

## Education

### University of Michigan

Ann Arbor, MI

*Bachelor of Science in Engineering in Computer Science; GPA:3.43 Sep. 2013 – May 2017*

- Notable Courses: Machine Learning, Artificial Intelligence, Computational Neuroscience, Agent Based Modeling, Game Theory, Theory of Complex Systems, Cryptography, Computer and Network Security, Computer Architecture and Organization, Theory of Computation, Programming and Data Structures, Data Structures and Algorithms
- Minor in Complex Systems; GPA:4.0

## Publications

### Control of Memory, Active Perception, and Action in Minecraft

ICML '16

*Junhyuk Oh, Valliappa Chockalingam, Satinder Baveja, Honglak Lee*

## Experience

### University Of Michigan

Ann Arbor, MI

*Directed Independent Study Research*

*Sep. 2016 – Present*

Supervised by: Professor Satinder Singh Baveja

- Reading papers in hierarchical reinforcement learning and planning
- Developing novel agents that can act and plan at different temporal scales
- Writing a report for possible later publication

*EECS 445 (Machine Learning) Instructional Aide*

*Sep. 2016 – Dec. 2016*

- Constructed programming assignments for homework and hands-on lecture sections
- Taught weekly discussion sections and hands-on lecture sections

### Microsoft Research

Cambridge, UK

*Research Intern*

*May 2016 – Aug. 2016*

- Helped with developing the Minecraft AI Platform, Project Malmö, with a focus on building a range of tasks
- Implemented a variety of RL agents (primarily in TensorFlow and Chainer), from traditional RL agents like SARSA- $\lambda$  to more complex state-of-the-art Deep RL agents like Dueling DQN
- Looked at generalization performance of agents using a difficulty metrics based approach

### University Of Michigan

Ann Arbor, MI

*EECS 545 (Graduate Machine Learning) Instructional Aide*

*Jan. 2016 – Apr. 2016*

- Created Jupyter notebook based lecture slides using Markdown and LaTeX
- Wrote Python programs to demonstrate various Machine Learning concepts

*Machine Learning Research Assistant*

*Jun. 2015 – Present*

Working with: Professor Honglak Lee, Professor Satinder Singh Baveja, Junhyuk Oh

- Constructing memory based Deep Q-Network architectures: Memory Q-Networks (MQNs), Recurrent Memory Q-Networks (RMQNs), & Feedback Recurrent Memory Q-Networks (FRMQNs)
- Developing agents that can learn to traverse “real-world” like 3-Dimensional environments and perform complex tasks with good generalization capabilities
- Deepening understanding of Deep Learning and Reinforcement Learning research by reading relevant papers
- Gaining experience with programming languages such as Java, Python, and Lua, and Deep Learning packages such as Torch
- Extending on the progress based on recent related work on Zero-Shot Task Generalization

*EECS 203 (Discrete Mathematics) Instructional Aide*

*Jan. 2014 – May 2015*

- Managed and answered questions on the online Piazza forum
- Conducted weekly office hours and discussion sections
- Created “challenge” problems for students keen on going “beyond the syllabus”

### EdGE Networks

Bangalore, India

*Intern*

*Apr. 2014 – Jun. 2014*

- Learned Natural Language Processing techniques
- Worked on developing recommender systems that match résumés to companies through web scraping
- Gained experience with Python packages such as Scikit-Learn, PyBrain, NLTK, and BeautifulSoup

## iVista Solutions

*Intern*

- Learned to create and manage simple web servers
- Worked with PHP, MySQL, HTML, CSS, and Wordpress
- Used what was learned to create and manage a website for a cancer fundraiser marathon

Bangalore, India

*Jun. 2012 - Aug. 2012*

## Taneja Aerospace

*Intern*

- Constructed models for remote controlled airplanes using CAD software
- Used wind tunnels and computer simulations to test the aerodynamics of different models
- Built and tested a RC plane model on an actual runway

Hosur, India

*Apr. 2012 - Jun. 2012*

## Languages

**Programming and Markup Languages, and Frameworks:** Python, TensorFlow, Keras, Chainer, SciKit-Learn, NumPy, SciPy, Matplotlib, Sequest, C++, C, Java, LaTeX, Markdown, NetLogo, Lua, Torch, MATLAB, PHP, MySQL, HTML, XML, CSS, JavaScript, Swift, Objective-C, R, Verilog

**Languages:** English, Tamil, Japanese, Spanish, French, Kannada

## Projects

**Zero Shot Task generalization of agents in Minecraft:** In progress. Looking into more structured memory addressing schemes and better temporal abstractions to get agents with better and faster generalization in Minecraft, especially over previously unseen subtasks or compositions thereof.

**Hierarchical Differentiable Planning Networks:** In progress. Extending on Value Iteration Networks with Options and analyzing inferred reward and value functions with the aim of getting interpretable Markov Decision Process models.

**Studying depression and reward processes through Serotonergic neurons:** Implemented computer models of Serotonergic neurons using experimental data and past literature, and studied how various parameters affect reward processing and could cause or cure depression.

**Anomaly detection in Controller Area Network messages:** Looked at how anomalies in the messages traversing vehicles through CAN buses can be detected through stateless one-class Support Vector Machines and stateful time-series based Long Short Term Memory neural networks.

**Deep Q-Network based agents with external memory in Minecraft:** Used Minecraft Forge, Lua and Torch, to implement memory based DQN agents that can learn to solve different tasks, and a Minecraft Forge Mod that can interact with the agents by providing appropriate visual inputs and reward signals.

**Incentivizing exploration with denoising autoencoders for learning to play Atari Games:** Built Deep Q-Network agents that predict next state encodings conditioned on action and current state using denoising autoencoders to better handle random aspects of domains like enemies in Atari 2600's Seaquest.

**MNIST handwriting recognition:** Implemented, from first principles, a backpropagation multilayer perceptron in Python w/ NumPy to classify handwritten digits from the MNIST database with over 98% accuracy.

**Search engine keyword popularity prediction:** Used NetLogo to simulate system dynamics of a large network in conjunction with real world statistics obtained from Google Analytics to identify common patterns in keyword popularity.

**Social network structure Analysis:** Extended on Schelling's experiment using computer models to explain how social groups are formed and how the preferences of people affect underlying social network structure.

**Sociopolitical opinion Analysis:** Used different complex systems models such as Voronoi maps to find social and political scenarios where the opinions of a group do better than the opinion of a few experts.

**Elliptic Curve Cryptosystem:** Implemented a cryptographic protocol based on El-Gamal in C++.