

# Rahul Moghe

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## Education

### The University of Texas at Austin

PhD, Aerospace Engineering and Engineering Mechanics: *Control, Autonomy and Robotics*  
Graduate Portfolio Program in Robotics

Aug '17 - Ongoing

**GPA: 4.00/4.00**

Advisors: Dr. Maruthi Akella & Dr. Renato Zanetti

### The University of Texas at Austin

MSE, Mechanical Engineering: *Dynamics, Systems and Controls*

Aug '15 - '17

**GPA: 3.88/4.0**

### Indian Institute of Technology Bombay

B.Tech., Mechanical Engineering with Honors

Jul '11 - '15

Minors in Systems and Control Engineering

**GPA: 8.44/10**

## Publications

- R. Moghe, R. Zanetti and M. Akella, '**Covariance Matching filter for IMU error estimation**', presented at the AAS/AIAA Astrodynamics Specialist Conference, August 2018
- R. Moghe, R. Zanetti and M. Akella, '**Covariance Matching Kalman filter for observable LTI systems**', presented at the IEEE Conference on Decision and Control, December 2018.
- M. Almeida, R. Moghe and M. Akella, '**Real-Time Minimum Snap Trajectory Generation for Quadcopters: Algorithm Speed-up Through Machine Learning**', submitted to the IEEE International Conference on Robotics and Automation, 2019.

## Research Projects

### Robot Soccer for Aldebaran Nao Robot: Robotics Course Project

Aug '18

- Used extended Kalman filters and Particle filters for localization using object detection on the Nao Robot
- Stood 4<sup>th</sup> out of 10 teams in the penalty shootout competition on the Nao Robot
- Using Reinforcement Learning to train the friction model between the ball and the ground online

### Machine learning for generating real-time minimum snap trajectories for quadcopters

Jul '18

- Developed a real-time minimum snap trajectory generation algorithm for quadcopters using neural networks
- Trained on the gradient descent output and compared to trapezoidal velocity profile methods
- Reduced relative error from 136% to 18% with the same computation time as the trapezoidal method

### Adaptive Kalman Filter for observable LTI systems

Mar '18

- Developed an adaptive filter to estimate the states and the noise covariance matrices simultaneously
- Proved convergence of the filter and the covariance matrices for detectable LTI systems
- Used the filter to estimate the velocity random walk reliably in an IMU sensor for space application

### Variable Structure Energy based controller on a single inverted pendulum

May '16

- Performed system ID on the unknown parameters of the motor and pendulum
- Designed an unstable energy based controller for stabilizing the inverted pendulum
- Implemented the controller on the system in LabVIEW with NI CRIO Module

### Mixed-Integer Convex Optimization for optimal sensor alignment in surveillance

Dec '15

- Formulated an optimization problem on a multi-agent sensor surveillance problem in CVX Toolbox MATLAB
- Convexified the problem to maximize the adversarial agents observed by the sensors

## Work Experience

• **Graduate Research Assistant** at ReNeu Robotics and C-DUS Lab, UT Austin

May '16 - Present

• **Teaching Assistant** for Mechatronics Lab, UT Austin

Aug '15 - May '16

• **Field Engineering Intern** at Schlumberger Asia Services Ltd.

May '14 - Jul '14

## Skills

C++, Python, ROS, MATLAB, Tensorflow, Convex Optimization, LabVIEW, Solidworks

## Relevant Courses

Optimal Control Theory

Nonlinear & Adaptive Control

Advanced Topics in Estimation Theory

Convex Optimization

Neural Networks for Control

Verification/Synthesis of Cyberphysical Systems

## Achievements

- Secured All India Rank 369 out of 0.5 million in IIT Joint Entrance Exam 2011
- Secured All India Rank 123 out of 0.5 million in ISAT Exam 2011
- Finished in Top 1% out of 40,000 in Indian National Physics Olympiad 2011