

Achin Jain

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Research Interests

Machine Learning, Optimization, Statistics and Control Theory applied to Cyber-Physical Systems

Education

- 07/15–today **University of Pennsylvania (UPenn)**, Philadelphia, U.S.A.
Ph.D. in Electrical and Systems Engineering GPA: 3.97/4
Thesis: Bridging Machine Learning and Controls for Cyber-Physical Systems
Advisors: Rahul Mangharam, Manfred Morari
- 08/16–today **Wharton School of Business**, Philadelphia, U.S.A.
Dual Master's Degree in Statistics GPA: 4/4
- 09/12–02/15 **Swiss Federal Institute of Technology (ETH) Zurich**, Switzerland.
Master of Science in Robotics, Systems and Control GPA: 5.80/6
Thesis: Optimal Control of a Hybrid Electric Vehicle with an Electrically Assisted Turbocharger
Advisors: Manfred Morari, Christopher Onder
- 07/08–05/12 **Indian Institute of Technology (IIT) Delhi**, India.
Bachelor of Technology in Mechanical Engineering GPA: 8.77/10
Thesis: Tele-operation through Brain Machine Interface (BMI)
Advisor: Sudipto Mukherjee

Research Experience

- 07/15–today **Real-time and Embedded Systems Lab, UPenn**, Philadelphia, U.S.A.
Graduate Research Assistant
Project 1: Data Predictive Control (DPC) for building control and volatile energy markets
Project 2: Interactive Analytics (IAX) using natural language interaction for energy dashboards
Project 3: Explaining black-box algorithms with local interpretability
- 07/14–12/14 **Daimler A.G.**, Stuttgart, Germany.
Master Thesis Student
Project: Optimal control of a hybrid electric vehicle with an electrically assisted turbocharger
- 04/14–12/14 **Institute for Dynamic Systems and Control, ETH Zurich**, Switzerland.
Master Thesis Student
Project: Optimal control of a hybrid electric vehicle with an electrically assisted turbocharger
- 09/13–02/14 **ABB Corporate Research**, Dättwil, Switzerland.
Intern at Control and Optimization Group
Project 1: Design optimization using surrogate functions of noisy and computationally expensive models
Project 2: Optimal power management of a wind farm considering wake effects
- 02/13–08/13 **Automatic Control Laboratory, ETH Zurich**, Switzerland.
Semester Thesis
Project: Design and tuning of Model Predictive Control for a wind turbine
- 05/12–07/12 **Arts et Métiers ParisTech**, Metz, France.
Visiting Researcher at Design, Manufacturing and Control Laboratory
Project: Optimal task placement of 6 DOF manipulator during friction stir welding
- 07/11–05/12 **Mechatronics Lab, IIT Delhi**, India.
Bachelor Thesis
Project: Tele-operation through Brain Machine Interface
- 08/09–05/12 **Formula Society of Automotive Engineers, IIT Delhi**, India.
Coordinator
Project: Design of suspension system and fabrication of formula-style racing car

Course Projects

- Fall 2016 **Machine Learning**, UPenn.
Project: Tweet Classification and Sentiment Analysis using Supervised and Semi-supervised Learning
- Spring 2016 **Advanced Robotics**, UPenn.
Project 1: Motion Planning, Trajectory Generation and Control for a Quadrotor
Project 2: Estimation of Pose and Velocity using Optical Flow and RANSAC
Project 3: Estimation of Pose and Velocity using Vicon/IMU and Error State Kalman Filter
- Fall 2015 **Real-time and Embedded Systems Lab**, UPenn.
Project: Development of Building Automation Design, Co-simulation Software: Matlab Energy Plus (MLE+)
- Spring 2013 **Recursive Estimation**, ETH Zurich.
Project: Extended Kalman Filter for Tracking a Three-Wheeled Robot
- Fall 2012 **Bio-Inspired Motor Control**, ETH Zurich.
Project: Spring Mass Running Model on Rough Terrains

Teaching

- Fall 2017 **Machine Learning**, CIS 520 UPenn.
Teaching Assistant
- Summer 2017 **Intro to Probability and Statistics**, ENM503 UPenn.
Teaching Assistant
- Spring 2017 **Model Predictive Control**, ESE619 UPenn.
Teaching Assistant
- Fall 2016 **Real-Time Embedded Systems**, ESE519 UPenn.
Instructor for lectures (2) on real-time control systems

Honors and Awards

- 2017 Selected for Amazon's 5th annual Graduate Research Symposium
- 2017 Travel Award for the 56th IEEE Conference on Decision and Control (CDC), Melbourne, Australia
- 2017 Energy Systems **Best Paper Award** at the 2017 IEEE American Control Conference (ACC), Seattle, WA
- 2016 3rd prize in CIS 520 Machine Learning Competition on Tweet Classification, UPenn
- 2016 **Best Presentation Award** at the 3rd ACM International Conference on Systems for Energy-Efficient Built Environments (BuildSys), Stanford University, CA
- 2016 Diversity Scholarship, PyData Chicago
- 2016 Selected for GE Student Research Summit
- 2016 Selected for French-American Doctoral Exchange (FADEX) on Cyber-Physical Systems, Grant from Office of Science and Technology, Embassy of France in the US
- 2015 **Master's Degree with Distinction** for scoring overall grade 5.75+, ETH Zurich
- 2012 **Swiss Government Excellence Scholarship** (ESKAS), ETH Zurich
- 2012 Scholarship by ParisTech Foundation
- 2012 BOSS Award for the **Best Experimental Bachelor Thesis**, IIT Delhi
- 2012 Samsung Innovation Award, finalist
- 2011-12 Undergraduate Scholarship, IIT Delhi
- 2008-09 Semester Merit Awards (2) for ranking in top 7% in the batch, IIT Delhi

Coursework

- Machine Learning Machine Learning, Reinforcement Learning, Online Methods in Machine Learning
- Probability & Statistics Theory of Probability, Mathematical Statistics, Applied Regression and Analysis of Variance, Applied Econometrics
- Optimization & Controls Convex Optimization, Model Predictive Control, Dynamic Programming and Optimal Control, Recursive Estimation, Systems Identification, Control Systems-II, Vehicle Propulsion Systems, Nonlinear Controls, Linear Systems Theory
- Miscellaneous Robotics, Advanced Robotics, Vehicle Propulsion Systems

Publications

Journals

- J3 F. Smarra*, **A. Jain***, T. Rubeis*, D. Ambrosini, A. D'Innocenzo, R. Mangharam. Data Predictive Control with Random Forests: Theory and Applications. *Applied Energy*, 2017 [under review]
- J2 **A. Jain**, T. Nüesch, C. Nägele, P. M. Lassus, C. H. Onder. Modeling & Control of a Hybrid Electric Vehicle with an Electrically Assisted Turbocharger. *IEEE Transactions on Vehicular Technology*, 2016 [pdf]
- J1 **A. Jain**, G. Schildbach, L. Fagiano, M. Morari. On the design and tuning of linear model predictive control for wind turbines. *Renewable Energy*, 80, 664-673, 2015 [pdf]

Conferences

- C7 **A. Jain***, T. X. Nghiem*, M. Morari, R. Mangharam. Learning and Control using Gaussian Processes. 9th ACM/IEEE International Conference on Cyber-Physical Systems (ICCPS), Porto, Portugal, 2018 [under review]
- C6 **A. Jain**, F. Smarra, R. Mangharam. Data Predictive Control using Regression Trees and Ensemble Learning. Conference on Decision and Control (CDC), Melbourne, Australia, 2017 [pdf]
- C5 **A. Jain**, M. Behl, R. Mangharam. Data Predictive Control for Building Energy Management. American Control Conference, Seattle, WA, USA, 2017 [pdf]
- C4 **A. Jain**, M. Behl, R. Mangharam. Data Predictive Control for Peak Power Reduction. 3rd ACM International Conference on Systems for Energy-Efficient Built Environments (BuildSys), Palo Alto, CA, USA, 2016 [pdf]
- C3 M. Behl, **A. Jain**, R. Mangharam. Data-Driven Modeling, Control and Tools for Cyber-Physical Energy Systems. IEEE 7th International Conference on Cyber-Physical Systems, Vienna, Austria, 2016 [pdf]
- C2 **A. Jain**, J. Qin, G. Abba. Optimal Work Placement for Robotic Friction Stir Welding Task. 3rd IFToMM International Symposium on Robotics and Mechatronics (ISRMM), Singapore, 2013 [pdf]
- C1 P. Ajay, P. Singhal, **A. Jain**, S. Mukherjee. Teleoperation through Brain Machine Interface. National Conference on Emerging Trends in Mechanical Engineering, Ghaziabad, India, 2012 [pdf]

Technical Reports and Thesis

- T3 **A. Jain**, K. Jang. Classification of Tweets using Supervised and Semisupervised Learning, CIS520 Machine Learning Competition, University of Pennsylvania, Philadelphia, PA, USA, 2016 [pdf]
- T2 **A. Jain**. Optimal Control of a Hybrid Electric Vehicle with an Electrically Assisted Turbocharger, Master's Thesis, ETH Zurich, Switzerland, 2014 [pdf]
- T1 J. Poland, **A. Jain**, K. So. Ordinal Regression for Meta-Modeling in Optimization. Technical Report, ABB Corporate Research, Switzerland, 2014 [available upon request]

*equal contribution

Talks

- Aug 2017 **Amazon, Bangalore** – Bridging Machine Learning & Controls for Volatile Energy Markets
- Aug 2017 **Flipkart Data Science, Bangalore** – Bridging Machine Learning & Controls for Volatile Energy Markets
- Aug 2017 **TCS Innovation Labs, Bangalore** – Bridging Machine Learning & Controls for Volatile Energy Markets
- May 2017 **Microsoft Research Redmond** – Data Predictive Control for Volatile Energy Markets [video]
- May 2017 **University of Washington, Seattle** – Data Predictive Control for Volatile Energy Markets
- Mar 2017 **PhD Colloquium, University of Pennsylvania** – Bridging the Gap Between Machine Learning and Predictive Control
- Jul 2016 **University of L'Aquila, Italy** – Data Predictive Control for Energy Cyber-Physical Systems
- Jul 2016 **French-American Doctoral Exchange, Grenoble** – Data Predictive Control for Energy Cyber-Physical Systems
- Feb 2016 **PhD Colloquium, University of Pennsylvania** – Optimal Control of a Hybrid Electric Vehicle with an Electrically Assisted Turbocharger
- Dec 2014 **Daimler AG, Stuttgart** – Optimal Control of a Hybrid Electric Vehicle with an Electrically Assisted Turbocharger

Technical Skills

Programming	Python, MATLAB, R, C, C++
Machine Learning	scikit-learn, TensorFlow, Keras, GPML, Pandas
Optimization	CPLEX, CVX, YALMIP, MPT, CasADi, CVXOPT, IPOPT
Modeling	Simulink, EnergyPlus, Modelica, SolidWorks, Ansys APDL/Workbench

Interests and Activities

Reviewer	American Control Conference, 2017 IEEE Transactions on Vehicular Technology, 2015 IEEE IET Control Theory and Applications, 2015 Foundations and Trends in Electronic Design Automation, 2015 Energies MDPI, 2015
Secretary	Society of Automotive Engineers (SAE) IIT Delhi, 2011-12
Coordinator	Suspension Department, Formula Racing Team IIT Delhi, 2010-11
Speaker	CAD Workshops, IIT Delhi, 2011