Joshua Zhanson

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Education

Carnegie Mellon University Language Technologies Institute *Pittsburgh, PA*
M.Sc., Master of Language Technologies *August 2022*
QPA: 3.74/4.00 Advisor: Yonatan Bisk Supported by **NSF Graduate Research Fellowship**, *April 2020*

Carnegie Mellon University School of Computer Science *Pittsburgh, PA*
B.S. in Computer Science, minor in Machine Learning *May 2020*
QPA: 3.95/4.00 Dean's List: Fall 2016 - Spring 2019 College & University Honors
Senior thesis: *Investigating and Robustifying Proximal Policy Optimization*
Advised by Emilio Parisotto, Adarsh Prasad, and Ruslan Salakhutdinov

Research Projects

Learning Visual Representations through Embodied Interaction Exploration *August 2020 - present*

- Created Find One and Interaction Exploration environments in **Python** built on AI2THOR interactive embodied household robotics simulator
- Designed customizable ResNet visual encoders and LSTM policy model architectures in **Pytorch** for control from RGB pixels and superpixels to superpixel or pixel-level interaction masks plus discrete action output
- Implemented custom variants of reinforcement learning algorithms Advantage Actor-Critic and Proximal Policy Optimization with hogwild asynchronous multiprocess training
- Built multiprocess autoencoder baseline, supervised topline, and visual probe experiment pipeline to evaluate quality of learned representations on datasets generated from different heuristic agents in AI2THOR simulator

On Proximal Policy Optimization's Heavy-tailed Gradients *August 2019 - May 2020*

- Modified Advantage Actor-Critic and Proximal Policy Optimization deep reinforcement learning algorithms in **Python** and **Pytorch** to use gradient estimators from robust statistics
- Evaluated effect of different optimization heuristics on heavy-tailedness of policy gradient and likelihood ratio distributions throughout a training epoch using alpha-index estimator from robust statistics
- Discovered significant heavy-tailedness in off-policy gradients taken on same batch of data, leading to a reevaluation of the policy gradient reinforcement learning paradigm
- Accepted to **ICML 2021**

Proprioceptive Spatial Representations for Generalized Locomotion *June 2018 - July 2019*

- Developed JSONWalker environment for robot locomotion and GUI editor with **Python** to allow users to easily construct complex robot bodies in box2d physics simulator
- Wrote scripts in **Python** to randomize robot bodies, build datasets, and evaluate control policies
- Trained **PyTorch** convolutional models for control using a grid-based proprioceptive robot body state that outperformed baseline models by 20% success rate and solved 9% more unseen robot body configurations
- Accepted to **Workshop on Structure & Priors in Reinforcement Learning** at **ICLR 2019**

Employment

Merit International, Inc. (formerly Sigma Accolade, Inc.) *Millbrae, CA*
Software Engineer Intern *May 2018 - Aug 2018*

- Implemented a feature that allows Orgs to disallow duplicate Merits issued to the same user by adding **React** components in **JavaScript** linked to the **Scala** backend with as-you-type **GraphQL** mutations and queries
- Used **Cats** type abstractions for error handling and threading errors to the frontend UI

Vizio Inc. *Seattle, WA*
Software Development Intern *May 2017 - Aug 2017*

Skills

Python ~ Pytorch, Tensorflow, Numpy, Pandas, OpenCV, Matplotlib ~ C/C++ ~ Git ~ Docker ~ Bash