Jacob Rafati

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Research Interests

- Machine Learning
- Deep Learning
- Numerical Optimization Methods
- Reinforcement Learning
- Artificial Intelligence

Education

- **University of California, Merced**, Merced, CA (2013 – 2019)
  Ph.D. in Electrical Engineering and Computer Sciences.
- **Sharif University of Technology**, Tehran, Iran, (2008 - 2010)
  M.Sc. in Mechanical Engineering.
- **Sharif University of Technology**, Tehran, Iran, (2003 - 2007)
  B.Sc. in Mechanical Engineering.

Recent Projects

- **Ph.D. Dissertation** "**Learning Representations in Reinforcement Learning**" (2014-2019)
- **Learning Representations in Model-Free Hierarchical Reinforcement Learning**.
- **Learning Sparse Representations of state in Reinforcement Learning**.
- **Trust-region Optimization in Deep Learning**.
- **Quasi-Newton Optimization in Deep Reinforcement Learning**.
- **Improving initialization of BFGS Matrices**.
- **Neural Network compressions in deep learning**.
- **Optical flow and edge detection to detect interesting objects when learning video games**.

Past Projects

- **M.Sc. Thesis** "Stability Analysis of hybrid nanotubes based on the nonlocal continuum theories" (2008-2010).
- **B.Sc. Thesis** "Dynamical simulation of a wagon passing upon a symmetrical non-smooth rail and obtaining the wearing stresses" (2005-2006).

Work Experiences

- **Ph.D. Graduate Student Researcher**. Computational Cognitive Neuroscience Laboratory. Electrical Engineering and Computer Science. University of California, Merced. (June 2014 - 2019)
- **Graduate Teaching Assistant** for computer science courses (2013 - 2018). UC Merced.
- **M.Sc. Graduate Student Researcher**. Sharif University of Technology. (2008 - 2010)
- **Mechanical Engineer**. Iran Powerplant Development Company. (2009 - 2012).

Technical Skills

- Programming Languages: `Python`, `MatLab`, `Java`, `C++`, `C#`, `Javascript`, `Bash`.
- Machine Learning Libraries: `TensorFlow`, `Keras`, `scikit-learn`, `PyTorch`.
- High Performance Computing on CPU Clusters and GPU using AWS.

Publications from Ph.D. Dissertation

PUBLICATIONS

- **Jacob Rafati**. (2019). Learning Representations in Reinforcement Learning. Ph.D. dissertation. University of California, Merced. USA.
- **Jacob Rafati**, David C. Noelle. (2019). Unsupervised Subgoal Discovery Method for Learning Hierarchical Representations. *7th International Conference on Learning Representations, ICLR 2019 Workshop on "Structure & Priors in Reinforcement Learning", New Orleans, LA, USA.*
- **Jacob Rafati**, David C. Noelle. (2019). Learning Representations in Model-Free Hierarchical Reinforcement Learning. *33rd AAAI Conference on Artificial Intelligence, Honolulu, HI.*
- **Jacob Rafati**, David C. Noelle. (2019). Unsupervised Methods For Subgoal Discovery During Intrinsic Motivation in Model-Free Hierarchical Reinforcement Learning. *AAAI (2019) workshop on Knowledge Extraction From Games.*
- **Jacob Rafati**, Roummel F. Marcia. (2019). Deep Reinforcement Learning via L-BFGS Optimization. Preprint at `https://arxiv.org/abs/1811.02693`.
- **Jacob Rafati**, and David C. Noelle (2019). Learning Representations in Model-Free Hierarchical Reinforcement Learning. Preprint at `https://arxiv.org/abs/1810.10096`.
- **Jacob Rafati**, Roummel F. Marcia. (2018). Improving L-BFGS Initialization For Trust-Region Methods In Deep Learning. *17th IEEE International Conference on Machine Learning and Applications, Orlando, FL.*
- **Jacob Rafati**, Omar DeGuchy, and Roummel F. Marcia (2018). Trust-Region Minimization Algorithms for Training Responses (TRMinATR): The Rise of Machine Learning Techniques. *26th European Signal Processing Conference (EUSIPCO 2018), Rome, Italy.*
- **Jacob Rafati**, David C. Noelle. (2017). Sparse Coding of Learned State Representations in Reinforcement Learning, *1st Cognitive Computational Neuroscience Conference, New York City, NY.*
- **Jacob Rafati**, David C. Noelle. (2015). Lateral Inhibition Overcomes Limits of Temporal Difference Learning, *37th Annual Meeting of Cognitive Science Society, Pasadena, CA.*

Publications from M.Sc. Dissertation

- **Jacob Rafati**, Mohsen Asghari and Sachin Goyal. (2014) Effects of DNA Encapsulation on Buckling Instability of Carbon Nanotube based on Nonlocal Elasticity Theory. *Proceedings of the ASME 2014 14th International Design Engineering Technical Conferences and Computers and Information in Engineering Conference. Buffalo, New York, USA.*
- Mohsen Asghari, **Jacob Rafati**, and Reza Naghdabadi. (2013). Torsional Instability of Carbon Nano-Peapods based on the Nonlocal Elastic Shell Theory. *Physica E: Low-dimensional Systems and Nanostructures*, 47: p. 316-323.
- Mohsen Asghari, Reza Naghdabadi, and **Jacob Rafati**. (2011). Small Scale Effects on the Stability of Carbon Nano-Peapods under Radial Pressure, *Physica E: Low-dimensional Systems and Nanostructures*, 43(5): p. 1050-1055.
- Mohsen Asghari, **Jacob Rafati**. (2010). Variational Principles for the Stability Analysis of Multi-Walled Carbon Nanotubes Based on a Nonlocal Elastic Shell Model, *ASME 2010 10th Biennial Conference on Engineering Systems Design and Analysis (ESDA2010).*
- **Jacob Rafati**. (2010). Stability Analysis of hybrid nanotubes based on the nonlocal continuum theories. M.Sc. Thesis. Sharif University of Technology. Tehran, Iran.

Talks

- "Quasi-Newton Optimization in Large-scale Machine Learning". (April 2019), CalTech.
- "Learning Representations in Reinforcement Learning". (April 2019). Ph.D. dissertation defense.
- "Unsupervised Methods for Subgoal Discovery". (January 2019). AAAI KEG workshop. Honolulu.
- "Trust-Region Methods In Deep Learning". (2018). ICMLA Conference, Orlando.
- "Optimization Methods in Deep Reinforcement Learning". (2018). EECS Technical Seminar Series.
- "Hierarchical Reinforcement Learning". (2018). SIAM Graduate Student Chapter Seminar.
- "State Representations in Reinforcement Learning". (2017). EECS Technical Seminar Series.

Honors & Awards

- University of California, Merced Graduate Dean's Dissertation Fellowship (Fall 2018)
- AAAI Travel Schoalrship Award (2019)
- ICLR Travel Schoalrship Award (2019)
- University of California, Merced Graduate Excel Peer Mentorship Program Fellowship (Fall 2018)
- UC Merced EECS Bobcat Fellowships (2014 – 2019)
- Best Student Paper Award from Iran Nanotechnology Council (2011,2013)
- **Ranked 131$^{\mathbf{st}}$** in the Iranian National Entrance Exam for Graduate Admission (2007)
- **Ranked 141$^{\mathbf{st}}$** in the Iranian National University Entrance Exam among 350,000 Participants (2003)

Societies & Membership

- Member of Institute of Electrical and Electronics Engineers (IEEE)
- Member of Association for Computing Machinery (ACM)
- Member of Society of Industrial and Appiled Mathematics (SIAM)
- Member of the Association for the Advancement of Artificial Intelligence (AAAI)

Teaching Experience

- **Graduate Teaching Assistant** (2013 - 2018)
  - Introduction to Artificial Intelligence. Fall 2017, Fall 2018.
  - Computational Cognitive Neuroscience. Spring 2017, Spring 2018.
  - Computer organizations. Spring 2016. Summer 2018.
  - Introduction to Computing. Spring 2015, Fall 2016.
  - Engineering Computing. Fall 2013.