

Abhinav Gupta

Master's in Computer Science at Georgia Tech

Email | Website | GitHub | Scholars

EDUCATION

Georgia Institute of Technology

Master of Science in Computer Science (MS CS)

- Specialization in Machine Learning

Starting Aug 2021

Atlanta, Georgia

International Institute of Information Technology, Hyderabad

Bachelor of Technology (Honors) in Computer Science and Engineering (CSE)

- Honors in Computer Vision and Robot Perception
- Dean's List Awardee (Spring 2020, Monsoon 2020)
- Undergraduate Research Award, 2020

Aug 2017 - May 2021

Hyderabad, India

PUBLICATIONS

- *RTVS: A Lightweight Differentiable MPC Framework for Real-Time Visual Servoing* [Project Page]
MN Qureshi*, P Katara*, **A Gupta***, H Pandya, Y V S Harish, A Sanchawala, G Kumar, B Bhowmick and KM Krishna. IEEE International Conference on Intelligent Robots and Systems (IROS), 2021, Prague
- *DeepMPCVS: Deep Model Predictive Control for Visual Servoing* [Project Page]
P Katara, Y V S Harish, H Pandya, **A Gupta***, A Sanchawala*, G Kumar, B Bhowmick and KM Krishna.
4th Annual Conference on Robot Learning (CoRL), 2020, Massachusetts Institute of Technology, USA
**indicates equal contribution*

RESEARCH EXPERIENCE

Robotics Research Center (RRC)

Research in Robotics and Vision, IIIT Hyderabad

May 2019 – July 2021

Hyderabad, India

- Worked with **Prof. Madhava Krishna** at the intersection of computer vision, deep learning and robotics, primarily in advancing vision-based robot control and visual navigation techniques
- Formulated a novel model predictive control framework for visual servoing in six degrees of freedom, conducted extensive experimentation of our approach in Habitat simulation and trained an unsupervised network for flow estimation. **Our work was accepted and published at CoRL '20.**
- Proposed a novel and lightweight visual servoing technique for fast navigation which is 10 times faster than existing state-of-the-art approaches. Utilised an effective sampling strategy for optimal control generation, resulting in a 74% decrease in the servoing time. **Our work was accepted at IROS '21.**

Siemens Corporate Research

Summer Intern, Advanced Data Management Research Group

May 2020 – July 2020

Bangalore, India

- Worked extensively in human pose estimation and action recognition in the *Digitalisation and Automation* research division at Siemens. Carried out an exhaustive qualitative and quantitative analysis of various state-of-the-art pose estimation networks for real-time applications.
- Reproduced results from the *Quo-Vadis: Action Recognition* paper on custom datasets, and benchmarked such deep learning based approaches against pose-based approaches to action recognition.

Centre for Visual Information Technology

Computer Vision Researcher, IIIT Hyderabad

January 2020 – Present

Hyderabad, India

- Worked with **Prof. P J Narayanan** on the applications of vision and AI for society, inspired by efforts to battle the coronavirus. Implemented a real-time object detection system which can detect unhygienic face touches. Efficiently trained YOLOv3 using transfer learning, achieving a confidence score of 75%, [Link]
- Worked with **Prof. Avinash Sharma** on neuromorphic vision algorithms and 3D human motion detection. Implemented an event trajectory generation system in ROS which sharpens and detects features from event-based data and simulates event streams from high fps conventional data. [Link]

PATENTS

- *Systems and Methods For Generating Control Commands For Navigation By An Agent In An Environment*
P Katara, Y V S Harish, H Pandya, **A Gupta**, A Sanchawala, G Kumar, B Bhowmick and KM Krishna.
Filed by Tata Consultancy Services Limited

TECHNICAL SKILLS

Languages: Python, C/C++, JavaScript, MATLAB, SQL, HTML/CSS, Elm/Racket, Golang, Bluespec

Machine Learning: TensorFlow, PyTorch, ROS, OpenCV, Caffe, keras, pandas

Frameworks and Tools: ReactJS, Node.js, Flask, Git, Docker, Linux, Bash, OpenGL, L^AT_EX

ACADEMIC PROJECTS

3DMV: 3D Semantic Segmentation | *Computer Vision*

- Implemented the popular ECCV Paper *3DMV: 3D Semantic Segmentation*, by combining 2D feature maps with 3D voxel data from the ScanNet dataset. Coded up the 2D and 3D deep networks to learn the semantics of the scene and obtained optimal results across the benchmark.

EKF-SLAM | *Mobile Robotics*

- Estimated the 2D pose and trajectory of a robot using sensor measurements from a wheel odometer and laser rangefinder, by applying an Extended Kalman Filter.

Stereo Reconstruction | *Robotic Vision*

- Generated a dense 3D point cloud reconstruction of a scene from stereo images by generating disparity maps for each stereo pair and implemented an iterative PnP algorithm to recover the pose.

Visual Odometry | *Robotic Vision*

- Implemented a monocular visual odometry algorithm from scratch, to recover the trajectory of the drone using a sequence of images and implemented the 8-point algorithm within a RANSAC scheme.

Face Classification | *Machine Learning*

- Trained various learning models on a dataset of real and animated face images by applying different feature transformations and quantitatively analysed the classification results.

Blue Skies: Interactive gaming | *Computer Graphics*

- Built a 2D arcade game and a 3D flight simulator game in OpenGL 3.0 using graphics concepts such as texture mappings, rasterisation and lighting, with support for multiple camera views for a great gameplay.

Metamorphose Compiler | *Compilers*

- Implemented a compiler and interpreter for a toy programming language, which supports basic mathematical operations and functions, performs lexical and semantic analysis and generates machine-understandable code.

Noughts and Crosses: AI Bot | *Artificial Intelligence*

- Built a bot for 3*3 Tic-Tac-Toe board, further divided into more 3*3 blocks using Minimax algorithm with alpha-beta pruning, using an optimal heuristic function.

Linux Shell | *Operating Systems*

- Implemented a Linux Bash shell, a command line interpreter in C. Supports numerous bash commands along with piping, redirection, foreground and background processing.

OTHER EXPERIENCE

IIIT Hyderabad

August 2019 – Present

Teaching Assistant

Hyderabad, India

- EC2.101: *Digital Logic and Processors* (Monsoon 2019) - Conducting weekly tutorials and teaching principles of digital design and processor architecture to 300 students.
- CS6.301: *Design and Analysis of Software Systems* (Spring 2020) - Setting various assignments, leading the course project and teaching software engineering principles and coding techniques in Python and JavaScript.
- EC4.403: *Robotics: Planning and Navigation* (Spring 2021) - Responsible for setting assignments and grading papers on various robot navigation and planning algorithms.

The Virtual Labs

August 2018 - December 2018

Software Engineering and Research Intern

Hyderabad, India

- Developed full-fledged experiments and interactive artefacts for various data structures and algorithms at The Virtual Labs, a social initiative of the Government of India.
- Worked with Prof. Venkatesh Choppella and developed multiple virtual experiments at the engineering and architecture division of the virtual labs.

RELEVANT COURSEWORK

Artificial Intelligence: Computer Vision, Statistical Methods in AI, Mobile Robotics, Optimization Methods

Systems: Advanced Computer Networks, Operating Systems, Compilers, Database Systems

Algorithms: Data Structures, C Programming, Principles of Programming Languages

Mathematics: Probability and Statistics, Linear Algebra, Discrete Structures

MISCELLANEOUS

- Served as President and Head of *The Music Club* at IIIT Hyderabad. Spearheaded numerous concerts and events and handled the finances and logistics of the club. A professionally trained drummer and guitarist.
- Served as a writer and penned many articles for Ping!, an independent magazine of IIIT Hyderabad.
- Achieved perfect scores (800/800) on the SAT Subject Tests (Math II, Physics and Chemistry)
- Awarded the prestigious Khimji Ramdas Gold Medal for securing first position in high school junior year (2016)
- A proficient speaker and debater. Qualified as a Finalist at the Muscat Daily Listen Up! Inter-School Public Speaking Contest, 2014 and a two-time Declamation School Champion (2013, 2014)
- A long distance runner, awarded the bronze medal at the annual 10 km run at IIIT Hyderabad (2018)
- An avid freestyle swimmer. Represented my high school at the CBSE Oman Swimming Clusters, 2015
- A skilled photographer, secured the third position at the Bhavalaya Oman National Photography Contest, 2015

REFERRALS

Prof. K. Madhava Krishna: Professor and Lab Head, Robotics Research Center, IIIT Hyderabad

Prof. P J Narayanan: Professor and Director, IIIT Hyderabad

Dr. Harit Pandya: Research Scientist, Toshiba Research Europe, Cambridge, UK

Prof. Avinash Sharma: Assistant Professor, Centre for Visual Information Technology, IIIT Hyderabad