Akshat Agarwal

https://agakshat.github.io
aa7@cmu.edu | 412.628.5196

EDUCATION

CARNEGIE MELLON UNIVERSITY
Masters in Robotics
Exp. May 2019 | Pittsburgh, USA
GPA: 4.13/4.33

INDIAN INSTITUTE OF TECHNOLOGY, KANPUR
B.Tech. in Electrical Engineering
Minor in Artificial Intelligence
May 2017 | Kanpur, India
GPA: 9.4/10.0

TECHNICAL SKILLS

Github: **https://github.com/agakshat**
Languages: Python • C++ • MATLAB
Deep Learning: Pytorch • Tensorflow
Robotics: ROS • OpenCV • Arduino
OS: Linux • Windows
Electronics: Altium Designer • EAGLE

COURSEWORK

Machine Learning
Computer Vision
Deep Reinforcement Learning
Optimization for Machine Learning
Probabilistic Mobile Robotics
Robot Motion Planning
Multi-Agent Systems: Games, Algorithms, Evolution
Underactuated Robotics
Math Fundamentals for Robotics
Kinematics, Dynamics and Control
Deep Learning for Computer Vision
Image Processing
Data Structures and Algorithms
Probability and Statistics
Digital Signal Processing
Signals and Systems

AWARDS

• Won the elevator pitch contest at the Leaders in Innovation Fellowship 2017
• Won the Academic Excellence Award 2014-16 at IIT Kanpur
• Won the KVPY Fellowship in 2013
• Top 1% in the National Standard Examination in Physics 2013

WORK EXPERIENCE

GRADUATE RESEARCH ASSISTANT | AART Lab
Robotics Institute, Carnegie Mellon University
Advisor: Katia Sycara | Oct. 2017 – present | Pittsburgh, PA

- Designing graph neural network based multi-agent reinforcement learning (RL) algorithms which can adapt quickly and robustly to new or evolving teammates in dynamic situations.
- Developed a neuroscience inspired paradigm for safe RL for which I established an inter-departmental collaboration and mentored an intern.
- Introduced Space Fortress as a testbed for research on context-aware RL.

CO-FOUNDER AND CTO | Agilo Technologies Pvt. Ltd.
Aug 2015 – Dec 2016 | Kanpur, India

- Spearheaded the development of **evive,** a pedagogical, open source Arduino powered electronics platform for hands-on learning.
- Designed (for manufacture) a PCB with >100 components and wrote the complete software stack for evive.
- Led a successful **crowdfunding campaign on Indiegogo,** raising $35k USD from over 350 backers in 33 countries and featuring in 25 magazines.
- Designed and implemented the control system and ROS interface for an industrial chemical reactor cleaning robot at the world's largest oil refinery.

RESEARCH INTERNSHIPS

INTERACTION LAB | University of Southern California
Advisor: Maja Mataric | May 2016 – July 2016 | Los Angeles, CA
Worked on a project to study the acceptance of robot buddies by children with Autism Spectrum Disorder. Defined robot behaviors for the MIT DragonBot in ROS and created multi-modal interactive games in JS.

IDEA LAB | Indian Institute of Technology Kanpur
Advisor: Nishchal Verma | May 2015 – July 2015 | Kanpur, India
Developed the **Majority Vote Point** classifier and rigorously proved its generalizability by proving bounds on its VC dimension, along with empirically demonstrating its performance on diagnosis of machine faults from acoustic data.

PUBLICATIONS

- "Community Regularization of Visually Grounded Dialog" (in review)
  Akshat Agarwal*, Swaminathan Gurumurthy*, Vasu Sharma, Mike Lewis and Katia Sycara **[Paper** | **Code]**
  ICML/AAMAS/IJCAI 2018 Adaptive Learning Agents Workshop
  CVPR 2018 Visual Dialog Workshop **[Poster]**

- "Generalization ability of majority vote point classifiers for motor fault diagnosis" **Akshat Agarwal** and Nishchal Verma **[Paper** | **Code]**
  Published at IEEE Industrial and Information Systems (ICIIS) Conference 2016

- "Challenges of Context and Time in Reinforcement Learning: Introducing Space Fortress as a Benchmark": **Akshat Agarwal,** Ryan Hope and Katia Sycara **[Paper** | **Code]** | AAAI 2019 Workshop on Reinforcement Learning in Games

- "Better Safe than Sorry: Evidence Accumulation Allows for Safe Reinforcement Learning": **Akshat Agarwal*,** Abhinau Kumar V*, Kyle Dunovan, Erik Peterson, Tim Verstynen, Katia Sycara **[Paper]**

PROJECTS

- **Community Regularization of Visually Grounded Dialog [Paper]** Prof. Ruslan Salakhutdinov | 2018
  Developed a novel multi-agent dialog framework to train dialogue agents to exchange information about an image using natural language, improving the relevance and coherence of the language generated by the agents (as judged by an extensive human study) without compromising on task performance.

- **Optimal Control of a Ballbot [Report]** Prof. Matt Travers | 2018
  Implemented open loop trajectory planning in MATLAB for the ballbot using optimal control techniques.

- **Symbiotic Localization [Report]** Prof. Oliver Kroemer | 2018
  Given a pair of planetary rovers, we improved their localization by using the rovers to track each other and reduce error introduced by dead reckoning. Used the HTC Vive Tracker and an Intel Realsense, using ROS for interfacing with the hardware.

- **Emergent Reciprocity in Iterated Prisoners' Dilemma [Report]** Prof. Michael Erdmann | 2017
  Investigated the emergence of reciprocal cooperative behavior between artificial agents in the Iterated Prisoners' Dilemma, and implemented opponent modeling using expectation-maximization.

- **Disparate Image Matching [Report]** Prof. Tanaya Guha | 2017
  Implemented the Duality Descriptor and the Multi-Modal Image Detector for image matching, outperforming algorithms like SIFT, SYMD and J-SPEC at much lower computational cost, while also being highly repeatable.

- **Quadrotor Localization and Landing [Report]** Prof. Gaurav Pandey | 2017
  Integrated data from ArUco markers, PX4 optical flow sensors and IMU in ROS with an Unscented Kalman Filter and rotation compensation implemented from scratch, for localizing a quadrotor and landing it on the ArUco marker.

- **Real-Time Obstacle Detection for Autonomous Vehicles [Report]** Prof. Gaurav Pandey | 2016
  Used stereo cameras to detect unoccupied on-road space in front of a vehicle, faster than real-time. We used a columnar representation similar to stixels to represent obstacles, reducing computational complexity.

- **Underwater Search and Surveillance Vehicle [Report]** Prof. Bhaskar Dasgupta | 2014
  Designed and built a tele-operated underwater vehicle capable of manoeuvrability with 6 degrees of freedom, and implemented a PID controller for autonomous stabilization against water currents.

- **Robocon: Playground traversing semi-autonomous robots [Report]** 2013
  As a member of the IIT Kanpur Robocon Team, responsible for design of power and electronics circuits for two robots.

VOLUNTEER WORK

- Teaching Assistant (drafting and grading assignments and tests) for the English Proficiency Program, IIT Kanpur, to teach English to students and staff from underprivileged backgrounds.
- Tutored academically weak students in Fundamentals of Computing, as a volunteer of the Counseling Service, IIT Kanpur.
- Personally mentored 9 students through their freshman year to help them acclimatize to college life, as a volunteer of the Counseling Service, IIT Kanpur.