

# Rishab Balasubramanian

358B, Dr.Lakshmana Swami Salai  
KK Nagar, Chennai-600078, Tamil Nadu  
☎ 541-250-7330  
✉ [rishab.edu@gmail.com](mailto:rishab.edu@gmail.com)  
🌐 <https://rishabbala.github.io/>

---

## About Me

I'm a first year MS student at Oregon State University, advised by Prasad Tadepalli. Currently I'm working on Combinatorial Bandit Problems, and previously I've worked on computer vision and machine learning with a specific focus on 3D vision, reconstruction, and detection. I previously worked on control, robotics, vision-based path-planning, SLAM, and Shape-from-Motion

[Personal Website](#)   [Github](#)   [Google Scholar](#)

---

## Education

2021 - Present	<b>MS/PhD in Artificial Intelligence and Computer Science</b> <i>Oregon State University, USA,</i>	CGPA- <b>3.89/4.0</b> .
2016 - 2020	<b>B.Tech - Instrumentation And Control Engineering</b> <i>National Institute of Technology, Tiruchirapalli (NIT Trichy),</i> First Class, Department Rank : 20/91	CGPA- <b>8.42/10</b> .
2016	<b>Higher Secondary Examination (CBSE)</b> <i>Maharishi Vidya Mandir, Chennai,</i>	<b>94%</b> .
2014	<b>Secondary Examination (CBSE)</b> <i>Padma Seshadri Bala Bhavan, Chennai,</i>	<b>10/10</b> .

---

## Technical Strengths

**Programming Languages:** *Embedded C, C, C++, Python, MATLAB, HTML, Assembly Language, SQL, L<sup>A</sup>T<sub>E</sub>X, Scratch, Shell Programming.*

**Software Packages Used:** *ROS, Gazebo, OpenCV, Keras, PyTorch, Arduino, Tina, Pygame, MATLAB & Simulink, Ardupilot, Px4, SITL.*

---

## Research Work/Internships

June 2022 - Present	<b><u>Attacks on Combinatorial Multi Arm Bandits</u></b> <i>Research Dr. Huazheng Wang.</i> <ul style="list-style-type: none"><li>Working on theoretical methods for attacking combinatorial bandits</li><li>Extension of present attacks to Online Influence Maximization</li></ul>
April 2022 - June 2022	<b><u>Contrastive Learning for Object Detection and OOD Detection</u></b> <i>Course project with Prof. Stefan Lee.</i> <ul style="list-style-type: none"><li>Used ranking to incorporate human knowledge into contrastive learning framework</li><li>Verified on Object Classification, detection, and OOD detection</li><li>Analyzed shortcomings of our approach and described possible improvements</li></ul>
October 2021 - March 2022	<b><u>3D Object Mesh Reconstruction from Images</u></b> <i>PhD Research at Oregon State University with Prof. Prasad Tadepalli.</i> <ul style="list-style-type: none"><li>Working on algorithms to generate mesh representation of objects from image inputs.</li><li>Implementing topologically-aware networks that can remove faces from reconstructed meshes to modify topology.</li><li>Incorporating multi-view reconstruction for non-symmetric objects.</li></ul>

- January 2021 - **Computer Vision Data Scientist**  
 April 2021 *Research Engineer at **EndovisionAI**.*
- Working on developing an API for 3D reconstruction of the human anatomy using endoscope images.
  - Developed a model for unsupervised learning of depth from RGB endoscopy images using a U-Net based architecture.
  - Used Phong reflection model to generate Lambertian images, and cleaned them using inpainting techniques.
  - Used Shape-from-Shading methods to create 3D point clouds from RGB images.
- June 2020 - **Risk Averse Submodular Optimization for the Multi-Objective Travelling Salesman Problem**  
 November 2020 *Research project with **Prof. P.B.Sujit**, IISER Bhopal, and **Prof. Pratap Tokekar**, University of Maryland, Accepted to International Conference on Robotics and Automation (ICRA) 2021.*
- Objective: To develop an approximation algorithm for the multi-objective Travelling Salesman Problem to determine optimal paths given the risk level.
  - Developed a risk aware greedy algorithm to maximize the Conditional Value at Risk (CVaR) using a submodular function over a matroidal constrained system.
  - Proved the algorithm has polynomial runtime and approximation factor is proportional to the optimal solution along with an additive term.
- June 2020 - **Autonomous Mapping And Safe Footfall Planning For Hexapods**  
 November 2020 *Research project with **Prof. Guillaume Sartoretti**, MARMOT Lab, National University of Singapore.*
- Objective: To develop algorithms to facilitate legged locomotion on uneven terrain.
  - Used RTABMap to generate a global map with teleoperated controls
  - Developed an elevation map from input images, by fusing localization data with an octomap.
  - Computed gradients and safe foot positions by applying a sobel filter to the input pointcloud data.
  - Working on closed loop footstep planning using a Central Pattern Generator.
- June 2020 - **Domain Decomposition Using Reinforcement Learning for Multi-Agent Search**  
 November 2020 *Research project with **Prof. Guillaume Sartoretti**, MARMOT Lab, National University of Singapore.*
- Objective: To develop an algorithm to decompose the environment into small modules to simplify multi-agent search given information estimation and robot positions.
  - Used Asynchronous Actor Critic (A3C) to learn the optimal generator placements, and create a Voronoi diagram using these to decompose the map.
  - Analyzing the effect of communication restrictions and uncertainty of sensors on the efficiency of the search.
  - Working on integrating the decomposition with search algorithms to verify the performance.
- May 2019 - May 2020 **A Cooperative Framework for Autonomous Landings of Quadrotors using Vision on a Moving UGV**
- Summer Research Internship under **Prof. P.B.Sujit**, IIIT-Delhi, Accepted to American Institute of Aeronautics and Astronautics SciTech 2021.*
- Objective: To develop a control algorithm for guaranteed UAV landing on a moving ground target using only vision from onboard camera
  - Used State Dependent Ricatti Equation (SDRE) for the problem
  - Applied homographic transformations on the visual data from camera feed to detect and determine the target's position
  - Used a Kalman Filter to estimate the target's position and velocity
  - Proved robustness and stability of proposed controller
  - Developed strategies for multi-agent coordinated landing for high-speed targets.
- February 2020 - **Formation Control And Collision Avoidance For Multi-Agent Systems**  
 April 2020 *Undergraduate Research Thesis under **Prof. Umapathy**, Department of Instrumentation And Control Engineering, NIT-Trichy.*
- Objective: To develop a framework for multi-agent formation control without collisions.
  - Developed CAD files for omni-directional robots, and packages to spawn multiple robots.
  - Used Optimal Reciprocal Collision Avoidance (ORCA) for implementing collision avoidance and PID control for waypoint following.
  - Compared the results with Potential field and histogram based collision avoidance.

- November 2018 - January 2019 **Efficient Geometric Algorithm for the Multi-Player Pursuit Evasion Game**  
*Winter Research Internship under Prof.P.B.Sujit, Department of Electronics And Communication Engineering,IIIT-Delhi.*
- Objective: To develop a novel algorithm for the guaranteed capture of a single evader by multiple pursuers with equal or lesser speed in a bounded environment with circular or cylindrical obstacles.
  - Investigated Voronoi Tessellation-based strategy for the pursuers and their proof for definitive capture.
  - Developed a unique algorithm based on a fractional relationship between the attributes of the polygon formed by all players in the game, specifically its area, perimeter and centroid.
  - Applied Virtual Potential Fields for the motion of the evader and for obstacle avoidance.
  - Simulated the algorithms using Pygame.
- May 2018 - July 2018 **Real-Time American Sign Language To Text Conversion Using Convolutional Neural Networks**  
*Summer Research Internship under Dr.Ramasubba Reddy, Department of Applied Mechanics, Indian Institute of Technology - Madras.*
- Objective: To develop a system to aid speech or hearing impaired people to communicate with others by translating American Sign language into text and vice versa in real-time
  - Used Haar-Cascade Face Detection Algorithm to detect the face and extract the skin color from four distinct points on it.
  - Used the detected skin color as a mask to localize the position of hands in the incoming video feed.
  - Applied Background Subtraction, Thresholding and Morphological transformations for noise removal.
  - Used a combination of Google Inception and YOLO architecture in Keras, with lesser convolutional layers and more pooling and normalization layers.
  - Achieved a validation accuracy of 84%.

---

## Projects

- July 2018 - Present **Ballbot.**
- Objective: To develop a five degree of freedom, stable ball-balancing robot.
  - Worked on developing a functional simulation in Gazebo-ROS using cascaded PID controller, and developed go-to-goal algorithm for the robot
  - Implemented minimal balancing on hardware using DC motors
- December 2017 - February 2018 **Snakebot.**
- Objective: To develop a snake-like robot that can move through different terrains for the purpose of surveillance
  - Designed the snakebot using six servo motors which were independently actuated using Arduino Uno.
  - Developed the robot to traverse different terrains, using three different gaits - caterpillar, rotatory and sidewinding.
- August 2017 - September 2017 **Two Degree of Freedom Planar Robotic Arm.**
- Objective: To develop a simple two-link arm mechanism to write any alphabet given as input.
  - Used two servos to actuate the motion, and Arduino Uno micro-controller for processing.
  - The input letter from the user is split into several points (co-ordinates) through which the end-effector of the arm has to pass
  - Applied inverse kinematics to determine the angles of rotation for each servo motor, when a co-ordinate in the plane was given

---

## Achievements and Extra-Curricular Activities

- Was among the top 1% of students graduating from high school in 2016
- Member of the Workshops team at **Sensors'17, '18**, which conducts two day workshop for teaching young students
- Lecturer in **Genesis'17, '18, '19** - four day annual workshops for tutoring first years on the basics of micro-controllers, robotics, electronics and mechanics
- Member of **Robotics And Machine Intelligence (RMI)**, the official robotic research club of NIT-Trichy.
- Selected twice for regional **AMTI (Association of Maths Teachers of India)** examination
- Participant in the **National Service Schemes (NSS)**

---

## Relevant Courses

- Machine Learning (Oregon State University)
- Algorithms (Oregon State University)
- Causal Inference (Oregon State University)
- Machine Learning by Prof.Andrew Ng (Coursera) - 94% : Certificate
- Control Of Mobile Robots (Coursera) - 94.2% : Certificate
- Deep Learning Specialization by Prof.Andrew Ng (Coursera)
- Artificial Intelligence - MIT OCW
- Probability And Statistics - Edx
- Data Structures And Algorithms - MIT OCW