Amir Arsalan Soltani (US Permanent Resident)

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EDUCATION

Brown University, *Providence, RI* **September 2020 - Present**
Doctor of Philosophy, Computer Science

State University of New York at Buffalo, *Buffalo, NY* **September 2013 - December 2015**
Master of Science, Computer Science | *Concentration: Machine Learning*

Islamic Azad University, *Najafabab, Iran* **September 2007 - May 2012**
Bachelor of Science, Computer Engineering
Awards: Ranked 19th overall in the nationwide entrance exam for B.Sc, Distinguished Student Award

EXPERIENCE

Brown University, PhD Student **September 2020 - Present**
Department of Computer Science *Providence, RI*

- ***Endow agents with the ability to build causal models of the 3D world for high-level cognition and abstract reasoning***
  - **Novel unsupervised perception and action model for human-like abstract spatial reasoning in 3D**
    - Inspired by how Cognitive Map cells work in the brain, developed a model for active perception to enable agents ground a "causal" model of the 3D world in abstract space, from few consecutive egocentric visual observations
    - Used MuJoCo to generate datasets for the perception and action, goal representation and path integration models
    - Currently developing a path integrator for human-like abstract spatial reasoning that respects causal constraints
    - Proposed the idea, leading development, implemented all models, collaborating in a team of 3
  - **Novel unsupervised language grounding method for executing command-like instructions in 3D**
    - Developing an unsupervised language grounding model to interpret language commands such as "put the red box on the blue one" into compositional, causal representations of the 3D world
    - Used MoJuCo to create a dataset containing language instructions for manipulating objects in an environment
    - Proposed the idea, leading development, implemented all models, collaborated in a team of 3
  - **Developed a prototype for a novel unsupervised neural network physics engine for real-time soft body simulation**
    - Developed a model to encode implicit 3D object interactions abs abstract priors,to approximate the governing PDE
    - Showed how leveraging such abstract priors enable explaining unseen object interactions or simulate future
    - Used Blender to generated a dataset for interactions of soft body objects with random physics/object parameters
    - Developed a model learns an approximation to the underlying PDE; showed it can explain novel object dynamics
    - Proposed the idea, led its development, implemented core models, collaborated in a team of 3
  - **Unsupervised [re]localization of an agent in the 3D world using implicit scene representations**
    - Proposed the core idea, led development, modified and trained the GQN model, collaborated in a team of 3
    - Designed and trained a supervised localization model on GQN representations for novel scenes given an image
    - Achieved near-perfect localization accuracy as measured with MSE and mean structural similarity (SSIM) metrics
    - Worked on an unsupervised [re]localization method using Pyro to infer camera parameters

Massachusetts Institute of Technology, Research Assistant **April 2016 - August 2020**
PI: ***Joshua B. Tenenbaum****, Computational Cognitive Science Lab* *Cambridge, MA*

- ***Built human-like computational models of perception in 3D via inverse graphics***
  - **A computational model for zero-shot perception of objects draped by cloth (*in preparation for PNAS)***
    - Proposed a new theory for building human-like models of perception in collaboration in a team of 5
    - Contributions include model design, parts of analyses and implementation: stimuli generation with Blender and NVIDIA FleX and pipeline for all experiments and evaluation, including training baseline neural network models
    - Reached near-perfect recognition accuracy match with respect to human data :near chance for pre-trained neural networks and slightly above chance for fine-tuned neural network models
    - The model achieves trial-by-trial correlation with human performance (R~0.65) and their response time (R~0.79)
    - The proposed model beats SOTA neural network-based models in all aspects of our analyses
  - **A Bayesian model for face perception in novel contexts (*CogSci 2020 -- journal article in prep. for submission in 2022*)**
    - Trained baseline neural network models by replicating the training pipeline in "Deep Face Recognition" paper
    - Participated in discussions for designing the model for perception of Mooney faces
    - Showed using natural illumination priors in our analysis-by-synthesis model results in performance and behavior that correlates better with humans data and while beating neural network models for face perception
  - **Built a generative model for 3D objects by modeling depth maps or silhouettes (*CVPR 2017*)**
    - Trained a single model for objects from all ShapeNet categories capable to generate good-looking 3D object samples including for categories which had less than 50 training examples (e.g. headphones)
    - Showed results for out-of-sample generalization, view-consistent representations/reconstructions and obtained similar classification accuracy to some supervised methods

- ***Intuitive physical reasoning for objects draped with cloth in both children and adults***
    - **Effects of physically-implausible changes in perception of draped objects (*Psych Science -- under review*)**
        - Contributed to the development of the codebase for generating the stimuli using Blender and NVIDIA FleX
        - Finding: experiments suggest humans encode approximation to the true causal generative processes of physical reality as physically-implausible changes to cloth drapery degrades human ability to perceive draped objects
    - **Evaluating children's perception of objects draped with cloth (*CogSci 2019*)**
        - Prepared the stimuli used in the experiments using Blender and NVIDIA FleX
        - Finding: young children are able to perceive objects draped with cloth with similarities to adults, suggesting that we have a good intuitive understanding of how physics of cloth works from a young age

Research Assistant, State University of New York at Buffalo **September 2015 - December 2015**
Center for Unified Biometrics and Sensors *Buffalo, NY*

- **Built a LDA-based model for author name disambiguation for *BioXFEL.org* given one or few sample papers**
    - Fitted an LDA model via SVB on all Wikipedia content and a massive dataset of scientific papers from Thomson Reuters
    - Assigned papers to authors via computing the KLD of the inferred LDA parameters of sample papers and unassigned ones
- **Optimal battery charging time suggestion for hundreds of cellphone users with Hidden Markov Models**
    - Implemented the Baum–Welch algorithm for model fitting
    - Given a short behavioral pattern of a user, the model suggests a time that the user should recharge their phone

MANUSCRIPTS UNDER REVIEW

Wong, K. W.**,** Bi, W., **Soltani, A. A**., Yildirim, I., & Scholl, B. "Seeing Soft Materials Draped Over Objects: A Case Study of Intuitive Physics in Perception, Attention, & Memory", Psychological Science

MANUSCRIPTS IN PREPARATION

Yildirim, I**.***, Siegel, M.*, **Soltani, A. A**.*, Chaudhuri, S. & Tenenbaum, J. "Seeing 3D Shape Under Complete Occlusion: Evidence for Approximate Physics-Based Generative Models During Ongoing Perception"
Egger B., Siegel M., Arora R., **Soltani A. A**., Yildirim I. & Tenenbaum J. "A Computational Model for Unconstrained Face Perception" *(Placeholder Title – Early Stage)*

PEER-REVIEWED PUBLICATIONS

Egger B., Siegel M., Arora R., **Soltani A. A**., Yildirim I. & Tenenbaum J. "Inverse Rendering Best Explains Face Perception Under Extreme Illuminations, "Abstract, CogSci 2020.
Ullman T., Kosoy E., Yildirim I., **Soltani A. A**., Siegel M., Tenenbaum J. & Spelke E. "Draping an Elephant: Uncovering Children's Reasoning About Cloth-Covered Objects," CogSci 2019.
Soltani, A. A., Huang, H., Wu, J., Kulkarni, T. & Tenenbaum, J. "Synthesizing 3D Shapes via Modeling Multi-View Depth Maps and Silhouettes with Deep Generative Networks," CVPR 2017.

INVITED TALKS

Brown Robotics Group, Brown University**,** *Providence, RI* **October 2020**
MIT Vision Seminar, Massachusetts Institute of Technology**,** *Cambridge, MA* **October 2017**
Vision Meets Cognition Workshop, CVPR**,** *Honolulu, HI* **July 2017**

REVIEWER

International Conference on Learning Representations (ICLR) **2021-Present**
International Conference on Machine Learning (ICML) **2021-Present**
Neural Information Processing Systems (NeurIPS) **2019-Present**
IEEE Conference on Computer Vision and Pattern Recognition (CVPR) Workshops **2019-2020**

COMMUNITY SERVICE

Science Teacher, Science is Elementary, *Buffalo, NY* **July - December 2015**

- Taught science lessons and visualized scientific and measurement concepts in an accessible way to more than 70 children from underrepresented communities at Westminster Community Charter School. Lessons

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ranged from measuring distances, to how magnets work in practice for Maglev and how magnets can be used to build high-speed trains.

TECHNICAL SKILLS

AI and ML: Neural Networks, Graphical Models, Bayesian Optimization, Reinforcement Learning
Tools: PyTorch, Blender, MuJoCo, NVIDIA FleX, C++