Ritwik Bera

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Academic Qualifications

- **Texas A&M University, College Station**
  Graduate Student in Aerospace Engineering , GPA: 4.0/4.0 *Aug 2019–present*
- **Indian Institute of Technology, Kanpur**
  B.Tech in Mechanical Engineering , CPI: 9.6/10 (equivalent GPA: 3.84/4.0) *Jul 2014–Jun 2018*

Research Interests

I work at the intersection of machine learning and control. My work is focused on leveraging unsupervised learning techniques such as generative models to help machines understand the context and semantics of the tasks they are required to accomplish. The goal of my research is to enable machines to easily generalize their learning to new unseen tasks.

Publications

- **PODNet: A Neural Network for Discovery of Plannable Options**
  AAAI Spring Symposium 2020: Machine Learning and Knowledge Engineering
  R. Bera, V. G. Goecks, J. Valasek, N. Waytowich
  `https://arxiv.org/abs/1911.00171`
- **A Comprehensive Differential Game Theoretic Analysis of A Game of Two Cars**
  Journal of Optimization Theory and Applications,
  R. Bera, M.V. Ramana, M. Kothari
  `http://doi.org/10.1007/s10957-017-1134-z`.

Experience

- *Graduate Research Assistant-Vehicle Systems and Control Laboratory*
  Enhanced Cycle of Learning for Human-Machine Teaming.
  under Prof. John Valasek (Aug 2019 - present)
  Working on techniques utilised in deep unsupervised learning, to help machines discover modular sub-behaviours from task demonstration data. The ultimate goal is to make transfer learning much more sample-efficient and help machines learn from demonstration data provided on unrelated/unpaired tasks.

- *Texas A&M University Research Experience for Undergraduate (REU) Program 2017*
  Control of Stochastic Multiple Time-Scale Systems
  under Prof. John Valasek (Vehicle Systems and Control Laboratory) Jun-Jul 2017
  Learned about the theory behind control of multiple time-scale systems and implemented a new Unscented Kalman Filter based control algorithm for control of a stochastic, non-linear spring mass damper system.

- *Summer Undergraduate Research Grant for Excellence (SURGE) 2016*
  Differential Game-Theoretic Motion Control for Autonomous Agents
  under Prof. Mangal Kothari (Intelligent Guidance and Control Lab, IIT Kanpur) May-Jul 2016
  Carried out a comprehensive dynamic programming driven analysis of *A Game of Two Cars* and a

reversed version of the *Homicidal Chauffeur Game* to evaluate changes in optimal trajectories and control policies under varying payoff/reward structures.

Other Projects

- **Design and development of a 3DOF Robotic Manipulator for Cranial Surgery**
  Capstone Project Jul 2017-Apr 2018 Advisor: Prof. Shakti S. Gupta
  Led a 3 member team to design a 3-DOF robotic arm purpose-built for machine-driven precise cranial surgery. The project involved mechanism design, inverse kinematics computation, CAD designing and installing electrical systems.

- **Visual Odometry using Careful Feature Selection and Tracking**
  Course Project for EE698G: Probabilistic Mobile Robotics
  Implemented the algorithm for vison-based stereo odometry, adapted from the works of I. Cvišić and I. Petrović in 'Stereo odometry based on careful feature selection and tracking'

- **Semi-autonomous ground vehicle for indoor exploration**
  Project Sponsor: Boeing India
  Project Coordinators: Prof S. Bhattacharya and Prof. S. Kamle
  Responsible for creating the system architecture for sensor data fusion (included LIDAR and wheel encoders) and implementing grid-based FastSLAM algorithm on a networked ROS setup that included the ground robot and a remote data-processing ground station.

- **Development of a 'Smart Lock' system**
  Under Science and Technology Council, IIT Kanpur (May-Jun 2015)
  Designed an IoT based biometric security system with features such as remote user registration, fingerprint matching through HEX codes, cloud-based data logging and auto-lock and shutdown on sensing human error.The entire system was built on the Jinja2 template engine and the Python-based Flask micro-framework.

Relevant Courses

- Applied Game Theory
- Robot Dynamics and Control
- Robot Motion Planning
- Probabilistic Mobile Robotics
- Linear Algebra
- Advanced Calculus

Skills

- **Languages**: Python, Java, C++, Bash
- **Tools**: Git, MATLAB, LaTeX, Autodesk Inventor, Arduino, Docker
- **Frameworks**:PyTorch, ROS

Honors

- AERO Graduate Research Excellence Fellowship Spring 2020, Texas A&M University.
- Stillwell Fellowship 2019 by UIUC Aerospace Engineering (declined)
- Banco Foundation Prize 2018 for Department Rank 1 at Indian Institute of Technology, Kanpur
- Academic Excellence Award 2014-15 and 2015-16 by IIT Kanpur (given to **top 7%** students)

Positions of Responsibility

- Secretary, Electronics Club, IIT Kanpur
- Executive, Science and Technology Council, IITK