Prateek Arora

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Research Interests: Computer Vision and Artificial Intelligence.

Education

- **University of Maryland, College Park, MD** — GPA: (3.85/4)
  Master of Engineering in Robotics — *August 2018 – Present*
- **GGSIPU University, New Delhi, India** — CPI: (68.46/100)
  Bachelors in Electrical and Electronics Engineering — *2012–2016*

Experience

Graduate Teaching Assistant — *with Prof. Yiannis Aloimonos*
Office of Advanced Engineering Education, University of Maryland — *January 2020 – Present*

- Full-time TA for the course ENPM673, **Perception for Autonomous Robots**, during the Spring 2020 semester.

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

- Designed a **hardware sensor and compute suite** "PRGEye" capable of estimating **Visual Inertial Odometry**, compact and light enough to be mounted on **nano-sized** quadrotor (130 mm). The suite consists of a global shutter camera, an IMU and ToF distance sensors, a microcontroller and a microprocessor.
- Implemented trajectory tracking on quadrotor (equipped with pixhawk and odroid) using cascaded PID controller on position and velocity.

Research Associate — *with Asst. Prof. Sujit and Asst. Prof. Sanjit Kaul*
Indraprastha Institute of Information Technology (IIIT), Delhi, India — *July 2017 - July 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 (OMPL).

Research Assistant — *with Asst. Prof. Gargi Mishra*
Guru Gobind Singh Indraprastha University, India — *August 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(UKF)** 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 the optical flow equation
- *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 CCTag (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 Gunnar Farnebäck method 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 (**SFM**)*: 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)
- *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*).
- *Boundary detection using Pb-Lite*: Boundary detection in image using a modified "Probability of Boundary" method. The probability is measured by computing changes in texture and brightness in the local neighborhood.

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. (Link)
- **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 (Link)

Skills

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

References

Yiannis Aloimonos
Professor,
University of Maryland

Dr. P.B. Sujit,
Associate Professor,
IIIT-Delhi

Dr Gargi Mishra,
Asst Prof.
GGSIPU