Kaushik Subramanian

Contact Information

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Research Objectives

To perform research in the field of Interactive Machine Learning with the goal of designing learning algorithms that can efficiently interact with humans and/or utilize information from them to solve real-world problems.

Academic Qualifications

Georgia Institute of Technology, USA — August 2010 - Present
Doctor of Philosophy in Computer Science

Rutgers, The State University of New Jersey, USA — August 2008 - May 2010
Master of Science in Electrical and Computer Engineering

Anna University, India — July 2004 - May 2008
Bachelor of Engineering in Electrical and Communication Engineering

Research Experience

Intern in the CUE research group at Microsoft Research, Redmond, USA — June 2011 - August 2011
Completed a 3 month internship on applying machine learning algorithms to large scale datasets on human muscle activity.

Research Assistant in the pFunk Machine Learning Lab, GAtech. — August 2010 - Present

Research Assistant in the Socially Intelligent Machines Lab (SIM), GAtech. — August 2010 - Present

Adjunct Member of the Real Life Reinforcement Learning Lab (RL^3), Rutgers. — January 2009 - May 2010

Intern at RWTH Aachen University, Germany — June 2009 - August 2009
Completed a 3 month internship on robot learning from demonstration using gaussian mixture models.

Intern at Texas Instruments, India — May 2008 - July 2008
Completed a 3 month internship focusing on data compression algorithms in video encoding standards.

Research Trainee at WAran Research FoundaTion, India — June 2006 - May 2008
Completed a 2 year research training program with specialization in signal processing.

Teaching Experience

Teaching Assistant for CS4641, Machine Learning by Prof. Charles Isbell — Spring 2012

Masters Dissertation

"*HELP - Human assisted Efficient Learning Protocols*" - an analysis into the effect of human interactions on learning algorithms, with focus on methods like learning by demonstration and apprenticeship learning.
Advisor - Prof. Michael Littman

Publications

Monica Babes, Vukosi Marivate, Kaushik Subramanian, Michael L. Littman: *Apprenticeship Learning about Multiple Intentions.* Appeared in ICML 2011, Bellevue, Washington, USA, June 2011.

Thomas J. Walsh, Kaushik Subramanian, Michael L. Littman, Carlos Diuk: *Generalizing Apprenticeship Learning across Hypothesis Classes.* Appeared in ICML 2010, Haifa, Israel, June 2010.

Workshops

Kaushik Subramanian, Andrea Thomaz, Charles Isbell: *Learning Options through Human Interaction.* Appeared in the ALIHT Workshop, IJCAI 2011, Barcelona, Spain, July 2011.

Kaushik Subramanian: *Task Space Behavior Learning for Humanoid Robots using Gaussian Mixture Regression.* Appeared in AAAI 2010, Atlanta, USA, July 2010.

Technical Reports

Baris Akgun, Kaushik Subramanian, Jaeeun Shim, Andrea Thomaz : *Learning Tasks and Skills Together From a Human Teacher.* Appeared in AAAI 2011, San Francisco, USA, August 7th 2011.

Kaushik Subramanian and Michael Littman: *Efficient Apprenticeship Learning with Smart Humans.* Appeared in AAAI 2010, Atlanta, USA, July 2010.

Projects in Progress

Automatic Feature Construction (GAtech) January 2012
Using neural networks to extract non-linear relationships present in data to generate features useful for supervised learning algorithms. This is achieved by modifying the network to take into account the characteristics of the chosen learner. An exploration into such methods will greatly enhance the learning algorithm and also reduce the burden on the human to design useful features. *Advisor - Prof. Charles Isbell and Prof. Andrea Thomaz*

Using Action Abstractions to enhance Monte Carlo Tree Search (GAtech) September 2011
Developed an automatic way of leveraging human input to acquire task decompositions. These can be used as pruning heuristics and rollout policies to assist Monte Carlo Tree Search. They were applied to game-based domains - PacMan. The enhanced MCTS approach outperforms standard approaches in terms of optimality of the solution by 35%. *Advisor - Prof. Charles Isbell and Prof. Andrea Thomaz*

Completed Projects

Learning Task Attributes from Human Interaction (GAtech) May 2011
Used supervised learning algorithms like kNN and GMMs, to learn relevant attributes for a simulated animal classification and a robot table clean-up task. The algorithm utilized human interaction to instantiate the attributes that aided complex concept learning and increased overall task efficiency. *Advisor - Prof. Andrea Thomaz*

MDP-based Planning for a Table-top Search and Find Task (GAtech) December 2010
A novel tree-based task representation was developed to perform table-top search of occluded objects. The problem was modeled as a POMDP and solved to acquire the set of actions that lead to efficient object retrieval. *Advisor - Prof. Mike Stilman*

AAAI 2010 *Learning by Demonstration Challenge* (GAtech) July 2010
A live demonstration was performed of the "Taxi Task" using Apprenticeship Learning. A Mindstorms^{TM}Lego robot was navigated through a discrete world and it was allowed to build a model of the environment. The robot was able to learn the optimal policy from a single demonstration. *Advisor - Prof. Michael Littman*

Interactive Learning with the Highway Car Domain (RL^3 Lab) December 2009
A novel approach was developed where the humans provides high-level state abstractions to learn the task of navigating on a simulated highway. The criteria used by the human was - "states are similar if the same optimal action is to performed in both the states". The interactive abstraction significantly sped-up the performance of the agent. *Advisor - Prof. Michael Littman*

Robot Learning by Demonstration using GMM's (KBSG Lab, RWTH University) July 2009
A behavior acquisition model was developed for the Nao's using Gaussian Regression. After generalizing the kinesthetic demonstrations, the robot was used to imitate constrained reaching gestures. *Advisor - Prof. Gerhard Lakemeyer*

Best Narration Award - Introduction to Reinforcement Learning (RL^3 Lab) April 2009
The Lego Mindstorms was programmed to learn real-time in a deterministic environment and to build a model of the world using concepts of Graph Search and Dynamic Programming. A video tutorial was submitted to IJCAI 2009. *Advisor - Prof. Michael Littman*

Autonomous Object Recognition using Corner Detection (Rutgers) December 2008
Object Recognition implemented using corner descriptors and geometric point matching methods. The advantage of the system was the reduced number of descriptor points as compared to the traditional approaches (SIFT algorithm). *Advisor - Prof. Lawrence Rabiner*

Parallel Particle Swarm Optimization (Rutgers) December 2008
Parallel implementation of the Particle Swarm Optimization (PSO) algorithm using MPI. Performed a comparative analysis with the sequential algorithm and evaluated its application for multi-agent systems. *Advisor - Prof. Manish Parashar*

Mobile Video Reference Data Compression (TI) July 2008
Developed signal transform based techniques using *C* to compress the videos captured using mobile phones. This technique was implemented in the H.264 standard. *Advisor - Dr. Ajit Gupte*

Computing Skills

Programming - Python, Matlab, C++, Java
Softwares - ROS, OpenCV, Weka, R Statistical toolkit
Operating Systems - Unix and Windows