MAYANK MITTAL

Senior, Dept. of Electrical Engineering, IIT Kanpur, India

E-mail: mayankm@iitk.ac.in
Website: mayankm96.github.io

Education

2014–present **Bachelor of Technology**, *Indian Institute of Technology*, Kanpur, *CGPA- 9.3/10*
Major: Electrical Engineering

2014 **Grade XII**, *Amity International School*, Noida, *Result- 97%*

2012 **Grade X**, *Amity International School*, Noida, *CGPA- 10/10*

Research Experience

May–July '17 **Predicting Landing Sites from Aerial Images of Disaster Scenes**
University of Freiburg, Prof. Wolfram Burgard

- **Created large dataset**, using Mircrosoft drone **simulator AirSim**, comprising of scene, normals and depth views of a self- designed map of a disaster affected region
- Trained deep learning model inspired from **'MarrRevisisted'** architecture by Aayush B. *et al.* on the created dataset; performed a qualitative and quantitative analysis of the results
- Proposed a **pipeline to extract candidate landing sites**, using the trained model and input RGB-D data, based on histogram based segmentation **in real-time**

July '16–Mar '17 **Bomb Disposal using Multi-Robot System**
website
github
Boeing-IIT Kanpur Joint Venture, Prof. Shantanu Bhattacharya & Prof. S. Kamle

- Integrated various hardware into a custom two-wheeled differential drive robot, *Alpha*
- Performed simulation of *Alpha* in **gazebo** environment for creating maps and navigation
- Implemented and compared the results of `RGBD-SLAM`, `ORB-SLAM`, `Gmapping`, and `Hector-SLAM`
- Implemented the **object detection model 'YOLOv2'** by Joseph Redmon *et al.* using ROS and Caffe framework to classify objects as potential explosives in real time

Nov '14–present **Autonomous Underwater Vehicle (AUV)**
website
github
report
IIT Kanpur, Prof. K.S. Venkatesh & Prof. Sachin Y. Shinde

- Designed and developed **Institute's first AUV**, *Varun*, which uses computer vision and dead- reckoning sensors for navigation and is capable of shooting torpedo and drop markers
  - Optimized robot's structure and assemblies using **SolidWorks and Ansys Workbench**
  - Fabricated **waterproof casings** using in-house manufacturing facilities like lathe, milling
  - Designed **power distribution board** for the vehicle to ensure isolation between processor and motors, and also provide circuit protection
  - Formalized **experiment** to **calibrate thrusts** from vehicle's actuators to PWM signal
- Currently mentoring the software subsystem team of our next vehicle, *Triton*

Major Course Projects

Feb–Apr '17 **Visual Odometry using careful Feature Selection and Tracking**
github
report
Course Project for Probabilistic Robotics (EE698G), Prof. Gaurav Pandey

- Implemented the algorithm for stereo odometry, adapted from the works of I. Cvišić and I. Petrović in 'Stereo odometry based on careful feature selection and tracking'
- Evaluated the implemented algorithm on KITTI Dataset City 01 and Residential 07 sequences

Mar–Apr '17 **MATLAB based GUI for Motion Planning**
github
Course Project for Robot Motion Planning (ME766A), Prof. Ashish Dutta

- Created an interactive user interface on MATLAB to run a number of motion planning algorithms such as Rapidly exploring Random Tree (RRT) and its variants, and potential field method, in a user defined 2-D environment at specified start and goal points

Oct–Nov '16 **Failure Handling in Swarm of Quadrotors**
report
Course Project for Embedded and Cyber-Physical Systems (CS637A), Prof. Indranil Saha

- Proposed an **extended state machine design for communication in a swarm**, with ability to handle failures, while ensuring redundancy, decentralization and anonymity
- Used gazebo to simulate swarm behavior in quadrotors using `hector-quad` packages
- Tested communication network on hardware using X-Bees(Series 2) in broadcasting mode

Other Projects

Oct–Nov '16 **Applying $\mathscr{H}_\infty$ Control to Reduce Risks of Diabetes Mellitus in Patients**
Course Project for Robust Control Systems (EE654A), Prof. Ramprasad Potluri
- Proposed an alternate design to the original controller by P. Colmegna *et al.*,
- Used **Robust Control Toolbox** and **Simulink** to show that new controller ensured a better performance for the considered nominal model of adult patient

May–Jun '16 **Reviewing Approaches to Simultaneous Localization And Mapping (SLAM)**
NYU-IIT Kanpur Research Track, Prof. Farshad Khorrami (New York University)
- Reviewed **Kalman Filter** and **Monte- Carlo methods** for back-end system in SLAM
- Implemented **EKF SLAM** in virtual environment through **V-REP** and MATLAB

Feb–Mar '16 **Adjustable Medical Chair**
Course Project for course Manufacturing Processes-II (TA202A), Prof. Neeraj Sinha
- Designed and manufactured a scaled-down model of **dental chair** with independent controls for various motion, using operations like welding, turning, milling, drilling and fitting

Dec '15 **Finite Element Analysis in Electromagnetism**
NPDE-TCA Winter Internship, Dr. B.V. Rathish Kumar (IIT Kanpur)
- Studied the Ritz-vibrational and Glarenkin's finite element analysis in 1- and 2- dimensions
- Solved 2-D boundary valued problems on electrostatics and time harmonics on MATLAB

Teaching Experience

Upcoming **Autonomous Navigation**, *AE640A*, Prof. Mangal Kothari, IIT Kanpur
Preparation of course material and assignments

Academic Achievements

2017 **WISE Scholarship** by DAAD (Awarded to 192 students in the country)
2016 **Academic Excellence Award**, IIT Kanpur (Awarded to 60 students out of 840)
2016 **2nd place** in **Student Underwater Vehicle** (SAVe) competition by NIOT, Chennai
2014 **All India Rank 656** in JEE Advanced among 150,000 students
2014 **All India Rank 324** in JEE Mains among 1.2 million students
2012 **Kishore Vaigyanik Protsahan Yogna** (KVPY) Fellowship by Govt. of India
2010 **National Talent Search Scholarship** (NTSE) by Govt. of India

Technical skills

Software: Gazebo, UnrealEngine Editor (AirSim), V-REP, SolidWorks, Ansys, KiCAD, PSpice
Languages: Python, C++, C, Shell(bash), MATLAB, HTML, CSS
Frameworks: ROS, Caffe, TensorFlow, OpenCV, PCL
Other: Git, GNU Octave, LaTeX

Relevant Coursework

Robotics: Probabilistic Mobile Robotics, Robot Manipulators: Dynamics and Control, Robot Motion Planning, Embedded and Cyber-Physical Systems, Robust Control Systems
Mathematics: Matrix Theory and Linear Estimation, Topics in Probabilistic Modeling and Inferences*, Probability and Statistics, Ordinary/Partial Differential Equations, Complex Analysis
Algorithms: Data Structures and Algorithms, Fundamentals of Programming
Electronics: Power Electronics, Digital Electronics, Microelectronics- I, Power Systems

** to be completed in Spring 2018*

Positions of Responsibility

Jan '16–present **Team Leader**, *AUV Team*, IIT Kanpur
- Leading a team of 16 members from various majors to develop our next underwater vehicle
- Overseeing various **operational and technical** aspects of the project
- Managed funding of Rs.769,000 for the development of our first vehicle *Varun*

Apr '16–Mar '17 **Coordinator**, *Robotics Club*, IIT Kanpur
- Led a team of 18 members and handled a budget of Rs.125,000 to organize various events, workshops, and competitions for robotics enthusiasts in the campus community
- **Mentored** and ensured completion of **summer projects** on facial recognition, 3-DOF robot manipulator, gesture-based gaming console, and Wi-Fi based indoor localization system
- Organized a week-long lecture series in collaboration with the Institute's Center of Mechatronics; presented **talks** on **sensing and actuation, micro-controllers and CAD designing**

Aug '15–July '16 **Student Guide & Academic Mentor**, *Counseling Service*, IIT Kanpur
- Assisted 6 freshmen students in adjusting to the college environment
- Provided personal tutoring to academically weak students for their courses

Miscellaneous

Oct '17 Conducted two-days **workshop** on **'Robot Simulation using ROS and Gazebo'**

Sept '17 Presented a **talk** on **'Applications of Deep Learning in Robotics'** for Machine Learning Research Day (MLRD) organized by SIGML, IIT Kanpur

Oct '15 Secured 2^{nd} place in inter-college lawn tennis tournament at SNU, Greater Noida

Mar '15 Secured 3^{rd} place at inter-college lawn tennis tournament at IIT, Roorkee