MAITREY GRAMOPADHYE

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RESEARCH INTERESTS

Robotic Perception, Common Sense in Robotics, Computer Vision, Deep Learning

EDUCATION

University of North Carolina, Chapel Hill *(Aug 2021 - present)*
Master of Science in Computer Science

Indian Institute of Technology, Bombay, India *(July 2016 - July 2020)*
Bachelor of Technology in Computer Science, with Honors

PUBLICATIONS

- **Generating Executable Action Plans with Environmentally-Aware Language Models**. **Maitrey Gramopadhye**, Daniel Szafir. *arXiv preprint 2022*
- **CuRL: Coupled Representation Learning of Cards and Merchants to Detect Transaction Frauds**. **Maitrey Gramopadhye***, Shreyansh Singh*, Kushagra Agarwal, Nitish Srivasatava, Alok Singh, Siddhartha Asthana and Ankur Arora. *Artificial Neural Networks and Machine Learning – ICANN 2021*

RESEARCH EXPERIENCE

Generating Executable Action Plans with Environmentally-Aware Language Models
Prof. Daniel Szafir, UNC Chapel Hill | arXiv preprint, 2022 *(June 2022 - Sept 2022)*
- In this paper, we propose an approach to utilise **large language models** and convert high level tasks to environmentally-aware action plans that can be directly executed by intelligent agents
- Our approach involves using the agent's environment to provide **situational awareness**
- We autonomously test and evaluate our system on the VirtualHome interface

CuRL
AI Garage, Mastercard | ICANN, 2021 *(Oct 2020 - Apr 2021)*
- **CuRL: Coupled Representation Learning of cards and merchants to detect transaction frauds** proposes method to generate contextual embeddings for payment entities (card and merchant)
- Key idea involved capturing the **cross-interactions** in a bipartite graph of payment entities
- Proposed approach ran faster and outperformed many SOTA representation learning algorithms
- Ensured efficient embedding generation process by keeping the model lightweight

3D RECONSTRUCTION IN CRYO-ELECTRON MICROSCOPY
Prof. Ajit Rajwade, IIT Bombay | Undergraduate Thesis *(July 2019 - July 2020)*
- Built a pipeline for reconstructing 3D structures of viruses from 2D tomographic projections
- Extended prior work for estimating projection angles by also estimating and **correcting for translation errors** in electron micrographs, thus adding (2+3) degrees of freedom to be estimated
- Devised **2-step** hierarchical approach by first estimating coarse translation error, and then fine tuning
- Conducted promising experiments on simulated as well as real electron micrograph images

MULTI-RESOLUTION WEAKLY SUPERVISED LEARNING
Prof. Amit Sethi, IIT Bombay | Research and Development Project *(Jan 2020 - July 2020)*
- Worked on tumor metastasis detection in histopathology slide images of breast tissue
- Models trained on slides at varying resolutions are used sequentially for improved accuracy
- Presented preliminary results using **Attention Multiple Instance Learning**

INDUSTRY EXPERIENCE

ASSOCIATE ANALYST
AI Garage, Mastercard India   *(Aug 2020 - Aug 2021)*

- Research paper **CuRL: Coupled Representation Learning of cards and merchants to detect transaction frauds** got accepted in **ICANN 2021**
- Built models to predict whether transactions would **clear** as well as the details of clearing, i.e. **time taken to clear**, **is clearing amount same as the authorised amount** etc. with **99.5%** precision
- Developed a **TextVQA** inspired solution for the **Product Pricing Challenge, RetailVision, CVPR 2021** for detecting and matching price tags to products, in images of supermarket shelves
- Built expected spend forecasting model for credit cards by analysing their transaction patterns

MONOCULAR 3D OBJECT DETECTION
Samsung Research Institute, Bangalore | Research Internship   *(May 2019 - July 2019)*

- Worked in the **Advanced Technology Lab** at Samsung Research Institute, Bangalore
- Built real-time monocular **3D object detection** model in Pytorch for mobile phones
- Implemented methods to estimate 3D bounding box around objects in 2D images
- Received a job offer for outstanding performance during the internship

REAL-TIME KINEMATIC POSITIONING
CarSense - formerly Carnot | Summer Internship   *(May 2018 - July 2018)*

- Developed a selection type **Network based Real-Time Kinematic (RTK)** Positioning System
- Used Skytraq **NS-HP Module** to communicate with satellites and get location accurate upto **3 cm**
- Setup RTK basestations to broadcast **correction data** to rovers, reliable upto **10 kms**
- Identified applications like region wide accurate positioning, precision agriculture, autonomous robotics

SELECTED COURSE PROJECTS

DEEP REINFORCEMENT LEARNING ON BREAKOUT   *(Aug 2019 - Dec 2019)*
Prof. Shivaram Kalyanakrishnan, IIT Bombay | Foundations of Intelligent and Learning Agents

- Trained an agent to play the arcade game: Breakout using Double-DQN and Actor-Critic algorithms
- Applied Reward Shaping to include features like distance to ball and episode time in the cost function
- Utilized domain knowledge of the game to extract meaningful features like ball position and velocity and paddle position from the game's GUI and reduce size of the state space to speed-up training

CONDITIONED TEXT TO SPEECH   *(Aug 2019 - Dec 2019)*
Prof. Preethi Jyothi, IIT Bombay | Automatic Speech Recognition

- Trained a model to generate speech given an input text that is conditioned on speaker and emotion
- Utilized wavenet architecture to generate raw unconditioned waveforms of speech for text
- Used LSTM based speaker encoder to generate speaker embedding, to condition the wavenet output
- Trained Auto-Encoder and GAN to take wavenet output and emotion and output conditioned speech

SPARSE MONO-SLAM 3D RECONSTRUCTION   *(Jan 2019 - May 2019)*
Prof. Arjun Jain, IIT Bombay | Computer Vision

- **Constructed** 3D surroundings and **tracked** the motion of a camera from a monocular video stream
- Implemented the project using Conventional Computer Vision **Structure from Motion** algorithm
- Displayed the constructed 3D surrounding and motion of camera frame in **real-time**
- Used **sparse feature based SLAM** to track feature points in the video stream

VECTOR-VALUED IMAGE REGULARIZATION WITH PDEs   *(Aug 2018 - Dec 2018)*
Prof. Ajit Rajwade & Prof. Suyash Awate, IIT Bombay | Digital Image Processing

- Implemented applications like color image restoration, inpainting, magnification and flow visualization
- Demonstrated that filtering using Oriented-Laplacian represents the smoothing geometry of PDEs
- Developed a closed form solution for propagating image gradients and updating the image

Student Technical Projects

IIT-B MARS ROVER TEAM
Student Technical Team, IIT Bombay *(May 2017 - July 2020)*
- The IIT Bombay Mars Rover Team builds rovers capable of traversing and conducting operations and experiments in Mars like terrain, for competing in the University Rover Challenge, Mars Society
- Intensively worked in the field of **Computer Vision** for autonomous tasks performed by the rover
- Worked on **Autonomous Object detection** task by implementing a hybrid method, using conventional CV approach followed by deep learning, to get real-time detection from a video stream
- Worked on **Autonomous Obstacle Avoidance** task of the rover, using data from **GPS** and **LiDAR**

SORT BOT
Electronics and Robotics Club, IIT Bombay *(May 2017 - June 2017)*
- Built a robotic car to find and sort balls by their colour for Institute Technical Summer Project
- Used **Raspberry Pi 3** for processing and **RPi3-NOIR-V2** module for taking pictures of objects
- Developed a Depth Mapping Algorithm by collecting sample images and observing a relation between pixel coordinate and depth to devise distance of the ball as a function of its y co-ordinate in images
- Presented the project in **Tech and RnD Expo 2017**, at IIT Bombay, to visiting researchers

Teaching and Mentoring Experience

GRADUATE TEACHING ASSISTANT
Department of Computer Science, UNC Chapel Hill *(Aug 2021 - May 2022)*
- TA for COMP 523 - Software Engineering Lab in Spring 2022, taught by Prof. David Stotts
- TA for COMP 475 - 2D Computer Graphics in Fall 2021, taught by Prof. Mike Reed
- Duties included regular meetings with students for tracking their progress, clarifying doubts with the course content, helping debug code in C++, python etc.

SOFTWARE SUBSYSTEM HEAD
Mars Rover Team, IIT Bombay *(May 2019 - July 2020)*
- **Head** of **Software Subsystem** of the IIT-Bombay Mars Rover Technical Team
- Responsible for supervising the team's progress on the software required for **URC 2020**
- The team participated in University Rover Challenge (URC) 2018 and stood 31st out of 95 teams

INSTITUTE STUDENT MENTOR
Institute Student Mentorship Program, IIT Bombay *(May 2019 - July 2020)*
- Responsible for guiding a group of 12 undergraduate freshmen for the academic year
- Providing counsel and mentoring them about any academic or personal problem

DEPARTMENT ACADEMIC MENTOR
Department Academic Mentorship Program, CSE Department, IIT Bombay *(Apr 2019 - July 2020)*
- Mentor to 5 sophomore students for helping them cope with the curriculum
- Responsible for guiding them with their academic and general concerns
- Mentor to additional 2 students in academic rehabilitation program, helping them get back on track

Scholastic Achievements
- Secured an All India Rank of **433** in JEE-Advanced out of 150,000 candidates *(2016)*
- Recipient of the KVPY Fellowship with an All India Rank of **596** *(2015-2016)*
- Achieved **99.34** percentile in JEE-Main out of 1.2 million candidates *(2016)*

Key Courses Undertaken

Computer Science - Computer Vision, Advanced Image Processing, Foundations of Intelligent and Learning Agents, Automatic Speech Recognition, Digital Image Processing, Computer Networks, Operating Systems, Computer Architecture, Data Structures and Algorithms, Data Analysis
Miscellaneous - Linear Algebra, Differential Equations, Calculus, Quantum Physics, Economics