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Mayank Mittal

Education

2018–present **Master of Science**, *Eidgenössische Technische Hochschule (ETH)*, Zürich
Major: Robotics, Systems and Controls

2014–2018 **Bachelor of Technology**, *Indian Institute of Technology (IIT)*, Kanpur, *CGPA- 9.0/10*
Major: Electrical Engineering

Publications

Sept '18 **Mayank Mittal***, Abhinav Valada*, Wolfram Burgard "Vision-based Autonomous Landing in Catastrophe-Struck Environments". *2018 IEEE/RSJ International Conf. on Intelligent Robots and Systems (IROS) Workshop, Vision-based Drones: What's Next?*
arXiv

Research Experience

May '17–Aug '17 **Predicting Landing Sites from Aerial Images of Disaster Scenes**
University of Freiburg, Prof. Wolfram Burgard
- **Created large synthetic dataset** on Mircrosoft drone **simulator AirSim** comprising of scene, normals, segmentation and depth information of a map for disaster affected regions
- Trained CNN model 'MarrRevisisted' proposed by Aayush B. *et.al.* on the created dataset for surface normals prediction and performed a qualitative and quantitative analysis of the results
- Proposed **pipelines for extracting candidate landing sites**, using the trained model and input RGB-D data, based on histogram based segmentation and costmaps

Nov '14-June '18 **Autonomous Underwater Vehicle (AUV)**
website
github
report
IIT Kanpur, Prof. Mangal Kothari & Prof. K.S. Venkatesh
- 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 voltage signal
- Mentored the electrical and software subsystem teams working on the next vehicle, *Hyperion*
  - Designing of hydrophones board to simultaneously sample data from four hydrophones and perform **acoustic pinger localization** using cross-correlation method
  - Implementing a **PID-based control system** for the vehicle to perform coupled motion

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

Major Course Projects

Feb–Apr '18 **Survey on Variational Autoencoders (VAEs) for Bayesian Inference**
report
Course Project for Probabilistic Modeling and Inferences (CS698X), under Prof. Piyush Rai
- Studied and implemented various recent developments in VAEs such as semi-amortized autoencoders, conditional VAEs, DRAW architecture

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

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

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

May–Jun '16 **Review on Recent Approaches to Simultaneous Localization And Mapping**
NYU-IIT Kanpur Research Track, Prof. Farshad Khorrami (New York University)

Feb–Mar '16 **Designing of Adjustable Medical Chair**
Course Project for course Manufacturing Processes-II (TA202A), Prof. Neeraj Sinha

Dec '15 **Review on Finite Element Analysis in Electromagnetism**
NPDE-TCA Winter Internship, Dr. B.V. Rathish Kumar (IIT Kanpur)

Teaching Experience

Jan–Apr '18 **Autonomous Navigation**, *AE640A*, Prof. Mangal Kothari, IIT Kanpur
website
- Developed the course syllabus and planned individual class sessions
- Preparation of course handouts and assignments
- Guest lecturer on system integration using ROS, robot simulation, mathematical foundation for robotics, and non-parametric filters for localization

Academic Achievements

2018 **SIIC Student Innovation Award**, IIT Kanpur (Convocation Award)
2018 **Sri. Binay Kumar Sinha Award**, IIT Kanpur (Convocation Award)
2018 **Science and Technology Excellence Award**, IIT Kanpur (Gymkhaana Award)
2017 **Academic Excellence Award**, IIT Kanpur (Dean's List)
2017 **WISE Scholarship** by DAAD (Awarded to 192 students in the country)
2016 **Academic Excellence Award**, IIT Kanpur (Dean's List)
2016 **2nd place** in **Student Underwater Vehicle** (SAVe) competition by NIOT, Chennai
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: Robot Dynamics*, Probabilistic Mobile Robotics, Robot Manipulators: Dynamics and Control, Robot Motion Planning, Embedded and Cyber-Physical Systems

Artificial Intelligence: Probabilistic Artificial Intelligence*, Reliable and Interpretable Artificial Intelligence*, Advanced Machine Learning*, Probabilistic Modeling and Inferences

Controls: Dynamic Programming and Optimal Control*, Robust Control Systems, Control System Analysis, Signal and Systems

Mathematics: Matrix Theory and Linear Estimation, 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

* *denotes current course at ETH Zürich*

Positions of Responsibility

Jan '16–Apr '18 **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 **workshop** on **'Robotics using ROS and Gazebo'** at IIT Kanpur

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