Stephen Giguere

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Research Interests

Optimization
- Differential Geometry
- Manifold Optimization
- Constrained Optimization
- Subspace Learning

Machine Learning
- Neural Network Structure Learning
- Deep Learning
- Representation Learning
- Transfer Learning

Education

In Progress — **Computer Science (Ph.D)**, *University of Massachusetts, Amherst, MA*
Passed Ph.D candidacy exam with distinction. Advised by Sridhar Mahadevan

May 2016 — **Computer Science (M.S.)**, *University of Massachusetts, Amherst, MA*
Advised by Sridhar Mahadevan

September 2012 — **Computer Science (B.S.)**, *University of Massachusetts, Amherst, MA*
Recipient of Outstanding Achievement in Computer Graphics

Experience

Jan. 2016 - Current — **Research Assistant at UMass, Amherst, MA**
Applications of Differential Geometry to Machine Learning
We are investigating ideas for applying differential geometry to model data, enforce constraints and learn representations. We proposed a new manifold that captures the geometry of a general class of orthogonality constraints, which we then applied to the problems of multiple-dataset analysis and domain adaptation. Advisor: Sridhar Mahadevan

May 2014 - Dec. 2016 — **Research Assistant at UMass, Amherst, MA**
Machine Learning for Preprocessing of Spectroscopic Data
Developed a system that automatically constructs and optimizes preprocessing methods to maximize the predictive accuracy of downstream models. Joint work with the Department of Astronomy at Mount Holyoke College. Advisors: Sridhar Mahadevan, M. Darby Dyar

Jan. 2013 - May 2014 — **Research Assistant at UMass, Amherst, MA**
Optimization for Reinforcement Learning
Researched and helped develop reinforcement learning (RL) algorithms by applying concepts from optimization. Projects included learning skills from demonstration for robotics applications, as well as developing RL algorithms that respect problem-specific safety constraints. Advisor: Sridhar Mahadevan

Sep. 2012 - Jan. 2013 — **Research Assistant at UMass, Amherst, MA**
3D Shape Construction
Helped develop a method for constructing and editing 3D shapes based on semantic shape characteristics, such as how "fast" the shape appears. Advisor: Evangelos Kalogerakis

May 2012 - Sep. 2012 — **Research Assistant at UMass, Amherst, MA**
Sampling Methods for Computer Graphics
Investigated methods for sampling positions on surfaces with user-defined spectral characteristics. Advisor: Rui Wang

Jan. 2008 - Mar. 2010 — **ASSISTments.org at Worcester Polytechnic Institute, MA**
Data Mining for Student Behavior Inference, Web Development
Applied a dynamic Bayesian network to predict student engagement while using an online tutoring system. Developed and maintained several features of the tutoring system's web interface. Advisors: Neil Heffernan, Joseph Beck

Publications

A Manifold Approach to Learning Mutually Orthogonal Subspaces
Giguere, S., Garcia, F. and Mahadevan, S. arXiv: 1608.07888, 2017.

A Fully Customized Baseline Removal Framework for Spectroscopic Applications
Giguere, S., Boucher, T., Carey, C., Mahadevan, S. and Dyar, M.D. Applied Spectroscopy, (in press).

An Optimization Perspective on Baseline Removal for Spectroscopy
Giguere, S., Carey, C., Boucher, T., Mahadevan, S. and Dyar, M.D. IJCAI Workshop on AI in Space, 2015.

Manifold Learning for Regression of Mars Spectra
Boucher, T., Carey, C., Giguere, S., Mahadevan, S., Dyar, M.D., Clegg, S. and Wiens, R.
IJCAI Workshop on AI in Space, 2015.

Automatic Whole-Spectrum Matching
Carey, C., Boucher, T., Giguere, S., Mahadevan, S. and Dyar, M.D. IJCAI Workshop on AI in Space, 2015.

Proximal Reinforcement Learning: A New Theory of Sequential Decision Making in Primal-Dual Spaces Mahadevan, S., Liu, B., Thomas, P. S., Dabney, W., Giguere, S., Jacek, N., Gemp, I., Liu J. Arxiv 2014.

Basis Adaptation for Sparse Nonlinear Reinforcement Learning
Mahadevan, S., Giguere, S., and Jacek, N. AAAI 2013.

Projected Natural Actor-Critic
Thomas, P., Dabney, W., Mahadevan, S., and Giguere, S. NIPS 2013.

AttribIt: Content Creation with Semantic Attributes
Chaudhuri, S., Kalogerakis, E., Giguere, S., and Funkhouser, T. UIST 2013.

Contextual Slip and Prediction of Student Performance after Use of an Intelligent Tutor
Baker, R.S., Corbett, A., Gowda S., Wagner, A., MacLaren, A., Kauffman, L., Mitchell, A., and Giguere, S. UMAP 2010.

Analyzing Student Gaming with Bayesian Networks
Giguere, S., Beck, J., and Baker, R.S. Intelligent Tutoring Systems 2010.

Awards

Outstanding Synthesis Award, 2017, awarded by the University of Massachusetts for the project *"A Fully Customized Baseline Removal Framework for Spectroscopic Applications"*.
Ph.D Qualifying Portfolio with Distinction, 2016, awarded by the University of Massachusetts for excellence in coursework, research contributions, and service.
Outstanding Achievement Award in Computer Graphics, 2012, awarded by the University of Massachusetts for undergraduate work on sampling for photorealistic rendering.