

ABHAY RAWAT

Research Assistant @ Data Science and Analytics Center

Currently working on Deep Reinforcement Learning and its applications in multi-agent robotic domains.

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EXPERIENCE

Research Assistant

Data Science and Analytics Center (Prof. Kamalakara Karlapalem), IIIT-H

Nov 2017 – Present

Hyderabad, India

- Developing behaviour and control using Reinforcement Learning in multi-agent domains involving cooperation.
- Developed and Implemented various flavors of Reinforcement Learning and Machine Learning Algorithms for deployment and operation on multi robot systems.
- Developed methodology for enhancing energy efficiency of multi-agent system using Mixed Integer Quadratic Constrained Optimization
- Worked on various facets of multi-agent projects including both software and hardware aspects.
- Firsthand experience with ROS, Gazebo, PyTorch, CVXOPT, CPLEX, Arduino and Linux.

Teaching Assistant

International Institute of Information Technology, Hyderabad

- **Statistical Methods in AI** under Prof. CV Jawahar in the monsoon semester 2018-19 & monsoon semester 2019-20
- **Introduction to Robotics: Mechanics and Control** under Prof. Abhishek Sarkar in the spring semester 2018-19
- Responsibilities include:
 - Drafting assignments
 - Clearing doubts during weekly assigned slots.
 - Grading assignments and semester exam papers.
 - Taking regular tutorial sessions to coach the class on using practical tools like Scikit-Learn, NumPy, PyTorch, TensorFlow, ROS, Gazebo and MATLAB.

PUBLICATIONS

A. Rawat, K. Karlapalem, "Multi-Robot Formation Control Using Reinforcement Learning." Ro-MAN 2019 Late Breaking Report

P. Verma, R. Tallamraju, **A. Rawat**, S. Chand, K. Karlapalem, "Loosely Coupled Payload Transport System with Robot Replacement." ARMS - AAMAS19

EDUCATION

M.S. by Research (COMPUTER SCIENCE)

International Institute of Information Technology, Hyderabad

July 2017 – Present

CGPA: 8.48

Bachelor of Technology (COMPUTER SCIENCE)

JSS Academy of Technical Education, Noida

July 2013 – May 2017

PERCENTAGE: 73.9%

PROJECTS

DDPG-HER

- Implementation of Deep Deterministic Policy Gradient (DDPG) and Hindsight Experience Replay (HER).
- Custom point-based environment for continuous control of multiple agents.
- Control and coordination of multiple agents to maintain a formation while reaching a goal.

PROJECTS

Multi-Agent Reinforcement Learning Environment (MAREN)



- A multi-agent platform for hassle free deployment of multi-agent solution.
- A wrapper over OpenAI's gym for multi-agent reinforcement learning.
- Integrated with ROS for communication and Gazebo for visualization.

Fast Feature Reduction (Course Project)



- Fast Feature Reduction for anomaly detection task on KDD-99 dataset.
- Implemented various dimensionality reduction processes like Principal Component Analysis (PCA), Linear Discriminant Analysis (LDA) and auto encoders.
- Compared results of using Deep Neural Networks, SVM and KNN augmented with the above methods for dimensionality reduction.

Ultra-Wideband Trilateration



- UWB Decawave modules placed on robots triangulate their positions.
- Modules on robots use two-way ranging to compute their distances with respect to stationary modules in the arena.
- Time Division Multiple Access protocol ensures every agent gets a time slice of access for communication.
- Provides decimeter level accurate positioning of multiple agents.

Motion Capture System



- Dynamic tracking of robots in real time, captured by an array of overhead cameras.
- Provides accurate position with errors up to ±5cm covering an area of 6.5m × 4m.
- ROS enabled, broadcasts locations of mobile robots with frequency of 50Hz.

Obstacle Avoidance Using Q Learning (Course Project)



- Implemented a custom Q learning based controller for obstacle avoidance and go to goal behavior.
- Deployed the system on a custom implantation of a Gym based environment for Gazebo and ROS

IP Patrol Robot

- Developed a patrol robot which could be teleoperated from the web interface, built using Flask.
- Camera feed captured by on board RaspberryPi was streamed to a server connected to the internet.

LANGUAGES

- | | | | | | |
|----------|-------|--------|-------|--------------|-------|
| • Python | ●●●●● | • C++ | ●●●○○ | • JavaScript | ●●●○○ |
| • C | ●●●○○ | • Java | ●●●○○ | • PHP | ●●●○○ |

TOOLS

- | | | | | | |
|--------------|-------|----------|-------|----------------|-------|
| • NumPy | ●●●●● | • Pandas | ●●●●○ | • Keras | ●●●○○ |
| • PyTorch | ●●●●● | • PICOS | ●●●●○ | • Scikit-Learn | ●●●○○ |
| • TensorFlow | ●●●●○ | • ROS | ●●●●○ | • OpenCV | ●●●○○ |
| • CPLEX | ●●●●○ | • Gazebo | ●●●●○ | • CVXOPT | ●●●○○ |

ACHIEVEMENTS

- All India Rank 253 in GATE (Graduate Aptitude Test in Engineering) Computer Science 2017.
- 5th position in eYantra Robotics Competition 2016, IIT Bombay.
- 2nd Position in Dinero Intercambio (Event based on image processing) in Troika held at Delhi Technical University, 2015.
- 3rd Position in Spectrum (Mathematical Coding), Cognizance, IIT Roorkee 2014.