2022)

Winter in Data Science, Analytics Club, IIT Bombay

- Surveyed various papers on techniques to visualize and plot hidden layers in different **Convolutional Neural Networks**
- Implemented visualization methods like Class Activation Maps, Grad-CAM, Occlusion Sensitivity and Saliency Maps

Customer Segmentation (Nov 2021)

Guide : Prof. Amit Sethi, Department of Electrical Engineering, IIT Bombay

- Performed customer segmentation on a dataset with over **10,000** records using **unsupervised learning algorithms**
- Implemented various clustering techniques like **KMeans, Mean Shift, and Hierarchial Clustering** using sklearn
- Achieved a **silhouette score of 0.587** by optimising using dimensionality reduction techniques like **PCA and t-SNE**

Scholastic Achievements

- Won 2nd place in ACCESS (ACcelerating Climate, Energy & Sustainability Solutions) — Received award of **0.2mn** (2023)
- Secured **All India Rank 896** in the **JEE Advanced Examination** out of over **0.15 million** candidates nationwide (2020)
- Achieved **99.84** percentile in **Joint Entrance Examination Main** among over **1.5 million** applicants in the nation (2020)

Positions of Responsibility

Institute Student Mentor and Department Academic Mentor (Jul 2023 - Present)

Student Mentorship Program, IIT Bombay

- Selected among **380+** ISMP applicants and **110+** DAMP applicants based on interviews and extensive peer reviews
- **Web Subgroup Head** - Leading a team of **6** mentors overseeing maintenance of blogs containing **230+** course reviews
- Assisting scholastically struggling students in the **Academic Rehabilition Program**(ARP) with their curricular endeavours
- Responsible for mentoring **14** freshmen by providing counselling pertaining to academic and extra curricular decisions

Teaching Assistant | CS101 - Computer Programming and Utilization (Jan 2024 - Present)

Prof. Shivaram Kalyanakrishnan, Department of Computer Science and Engineering, IIT Bombay

- Facilitated regular **tutorial** sessions for a cohort of **1600+** freshmen, providing guidance through direct interaction
- Collaborated with instructors to manage **course logistics**, contributing by proctoring exams and assessing answer scripts

Relevant Courses and Skills

Computer Science	Computer Programming and Utilization, Programming for Data Science, Data Structures and Algorithms, Foundations of Intelligent Agents, Statistical Machine Learning and Data Mining, Advanced Methods in Satellite Image Processing, Advanced Topics in Deep Learning for Image Analysis, Advanced Topics in Machine Learning
Miscellaneous	Calculus I & II, Linear Algebra, Linear Systems Theory, Ordinary Differential Equations, Introduction to Numerical Analysis, Deep Learning & Neural Networks*, Hyperparameter Tuning*, Convolutional Neural Networks*, Sequence Models*, Structuring ML projects*
Programming	C/C++, Python, OpenCV, MATLAB, Tensorflow, PyTorch, Scikit-learn, OpenAI Gym

*Deep Learning Specialization (set of 5 courses from Coursera)

Extracurricular Activities

Mentorship	• Guided a team of **4** freshmen students in CodeWars, India's inaugural robot programming contest. • Directed a team of **10** students in Summer of Code program, facilitating efforts in coding GANs • Mentored **4** students during a training program, aiding them in mastering ROS and OpenCV