Omanshu Thapliyal

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Education

Purdue University, West Lafayette — *Jan 2015 – Dec 2017, Jan 2019 —*

PhD, Aeronautics & Astronautics Engineering — GPA: ***3.8/4.0***

Master of Science, Aeronautics & Astronautics Engineering — GPA: ***3.9/4.0***
Major: *Dynamics & Control* ***Minor:*** *Systems Engineering*

Indian Institute Of Technology, Kanpur (IIT Kanpur) — *Jul 2010 – Jun 2014*
Bachelor of Technology, Aerospace Engineering — CGPA: ***7.8/10***

Research Interests

Machine learning methods in Estimation & Control
State estimation for Hybrid Systems & Distributed Systems

Publications

Journal Publications:

- *Kalman Filtering with State-Dependent Packet Losses* *(Apr 2018)*
  Omanshu Thapliyal, Jayaprakash S. Nandiganahalli, Inseok Hwang
  IET Control Theory & Applications
- *Distributed State Estimation for Stochastic Linear Hybrid System over a Sensor Network* *(Mar 2018)*
  Raj Deshmukh, Omanshu Thapliyal, Cheolhyeon Kwon, Inseok Hwang
  IET Control Theory & Applications

Conference Publications:

- *Predicting Mode Confusion Through Mixed Integer Linear Programming* *(submitted March 2019)*
  Vignesh Sivaramakrishnan, Omanshu Thapliyal, Abraham Vinod, Meeko Oishi, Inseok Hwang
  58th IEEE Conference on Decision and Control, Nice, France
- *Optimal state estimation in LTI systems with imperfect observations* *(Dec 2017)*
  Omanshu Thapliyal, Jayaprakash S. Nandiganahalli, Inseok Hwang
  56th IEEE Conference on Decision and Control, Melbourne, Australia

Research Experience

Graduate Thesis: **Kalman Filtering for LTI Systems with State Dependent Packet Losses**
(Advisor: Dr. Inseok Hwang) *(2016-2017)*

- Formulated optimal estimator for lossy channels carrying intermittent, time varying measurements
- Used projection approach to find state estimators for sensor networks with time varying packet losses
- Extended the optimal filter for state dependent packet losses and numerically validated the estimator for aircraft tracking subject to radar jammers

Undergraduate Thesis: **UAV velocity estimation using optic flow**
(Advisor: Dr. Abhishek) *(2013 – 2014)*

- Utilized optic flow information from real time video to extract the translational velocities of the camera
- Calculated optic flow field on a USB camera using Lucas-Kanade algorithm in C++
- Obtained UAV translation velocities by decomposing flow fields into pure divergence, curl & deformation

Work Experience

Application Support Engineer : MathWorks Inc., Natick, MA *(Mar 2018 – present)*

- Provided technical support to customers in MATLAB & Simulink and code generation for control design
- Implemented Square-Root algorithms for Kalman Filter source code used in all MATLAB products
- Interviewed Application Support candidates for control design and automation specialization

Graduate Technical Intern : MathWorks Inc., Natick, MA *(Jan – Jul 2017)*

- Enhanced HDL Coder functionality for producing more compact, synthesizable Verilog code from MATLAB code and Simulink models; realized above Verilog codes on FPGA boards
- Authored 6 new Simulink blocks & 2 block architectures for HDLCoder, released in MATLAB 2017b
- Developed hardware implementable Kalman Filter block for release in MATLAB R2018a
- Winner of Intern Hackathon; designed vision based IoT platform for parking lot monitoring deployed on a Raspberry Pi 3B

Relevant Coursework and Skills

Courses : Optimal Control & Estimation, Guidance & Control of Aerospace Vehicles (AAE 568), Guidance and Control of Aerospace Vehicles (AAE 565), Linear Systems Analysis and Synthesis (AAE 564), Intro to Stochastic Processes (AAE 567), Hybrid Systems: Theory and Applications (AAE 690/ECE 695), Multidisciplinary Design Optimization (AAE 550), Statistical Inference (STAT 517), Bayesian Applied Decision Theory (STAT 529), Machine Learning-I (EE 595) R/RHIPE & HADOOP (STAT 695V)

Programming : C++, Python, MATLAB, R

Software tools : Simulink, Autodesk Inventor, CodevisionAVR

Control Systems Projects

F-16 Autopilot Design in Simulink *(Jan – Apr 2016)*

- Designed an F-16 Lateral & Longitudinal autopilot in Simulink using classical control techniques
- Implemented a MIMO control system as stability augmentation and command augmentation systems
- Successfully simulated semi-autonomous flight through a series of pre-decided 3-D way-points

Foothold placement based Optimal Control for a Monopod Hopping Robot *(Jan – Apr 2015)*

- Designed a Model Predictive Controller for a monopod hopping robot (Raibert hopper)
- Simulated hybrid model and controller in MATLAB to compute the optimal control strategy offline
- Identified 2 modes of failure in the robot's gait based on the model predictive algorithm

Robotics Projects

Boeing IIT-K Autonomous Navigation System (Abhyast Phase III) *(Aug 2012 – Jul 2013)*

- Built an autonomous, obstacle avoiding, jumping robot in collaboration with Boeing India
- Designed a twin torsion spring jumping mechanism and a compatible latching mechanism for the robot
- Achieved a jumping distance 12 inches high and 12 inches across while the robot carries a $500g$ payload

Rubik's Cube Solving Robot *(May – Jun 2011)*

- Built an autonomous $3 \times 3 \times 3$ cube solving robot capable of solving from any starting configuration
- Used a webcam to input scrambled position of the Rubiks cube and generated offline solving steps
- Obtained a minimum solving time less than 21 seconds

Simulation & Design Projects

A study of Smart Grid Resilience *(Jan – Apr 2015)*

- Implemented an Agent Based Model to study micro grid to smart grid evolution in MATLAB
- Simulated the model for the grid performance & resilience metrics and different network growth models

Optimization Techniques for Support Vector Machines (SVMs) *(Jan – Apr 2013)*

- Studied optimization in SVMs based on kernel complexity and no. of parameters in the training set
- Compared various kernel models with respect to accuracy & complexity in MATLAB
- Achieved an accuracy $> 90\%$ in predicting breast cancer using SVM on a training data set

Teaching & Mentoring Experience

- Graduate Teaching Assistant
  - Control Systems Lab (AAE 36401) *(Fall 2017 & Spring 2019)*
  - Signal Analysis for Aerospace Engineering (AAE 30100) *(Fall 2016)*
  - Control Systems Analysis (AAE 36400) *(Spring 2016)*
  - Introduction to Aerospace Design (AAE 25100) *(Spring & Fall 2015)*
- Mentored a group of 9 freshmen at IIT-Kanpur as a Counseling Service Student Guide *(2011–12)*

Academic Achievements

- Recipient of **Boeing-IITK scholarship** for the academic year *(2011–12)*
- Placed in **top 0.3% in India** in IIT-Joint Entrance Exam *(2010)*
- Among the **top 2% in India** in the 7^{th} National Cyber Olympiad *(2006)*
- **Represented India** at the 7^{th} Asian Physics Olympiad held at Almaty, Kazakhstan *(2006)*

Co-curricular Achievements

- 2^{nd} runner up in Science & Astronomy Quiz at the annual Institute Technical Festival *(2012)*
- Winner in wireless robotic soccer event, at the annual Institute Technical Festival *(2011)*
- Part of the Institute soccer team at Sangram, annual sports festival, IIT Roorkee *(2010)*

Leadership Experience

Maintenance Secretary, Hall Executive Committee, IIT Kanpur *(2011-12)*

- Presided hostel maintenance issues & managed the hostel employees' job allocation, wages & bonuses
- Managed the annual hostel budget of INR 100,000

Secretary, Fine Arts Club, IIT Kanpur *(2011-12)*

- Conducted street painting workshops & events for 100 people at Fine Arts Club
- Doubled the student participation as compared to the previous year

Volunteering Experience

NGO Volunteer, Project Aryabhat *(2007-10)*

- Volunteered for 4 years at Project Aryabhat, to create awareness about astronomy among students
- Conducted 6 telescope handling workshops for students in rural schools across the state