Prateek Arora

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Research Interests: SLAM, 3D Mapping, State Estimation, Robotics and Artificial Intelligence.

EDUCATION

- **University of Maryland, College Park, MD**
  Master of Engineering in Robotics — *Aug 2018 – Present*
- **GGSIPU University, New Delhi, India**
  Bachelors in Electrical and Electronics Engineering — *Jul 2012–2016*

EXPERIENCE

Graduate Teaching Assistant — *with Prof. Mohammed Samer Charifa*
ENPM673 (Perception for Autonomous Robot), University of Maryland — *Jan 2020 – Present*

Graduate Research Assistant — *with Prof. Yiannis Aloimonos*
Perception and Robotics group, University of Maryland — *Aug 2018 – Dec 2019*

- Designed a hardware sensor and compute suite capable of estimating Visual Inertial Odometry, compact and light enough to be mounted on ano-sized quadrotor (130 mm). The suite consists of a global shutter camera, an inertial measurement unit and time-of-flight sensors, a microcontroller and a microprocessor.
- Implemented trajectory tracking on quadrotor (equipped with pixhawk and odroid) using cascaded proportional-integral-derivative controller on position and velocity.

Research Associate — *with Profs. P.B. Sujit and Sanjit Kaul*
Indraprastha Institute of Information Technology (IIIT), Delhi, India — *Jul 2017 - Jul 2018*

- Worked on traffic light detection in Indian traffic environment and system integration of software stack (ROS based) of the self driving car at IIIT-D named Swarath.
- Developed lane cost algorithm to replace binary cost map and integrated it with Open Motion Planning Library.

Research Assistant — *with Prof. Gargi Mishra*
Guru Gobind Singh Indraprastha University, India — *Aug 2014 - Jan 2016*

- Worked on Eye controlled robot, a system that tracks the movement of iris using harr-like features to control a differential drive robot. The results were published in IEEE INDICON.

COURSE PROJECTS

ENAE788M - Hands On Autonomous Aerial Robotics

- **Attitude Estimation**: Implemented *Madgwick* and *Unscented Kalman Filter* to estimate orientation of a 6-DoF IMU and compared the results with ground-truth vicon data.
- **Stereo Visual Odometry**: Estimated 3D trajectory of a quadrotor equipped with a stereo camera using optical flow.
- **Flying through gaps**: Implemented *Gaussian Mixture Model* to detect colored windows and used it as a feedback to autonomously navigate a drone through it.
- **Pose estimation of fiducial marker**: 3D pose estimation of CCTag marker in real-time in order to land a quadrotor on it.
- **Wall avoidance using optical flow**: Compared traditional optical flow algorithm and Spatial Pyramid network to compute dense optical flow for real time obstacle (wall in our case) avoidance on micro UAVs.

CMSC 733 - Computer Processing of Pictorial Information

- **Deep Homography Net, Supervised and Unsupervised**: Implemented deep CNN to learn homography between two images using TensorFlow.
- **Structure from Motion (or SLAM)**: Reconstructed 3D scene and simultaneously computed camera pose using multiple views from a single camera.
- **SFM using Deep learning**: Improved accuracy of an unsupervised learning framework for monocular structure from motion (paper: SFMLearner)
- **Face swap**: Implemented an end-to-end pipeline to swap faces in a video (just like Snapchat's face swap filter) using both *Delaunay Triangulation* and *Thin Plate Spline*.
- **Video SnapCut**: Implemented *tracking of a deformable object* in a video (given initial object boundary) using set of local classifiers (a feature available in *Adobe After Effects*).

PUBLICATIONS

- **Mobile Surveillance Spheroid Robot with Static Equilibrium Camera, Leaping Mechanism and KLT algorithm based Detection with Tracking**: Shamsheer Verma, Chahat Deep Singh, Sarthak Mittal, **Prateek Arora** and Arvind Rehalia. International Journal of Control Theory and Applications, 09(41) 2016, 473-488. ISSN: 0974-5572.
- **Control of wheelchair dummy for differently abled patients via iris movement using image processing in MATLAB**: **Prateek Arora**, Anshul Sharma, Anmoal Singh Soni, Aman Garg, IEEE INDICON 2015, doi: 10.1109/INDICON.2015.7443610

SKILLS

Computer Languages: Python, Matlab, C++, LATEX
Operating System: Linux, Windows
Softwares/Libraries: Tensorflow, Numpy, git, Matlplotlib, Jupyter, Eagle, Inventor