

Interests	My research interest lies at the intersection of machine learning, robotics and computer vision. Broadly, I build machine learning systems & algorithms for agents – such as robots, cars etc. – to learn from informative human signals at a large-scale. Most of my work has been in multi-modal sensor-rich robotic settings, for which I have developed sensory fusion deep learning architectures. I have developed and deployed algorithms on multiple robotic platforms (PR2, Baxter etc.), on cars, and crowd-sourcing systems.	
Education	Stanford University , California, USA (2014-Present)	Ph.D. student (visiting), Computer Science <ul style="list-style-type: none">• Advisor: Prof. Ashutosh Saxena and Prof. Silvio Savarese• Leading Brain4Cars and Machine Learning lead on RoboBrain.
	Cornell University , New York, USA (2012-2016 (Exptd))	Ph.D. student, Computer Science <ul style="list-style-type: none">• PhD committee: Ashutosh Saxena (advisor), Thorsten Joachims, Doug James, Robert Kleinberg, and Bart Selman.• Learning from large-scale human signals for robots and assistive cars• First author papers in NIPS, ICCV, SIGKDD, ICRA, ISRR, and IJRR
	Indian Institute of Technology Delhi , India (2007-2012)	B.Tech. Electrical Engineering & M.Tech. Information and Communication Technology <ul style="list-style-type: none">• Advisor: Prof. Manik Varma and Prof. S.V.N. Vishwanathan• Thesis: Large-scale Algorithms for Multiple Kernel Learning
Software	NeuralModels : A deep learning framework for quick prototyping of structures of Recurrent Neural Networks, Sensory-fusion architectures, and deep learning on graph structured data. Built on top of Theano. (Github URL)	
	Brain4Cars : A sensory-fusion architecture written in ROS for fusing multiple camera streams, tactile sensors, and GPS information. The package has integrated learning algorithms based on Bayesian networks for driver intention understanding and feature extraction modules. [Public URL coming soon after IP protection]	
	SPG-GMKL : Multiple kernel learning (MKL) with a million kernels. This is a generalized MKL tool kit based on spectral projected gradient. It can be used for optimizing arbitrary combination of kernels and regularizer. (Download page)	
Publications (in Chronological order)	A. Jain, A. R. Zamir, S. Savarese, and A. Saxena. Structural-RNN: Deep Learning on Spatio-Temporal Graphs In CVPR, 2016 (In review)	
	A. Jain, A. Singh, H. S. Koppua, S. Soh, and A. Saxena. Recurrent Neural Networks for Driver Activity Anticipation via Sensory-Fusion Architecture. In ICRA, 2016 (In review)	
	A. Jain, H. S. Koppua, B. Raghavan, S. Soh, and A. Saxena. Car That Knows Before You Do: Anticipating Maneuvers via Learning Temporal Driving Models. In ICCV, 2015	

A. Jain and A. Saxena. Brain4Cars: Sensory-Fusion Recurrent Neural Models for Driver Activity Anticipation
In BayLearn Symposium, 2015 (**Full Oral**)

A. Saxena, A. Jain, O. Sener, A. Jami, D. K. Misra and H. S. Koppula. RoboBrain: Large-Scale Knowledge Engine for Robots.
In ISRR, 2015.

A. Jain, S. Sharma, T. Joachims and A. Saxena. Learning Preferences for Manipulation Tasks from Online Coactive Feedback.
In IJRR, 2015.

A. Jain, D. Das, J. K. Gupta and A. Saxena. PlanIt: A Crowdsourcing Approach for Learning to Plan Paths from Large Scale Preference Feedback.
In ICRA, 2015

H. S. Koppula, A. Jain and A. Saxena. Anticipatory Planning for Human-Robot Teams.
In ISER, 2014.

A. Jain, B. Wojcik, T. Joachims and A. Saxena. Learning Trajectory Preferences for Manipulators via Iterative Improvement.
In NIPS, 2013.

A. Jain, S. Sharma and A. Saxena. Beyond Geometric Path Planning: Learning Context-Driven Trajectory Preferences via Sub-optimal Feedback.
In ISRR, 2013.

A. Jain, S. V. N. Vishwanathan and M. Varma. SPG-GMKL: Generalized multiple kernel learning with a million kernels.
In SIGKDD, 2012.

Research in Popular Press

- Brain4Cars appeared on CNN technology front page and Discovery News. (2015)
- Interviewed by MIT Technology Review for Car that knows before the driver makes a mistake. (2015)
- RoboBrain covered by The New York Times, Wired, and MIT Technology Review. (2014)
- Interviewed by BBC World News prime time show *Click* for building robots for supermarkets. Broadcasted to millions of viewers. (2014)
- Research video on Teaching Robots from Human Signals received more than 100,000 hits on YouTube in less than 24 hours. Research covered by Discovery Channel, FOX News, IEEE Spectrum, Techcrunch and many others. (2013)
- One of two students selected from IIT Delhi to present at the Indo-German Winter Academy on semiconductor device physics and fabrication. (2010)
- Director's Merit Award IIT Delhi, for highest semester grade point (2010)
- Summer Undergraduate Research Award, IIT Delhi, for embedded systems project on: Design and development of low cost optical densitometer for rural paramedics (2009)

Projects 2012-Present

Brain4Cars: Deep Learning and Perception for Smart Car Cabins (2014 - Present)
Project lead: <http://www.brain4cars.com>

- Integrated car cabin with an array of cabin sensors (cameras, tactile sensors, wearable devices, etc.) in order to extract valuable statistics about the driver.
- Developed sensory-fusion deep learning architecture for fusing information from multiple sensors in order to predict the driver's future maneuvers.

RoboBrain: Massive Knowledge Graph for Robots (2014 - Present)

Leading PhD student: <http://robobrain.me>

- Developed machine learning algorithms for knowledge graph combining multi-modal data from Natural Language, Vision, 3D-perception and Robot trajectories
- Conceptualized & built the distributed system architecture for managing multi-modal data, learning from crowd-sourcing feedback and visualizing the knowledge graph.
- Leading the project on major fronts: complete software stack, knowledge graph building, crowd-sourcing feedback and probabilistic beliefs on graph

PlanIt: A Crowd-sourcing Approach for Learning to Plan Paths

- Built a machine learning system to teach robots good trajectories from crowd-sourcing feedback. Project webpage: <http://planit.cs.cornell.edu>
- Modeled user feedback as a generative process with latent user intentions

Beyond Geometric path planning: Path planning in context

- Developed an algorithm to learn user preferences over robot trajectories from sub-optimal coactive feedback
- Deployed the algorithm on PR2 and Baxter robotic platforms and trained them for various household-chores and grocery checkout tasks
- Received substantial attention from popular press such as FOX News, IEEE Spectrum, Techcrunch, Discovery Channel and many others

SPG-GMKL: Multiple kernel learning (MKL) with Millions of kernels

- Developed MKL algorithm that scaled to Millions of kernels on UCI data sets
- The released software package is being used by many research groups

Professional Experience

Purdue University, USA (Summer 2011)

Research Intern, Statistics Department with Prof. S. V. N. Vishwanathan

- Developed Multiple Kernel Learning algorithms to scale to Millions of kernels

The Royal Bank of Scotland, India (Summer 2010)

- Developed software to automate testing of web application GUI

Mentoring

Led more than 20 Master and Undergraduate students from Cornell and Stanford University. Building the teams for Brain4Cars and RoboBrain. Below are few outstanding students.

Vaibhav Aggarwal (won **Cornell ELI 2014 award** for his work on PlanIt)

Debarghya Das, 2014 - Full year (now at Facebook)

Jayesh Gupta, Summer 2014 Intern from IIT Kanpur, India (now PhD Stanford)

Shikhar Sharma, Summer 2013 Intern from IIT Kanpur, India (now PhD U of Toronto)

Brian Wojcik, Spring 2013 (now at Microsoft)

Bharad Raghavan, 2014 - Present, MS at Stanford

Shane Soh, 2014 - Present, MS at Stanford

Avi Singh, 2015 - Present, Summer Intern from IIT Kanpur

Siddhant Manocha, 2015 - Present, Summer Intern from IIT Kanpur

Arpit Agarwal, 2015 - Present, Summer Intern from IIT Kanpur