Vihaan Akshaay Rajendiran

Portfolio | LinkedIn | GitHub

EDUCATION

- University of California, Santa Barbara M.S. in Computer Science; GPA: 4.0
- Indian Institute of Technology, Madras
- M. Tech in Robotics & B. Tech in Mechanical Engineering; GPA: 8.62/10

Research Projects & Experiences

- LandsatQuake: A Large-Scale Dataset for Practical Landslide Detection Jun 2023 Ongoing ICLR 2025, Machine Learning for Remote Sensing Workshop Mentors: Prof. Lei Li & Prof. Gen Li
 - **Created an open-source dataset leveraging 40 years of historical Landsat imagery** to fully characterize large landslides over extensive mountain ranges. Integrated Digital Elevation Model (DEM) data to enhance detection accuracy by combining slope information with satellite imagery.
 - **Evaluated existing computer vision models and proposed new methodologies** Demonstrated the challenges of applying traditional computer vision algorithms to moderate-resolution Landsat data by evaluating several baselines. The study revealed the necessity for developing new methodologies that address real-world challenges in landslide detection.
- Bi-Directional Goal-Conditioning for State Space Search Problems Dec 2022 Sept 2023 • NeurIPS 2023, Goal-Conditioned Reinforcement Learning Workshop [Paper]Mentors: Prof. Lei Li & Prof. Yu-Xiang Wang
 - Developed the **'SRE-DQN'** (Scrambler-Resolver-Explorer) framework, leveraging bi-directional task generation through **'Foresight Relabelling'** and **goal-conditioned DQN**. This approach smartly synthesizes samples from forward, backward and intermediate tasks to learn from, enhancing the agent's performance on the main task.
 - Demonstrated the effectiveness of **multi-directional goal-conditioning** with **knowledge of goal states** empirically on classical state space search tasks.
- Unsupervised Behaviour Recognition in Mice using Deep RL Indian Institute of Technology Madras, Masters Thesis [Report] Mentors: Prof. B Ravindran & Dr. Vivek Kumar
 - Developed unsupervised techniques for identifying mouse behaviors, using **Hierarchical Reinforcement Learning** and **Option Discovery** analysing video data from The Jackson Laboratory to uncover complex behavioral patterns.
 - Implemented **sim2real** techniques in a project to map 2D video data to 3D joint locations in a Blender mouse model, and experimented with **Generative Adversarial Networks (GANs)** to address discrepancies between synthetic and real images, showcasing challenges in applying theoretical models to practical scenarios.

Mixed Kernelized ensemble Deep Random Vector Functional-Link Network Graduate Student Researcher, Nanyang Technological University, Singapore Mentor: Prof. P. N. Suganthan

- Created a mathematical framework for a **Mixed Kernelized Ensemble Deep Random Vector Functional-Link Network**, which innovatively combines kerneled and original neural network models using randomization-based techniques unique to RVFL (Random Vector Functional-Link) networks.
- Conducted thorough performance testing of this advanced network framework on **UCI datasets for classification tasks**, showcasing its potential in enhancing machine learning applications through a closed-form solution approach.

DQN Stability Analysis

- Undergraduate Summer Research Internship, Georgia Tech, Atlanta [Report] [Code] Mentor: Prof. Siva Theja Maguluri
 - Replicated Deepmind's **Deep Q-Network** algorithm to analyze key stability factors like Q-Targets, Experience Replay, and Gradient Truncation, by testing on OpenAI environments that simulate classic control theory problems.

ARTEMIS - Railroad Crack Detection Robot

- Centre For Innovation, Robotics Club Head
 - Designed and enhanced a patented **Railroad Crack Detection Robot**, winner of the **International James Dyson Prize**, by engineering autonomous traversal and fault reporting systems. Overcame significant technical challenges to ensure reliable operation on active railway tracks, substantially aiding in the prevention of train derailments.

Santa Barbara, CA

Madras, India

May 2021 – Aug 2021

Jan 2018 – June 2021

Mentors: Dr. Boby George & Dr. Asokan Thondiyath

Edge-Attention U-Net for Shoreline Detection

- CMPSC 281B Advanced Topics in Computer Vision Course Project [Report] [Code]
 - Developed a U-Net with Edge-based Attention mechanism for Binary Semantic Segmentation, enhancing shoreline detection accuracy on the Satellite-2 Water Edge Dataset compared to standard U-Net and Attention U-Net models.
- Interactive Traffic Classification using Semi-Supervised Graphical Approaches Jan 2023 – March 2023

CMPSC 292F - ML on Graphs Course Project

• By leveraging graphical machine learning models (such as **GCN** and **DGCNN**), using **psuedo-labeling** and exploiting the dependencies between bursts, we achieved near State-of-the-Art performance in interactive network traffic classification with smaller models (0.2% the size of a BERT-based model).

Coursework

- Computer Science: Scalable Internet Services, Machine Learning (Graduate), Advanced Topics on Computer Vision, ML on Graphs, Matrix Computational Analysis, Reinforcement Learning, Multi-Arm Bandits, Stochastic Optimization.
- Robotics: Multi Body Dynamics & Applications, Mechanics and Control of Serial Robots, Field & Service Robotics
- Controls: Linear Dynamical Systems, Network Control, Process Optimization, Measurements Instrumentation & Control.

Leadership & Volunteering

Centre For Innovation (CFI) - Ibot (Robotics) Club
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- Indian Institute of Technology Madras
 - Club Head: Led a team of 30 students, responsible for motivating and guiding students interested in Robotics Mentored and nurtured projects with an allocated fund of **80.000 dollars** from the institute.
 - Club Coordinator: Conducted various robotics-oriented sessions with over 200 participants to improve the robotics culture in the institute • Mentored freshmen, providing guidance and inspiration for building innovative robots.
- DIC Terrace Farming Robot Challenge, IIT Roorkee.
- Indian Institute of Technology Madras
 - Robotics Lead: Lead a team of top 10 roboticists from IIT Madras and built an Autonomous agricultural robot that can climb up and down steps in hills and perform terrace farming activities • Silver Prize

AIoT Lab, Roboticist

- Ramakrishna Mission
 - **Robotics Engineer Intern**: Collaborated on 'Biley Bot', an interactive humanoid representation of young Swami Vivekananda for the Vivekananda House Museum • Explored humanoid design principles to achieve the desired robot form factor and employed **3D** Printing techniques for its exterior construction • Incorporated core hardware components, including Qualcomm RB3 and NVIDIA Jetson chips with sensors like Intel RealSense into the robot's architecture. April 2020 – July 2020

Madras Chimps - RoboCup

- Indian Institute of Technology Madras
 - Founding Team: Started and lead the institute's official team competing in the Robocup 3D simulation league Worked on Nao Robot dynamics, utilizing a **ZMP-IP based model** for bipedal walking and stability control strategies.

TEACHING

- CS6700: Reinforcement Learning [IIT Madras, Spring 2022] Lead TA with Prof. B Ravindran
- CMPSC 160A: Artificial Intelligence [UCSB, Spring 2023] with Prof. Yu-Xiang Wang
- CMPSC 130A: Data Structures & Algorithms [UCSB, Fall 2023] with Prof. Eric Vigoda

HONORS AND AWARDS

- Best Presentation Award: Graduate Machine Learning Course University of California Santa Barbara
- Best Presenter: Mechatronics, Autonomous and Robotics System Design Student Academic Conference, IIT Bombay
- Winners: 54-Hour Tech Hackathon Techstars Startup Weekend (Chennai Edition)
- Runners-up: Coding Hackathon (Public Sector Domain) Yet Another Hackathon 2k19 (Among 35 Finalist Teams)
- Winner: CliqTrix (Emotional Well-Being Chatbot) Zoho App Building Contest 2022 (Among 14 Finalist Teams)
- 3rd Prize: Tech and Innovation Fair, Shaastra Indian Institute of Technology Madras

Skills

Deep Learning & LLM: Data & Geospatial: Systems & Vision:

PyTorch, TensorFlow, LangGraph, LangChain, HuggingFace Transformers, FAISS, Pinecone Pandas, NumPy, SciPy, GDAL, Rasterio, GeoPandas, SQLite, PostGIS, Jupyter C++17, ROS 1/2, Gazebo, RViz, OpenCV, PCL, Docker, Git, Bash

March 2018 - May 2020

December 2019

Since May 2019