

Sriraam Natarajan
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Research Interests

Artificial Intelligence, Machine learning with emphasis on Statistical Relational Learning, Reinforcement Learning, Bayesian Networks and Bio-Medical Applications

Education

Doctor of Philosophy, Computer Science
Oregon State University Nov 2007
Major Advisor: Dr. Prasad Tadepalli

Master of Science, Computer Science
Oregon State University June 2004

Bachelor of Science, Computer Science
University of Madras, Chennai, INDIA April 2001

Research Experience

Research Associate
Department of Computer Science
University of Wisconsin, Madison Jan 2008 – Present

- Co-leading the research on extracting information from online biological texts to answer specific queries. My goal is to design efficient statistical relational learning inference algorithms to query very large knowledge bases.
- Co-leading the research on developing an "intelligent student". The aim is to build a student that learns from the teacher using several different machine learning methods. My goal in this project is to use inductive logic programming methods to specify prior knowledge to the agent (student) to accelerate learning.
- Exploring the use of statistical relational learning models for Bio-Medical applications such as predicting adverse drug reactions and personalized predictive medicines for patients. Currently working on submitting a NIH grant proposal for the same.
- Developing efficient inference algorithms for statistical relational learning models that can scale in the presence of a large number of objects and relations in the domain.

Student Associate
SRI International Jun 2007– Sept 2007

Developed a model that combines ideas from Statistical Relational Learning and Hierarchical Plan recognition to build a Logical Hierarchical Hidden Markov Model that is obtained from a model of the user's work flow. Designed an inference algorithm to predict the user's goals given the user's actions. Evaluated the system on a real world desktop assistant (CALO).

- Assistantship Learning: Developing a model for an intelligent assistant that can learn to assist a user in a rich environment. Formulated the problem of learning to assist as a POMDP with the hidden states being user's goal structure and developed approximate techniques for solving the POMDP. The model uses a relational hierarchical structure to track the user's progress towards the goal. This research spanned several areas of learning such as dynamic probabilistic models, decision theory and relational models.
- Statistical Relational Learning: Designed a probabilistic relational language to enable the domain expert to express prior knowledge about the domain and developed learning algorithms for learning the parameters of these rules. Evaluated the algorithms on two domains: A synthetic domain and a folder prediction task to predict the folder of a document given its attributes.
- Average Reward Reinforcement Learning: Considered the problem of learning in the presence of time-varying preferences among multiple objectives. Proposed a method that stores a finite number of policies, chooses an appropriate policy for any weight vector and improves upon it. Performed experiments in a grid-world domain and a network routing Domain. Was instrumental in extending this to include hierarchies.

Teaching Experience

Teaching Assistant, Department of Computer Science
Oregon State University

Sep 2004-Nov 2004

- Instructor, Introduction to Databases Summer 2002: Gave lectures on ER diagrams, relational schema, SQL Queries and programming in PHP. Designed course assignments, projects and exams. Handled a class of 20 students.
- Graduate Teaching Assistant, September 2001- June 2003: Was a teaching assistant for Introduction to programming in C, Introduction to databases and graduate level courses – Algorithms and Data Structures and Theory of Computation and Automata.

Relevant Publications

Book

- Sriraam Natarajan. *Intelligent Assistants - A Decision-Theoretic Model*. VDM-Verlag 2009.

Journal Papers & Book Chapters

- Sriraam Natarajan, Prasad Tadepalli, Thomas G. Dietterich and Alan Fern. *Learning First-Order Probabilistic Models with Combining Rules*. Annals of Mathematics and AI, Special Issue on Probabilistic Relational Learning 2008.
- Neville Mehta, Sriraam Natarajan, Prasad Tadepalli and Alan Fern. *Transfer in Variable Reward Hierarchical Reinforcement Learning*. Invited contribution to Machine Learning Journal, Springer Verlag publications, 2008.
- Alan Fern, Sriraam Natarajan, Kshitij Judah and Prasad Tadepalli, *A Decision theoretic model of Assistance*, Journal Of Artificial Intelligence Research (JAIR) – Submitted.

- Sriraam Natarajan, Prasad Tadepalli and Alan Fern. *A Relational Hierarchical Model of Decision-Theoretic Assistance*, Transactions on Autonomous and Adaptive Systems– Under Review
- Sriraam Natarajan, Prasad Tadepalli and Alan Fern. *Exploiting Prior Knowledge in Decision-Theoretic Intelligent Assistance*, Invited Contribution Interdisciplinary Advances in Adaptive and Intelligent Assistant Systems: Concepts, Techniques, Applications and Use – Under Review

Rigorously reviewed Conference Papers

- Sriraam Natarajan, Gautam Kunapuli, Kshitij Judah, Prasad Tadepalli, Kristian Kersting and Jude Shavlik, *Multi Agent Inverse Reinforcement Learning*, AISTATS 2010 – Submitted.
- Sriraam Natarajan, Gautam Kunapuli, David Page, Richard Maclin and Jude Shavlik. *More Natural Human-Machine Interaction Via the Use Of Machine Learning*. International Conference on Intelligent User Interfaces 2009 - Submitted.
- Sriraam Natarajan, Prasad Tadepalli, Gautam Kunapuli and Jude Shavlik. *Learning Parameters for Relational Probabilistic Models with Noisy-Or Combining Rule*, International Conference on Machine Learning and Applications 2009.
- Sriraam Natarajan, Gautam Kunapuli, Ciaran O' Reilly, Rich Maclin, Trevor Walker, David Page, and Jude Shavlik *ILP for Bootstrapped Learning: A Layered Approach to Automating the ILP Setup Problem* , International Conference on Inductive Logic Programming 2009.
- Kristian Kersting, Babak Ahmadi, Sriraam Natarajan. *Counting Lifted Belief Propagation*, UAI 2009.
- Jude Shavlik, Sriraam Natarajan. *Speeding up Markov Logic Networks in Markov Logic Networks By Preprocessing to Reduce the Size of the Resulting Grounded Network*, IJCAI 2009.
- Sriraam Natarajan, Hung H.Bui, Prasad Tadepalli, Kristian Kersting, Weng-Keen Wong. *Logical Hierarchical Hidden Markov Models for User Activity Recognition*, International Conference on Inductive Logic Programming 2008.
- Sriraam Natarajan, Prasad Tadepalli and Alan Fern. *A Relational Hierarchical Model of Decision-Theoretic Assistance*. Proceedings of the International Conference on Inductive Logic Programming, (ILP 2007), Corvallis USA.
- Alan Fern, Sriraam Natarajan, Kshitij Judah and Prasad Tadepalli, *A Decision theoretic model of Assistance*, Proceedings of The International Joint Conference in Artificial Intelligence (IJCAI 2007) Hyderabad India.
- Sriraam Natarajan and Prasad Tadepalli. *Dynamic Preferences in Multi-Criteria Reinforcement Learning*. Proceedings of The 22nd International Conference on Machine Learning (ICML 2005) Bonn, Germany.
- Sriraam Natarajan, Prasad Tadepalli, Eric Altendorf, Thomas G. Dietterich, Alan Fern and Angelo Restificar. *Learning First-Order Probabilistic Models with Combining Rules*. Proceedings of The 22nd International Conference on Machine Learning (ICML 2005) Bonn, Germany.

Workshop and Symposia Papers

- Sriraam Natarajan, Prasad Tadepalli Gautam Kunapuli and Jude Shavlik. *Knowledge Intensive Learning: Directed vs. Undirected SRL Models*. International Workshop in SRL 2009.

- Rodrigo De Salvo Braz, Sriraam Natarajan, Hung Bui, Jude Shavlik, and Stuart Russell. *Anytime Lifted Belief Propagation*. International Workshop in SRL 2009.
- Sriraam Natarajan, Irene Ong, David Haight, David Page, Vitor Santos Costa. *Modeling Temporal Biomedical Data by SRL*, ECML workshop on Bio-Medical Applications using SRL, 2008.
- Sriraam Natarajan, Kshitij Judah, Prasad Tadepalli and Alan Fern. *A Decision-Theoretic Model of Assistance - Evaluation, Extensions and Open Problems*, AAAI 2007 Spring Symposium on Interaction Challenges for Intelligent Assistants, Stanford University, USA.
- Sriraam Natarajan, Prasad Tadepalli and Alan Fern. *Exploiting prior knowledge in Intelligent Assistants - Combining relational models with hierarchies*, Extended Abstract in the Proceedings of the Dagstuhl Seminar on Probabilistic, Logical and Relational Learning - A Further Synthesis, (2007).
- Sriraam Natarajan and Eric Altendorf. *First Order Conditional Influence Language*. Technical Report CS05-30-01 September 2005.
- Alan Fern, Sriraam Natarajan, Kshitij Judah and Prasad Tadepalli, *A Decision theoretic model of Assistance*, Modeling Others from Observations workshop in AAAI 2006.
- Sriraam Natarajan, Weng-Keen Wong and Prasad Tadepalli, *Structure Refinement in First Order Conditional Influence Language*, Open Problems in Statistical Relational Learning, ICML 2006.
- Neville Mehta, Sriraam Natarajan, Prasad Tadepalli and Alan Fern. *Transfer in Variable Reward Hierarchical Reinforcement Learning*. Inductive Transfer NIPS workshop 2005.
- Lisa Torrey, Jude Shavlik, Sriraam Natarajan, Pavan Kuppilli and Trever Walker. *Transfer in Reinforcement Learning via Markov Logic Networks*. AAAI workshop on Transfer Learning for Complex Tasks 2008
- Hung Bui, Federico Cesari, Daniel Elenius, David Morley, Sriraam Natarajan, Shahin Saadati, Eric Yeh, and Neil Yorke-Smith. *A Context-Aware Personal Desktop Assistant*. Demonstrations track of Autonomous Agent and MultiAgent Systems, 2008.

Reports

- Sriraam Natarajan. *Effective Decision-Theoretic Assistance Through Relational Hierarchical Models*. PhD Dissertation, Oregon State University. Winter 2008. Advisor: Prasad Tadepalli.
- Sriraam Natarajan. *A Study of Probabilistic Logic Frameworks*. PhD Qualifiers Examination. Fall 2004.
- Sriraam Natarajan. *Multi-Criteria Average Reward Reinforcement Learning*. MS-Thesis. Spring 2004. Advisor: Prasad Tadepalli.

Talks and Posters

- *Efficient Inference in Probabilistic Logic Models*, Invited CS Departmental Colloquium, Oregon State University, August 2009
- *Intelligent Assistants - A Decision-Theoretic Model*, AIC seminar, SRI International June 2007
- *Exploiting prior knowledge in Intelligent Assistants – Combining relational models with hierarchies*, Dagstuhl Seminar on Probabilistic, Logical and Relational Learning – A Further Synthesis, Germany April 2007
- *A Decision-Theoretic Model of Assistance*, , Invited CS Departmental Colloquium Indian Institute of Technology, August 2006

- *Structure Learning in Relational Models*, , Invited CS Departmental Colloquium Indian Institute of Technology, August 2006
- *Learning in First-Order Probabilistic Models*, , Invited CS Departmental Colloquium Indian Institute of Technology, August 2005

Services

- *Co-chair* of Statistical Relational AI workshop at AAAI with Stuart Russell (Berkeley), Leslie Kaebbling (MIT), Kristian Kersting (Fraunhofer, Germany) Alon Halevy (Google) and Lily Mihalkova (UMD)
- Program Committee member ICML 08, 09, IJCAI 09, AAAI 08, Discovery Sciences 09
- In charge of the Proceedings of the 2007 Dagstuhl Seminar on Probabilistic, Logical and Relational Learning - A Further Synthesis
- Student Volunteer for ILP/ICML 2007

Professional Reviewing

- ACM transaction on Knowledge Discovery from Data
- Machine Learning Journal
- ILP 2007
- Proposal for a book on *Inductive transfer in Machine learning*, Springer-Verlag
- Indian International Conference on Artificial Intelligence, 2003

References:

Available upon request.