# Harshitha Belagavi Rajaprakash

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## Education

**Master of Science in Computer Science (GPA : 3.92/4)**

University of Southern California, Los Angeles [ Aug 2023 - May 2025 (expected) ]

Courses: Analysis of Algorithms ; Applied Natural Language Processing ; Robotics ; Machine Learning ; Deep Learning for Robot Manipulation ; Robotic Perception

**Bachelor of Engineering (Computer Science and Engineering) - 90.01% (GPA : 4.0/4) (1st Rank, Gold Medallist)**

University Visvesvaraya College of Engineering, Bangalore University, Bengaluru [ Aug 2017 - July 2021 ]

Relevant courses: Data Structures, Design and Analysis of Algorithms, Database Management, Machine Learning

## Skills

Languages: Python (Libraries : PyTorch, pandas, numpy, scipy, scikit-learn, OpenCV), Java, javascript, Node.js, React.js

Software: Unity, Mujoco, IsaacGym, ROS, SQL

## Areas of Interest

Robotics, Robot Perception, Robot Learning, Computer Vision, Assistive Robotics, Human Computer Interaction, XR Technologies, Machine Learning.

## Work Experience

**Research Assistant, SLURM Lab, University of Southern California, LA** Jan 2024 - Present

- Working at Sensing, Learning, and Understanding for Robotic Manipulation (SLURM) Lab at University of Southern California (USC) under **Professor Daniel Seita**.
- Building a solution to enable robotic assistance for dressing patients, by achieving maximum coverage of the arm via robot learning from segmented point clouds and human pose.
- Worked on robotic manipulation in contact-rich scenarios and leveraging trajectory optimization for planning. Compared and analyzed the performance with respect to traditional Inverse Kinematics.
- Building a simulation for to achieve bi-manual dexterous manipulation for scooping particular particles in a clustered environment.

**Research Assistant, Indian Institute of Science, Bangalore, India** Nov 2022 - Aug 2023

- Worked at Indian Institute of Science, CPDM, Intelligent, Inclusive Interaction Design (I3D) Lab under the guidance of **Professor Pradipta Biswas** on HCI solutions powered by AI/ML and computer vision.
- Developed I-ROD, an ensemble CNN model integrating encoder-decoder and dilated convolution branches with a dynamic fusion mechanism, achieving a 12.91% F1 score improvement over state-of-the-art models for semantic segmentation in unstructured road scenarios on the Indian Driving Dataset
- Built Mixed Reality application for tele-operated remote welding by mapping the coordinates defined for welding movement to the robot coordinates. Conducted a comparative study of the MR application with its VR counterpart.
- Built a mixed reality based Assistive Assembly Process Instruction tool in collaboration with Collin's Aerospace, where various object detection models were trained and evaluated to detect and track the intricate components. Instructions and warnings are provided to the user based on the tracked positions through multiple modalities; virtual cues and auditory feedback.
- Curated and annotated a custom dataset for the components with real and generated synthetic images to improve the detection. The mixed dataset with real and synthetic data improved the average confidence score by 4%.
- Studied the swimming effect of Holograms in MR applications deployed on Hololens, with different angles of perceiving the scene, and compared and analyzed various anchoring methods to effectively stabilize the holograms.

**Developer Associate, SAP Labs India** July 2021 - Oct 2022

- Built reuse services in Data Privacy and Protection that enables businesses to be compliant with GDPR regulations. Part of Devops activities in the team, ensuring deployment ready code-base, orchestrating the release of the services, sanitation of the code base and new data centre deployments for release of services.

**Developer Associate Intern, SAP Labs India** Feb 2021 - July 2021

– Worked on various reuse services( including Personal data Manager and Data Privacy Integration) built to archive and handle data of end users, analysed various consumption scenarios along with supporting customer incidents.

## Projects

**Caregiving and Assistive Robotics, SLURM Lab, USC**
Developing a solution to enhance robotic assisted dressing for people with neurological disorders like muscular dystrophy to help with Dressing

**Plant manipulation, SLURM Lab, USC**
Retrieval of a target by a robotic arm leveraging trajectory optimisation to plan the waypoints. Compared the achieved results with Inverse Kinematics and achieved improvement of 2+% success rate of the end effector reaching the target using our optimiser, in a collission sensitive approach.

**Dexterous Bi Manual Manipulation for Scooping, SLURM Lab, USC**
Built a simulation for facilitating scooping of a sphere from a cluster of particles

**IROD - Object detection, IISc Bangalore**
Designed a novel model for object detection for Indian Road Dataset. Benchmarked the model against state of the art models(MRCNN, DRN, FCN, etc) on IROD and Cityscapes Datasets.

**Instructive Assembly Process Application, IISc Bangalore**
Development of an application to initially identify different components of an Assembly Process using Computer Vision and then display instructions to the user on how Assembly must be carried out through Mixed Reality at IISc, Bangalore

**XR interface in Remote Welding Scenarios, IISc Bangalore**
Development and Comparison of remote welding through Mixed reality interface and Virtual reality application. Development of the Application for Hololens and used Regression Model to map the coordinates from Mixed Reality space to Robot workspace.

**Exploration and Analysis of Activation Functions, USC**
Analyse the performance of various state-of-the-art activation functions under five different datasets and two Deep Learning architectures, Extreme Learning Machine (ELM) and Multi-Layer Perceptron (MLP). Proposed three novel activation functions. Results show that the proposed activation functions perform fairly well as compared to the state-of-the-art counterparts

## Publications(2 ongoing)

**I-ROD: An Ensemble CNNs for Object Detection in Unconstrained Road Scenarios**
Signal, Image and Video Processing Journal, Springer (Accepted)

**Investigating Swimming Effect of Holograms in Mixed Reality**
International Conference on Pattern Recognition(ICPR 2024) (Accepted)

**Harnessing Learn Rate Schedule for Adaptive Deep Learning in LoRaWAN-IoT Localization**
IEEE Access, May 2024 Link

**Development and comparison studies of XR interfaces for path definition in remote welding scenarios**
Multimedia Tools and Applications, November 2023 Link

**Multiple Multicast Architecture for XMPP based Applications**
3rd International Conference for Emerging Technology (INCET), IEEE, 2022Link

**IoT-enhanced Extensible Messaging Presence Protocol:A Multiple Multicast Architecture for Diverse Applicatio**
IC-ICIC-2023; International Conference on "IOT, Communication, Intelligence and Computing", 2023 Link

## Achievements

1. Secured 1st Rank and 3 Gold Medals, Batch of 2021, UVCE, Bangalore University.
2. Awarded "Best Student Award", Batch of 2021, UVCE, Bangalore University.
3. First place in SAP-CSR Hackathon by developing app to get measurements for prosthetics using CNN, OpenCV, Mediapipe