Ethan Brooks

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RESEARCH INTERESTS

My interests focus on the intersection of reinforcement learning and natural language. I am interested in leveraging large data sets and the supervised models trained on them (e.g. GPT-X) to improve reinforcement learning. I am also interested in the role of reinforcement learning in discovering both natural language and structured programming languages (program synthesis). Finally, I am interested in the structures of memory best suited to storing knowledge.

PUBLICATIONS

[1] **Brooks, Ethan**, J. Rajendran, R. L. Lewis, and S. Singh, "Reinforcement learning of implicit and explicit control flow instructions", in *Proceedings of the 38th International Conference on Machine Learning*, M. Meila and T. Zhang, Eds., ser. Proceedings of Machine Learning Research, vol. 139, PMLR, 18–24 Jul 2021, pp. 1082–1091.

[2] E. Brooks, "Hazing versus challenging", *Marine Corps Gazette*, vol. 98, no. 8, pp. 24–25, 2014.

PROJECTS

Current Research (Deep RL, Multi-task RL, GPT-2, NLP)
Exploring applications of pretrained Foundation Models (e.g. GPT-2) to reinforcement learning. 2020-current
In particular, studying the psychological phenomenon of "internal monologue" in terms of utility.
Currently investigating problems relating to generalization, hierarchy, and exploration. (In collaboration with Logan Walls, Richard Lewis, and Satinder Singh.)

DARPA L2M Grant (Deep RL, Multi-task RL, Jax, Pytorch, Docker)
Application of lifelong reinforcement learning algorithms to the Habitat AI simulation platform. 2020-current

Run Tracker (Docker, Hasura, Postgres, React, Rescript)   github.com/run-tracker · click for demo
Utilities for launching hyperparameter sweeps, logging metadata, 2021
and visualizing runs.

Off-Policy RL that Prioritizes Value Function Improvement for Speedup (Deep RL)
Study of distributed learning of off-policy value-functions. (https://ethanabrooks.github.io/speedup.pdf). 2019

Reproduction of "Exploration in Policy Mirror Descent" (Deep RL, Optimization)
Reproducibility study (https://ethanabrooks.github.io/reproduction.pdf). 2019

Python MuJoCo Wrapper (MuJoCo, Cython)   github.com/mujoco
Minimal Python bindings for the MuJoCo physics simulator. 2017

SKILLS

Machine Learning: Python, Jax, Pytorch, Tensorflow

Web programming: React, CSS, Javascript, Postgres

Functional Programming: Haskell, OCaml, Scala

Education

University of Michigan   Ann Arbor, MI
Ph.D. in Computer Science, Advisor: Satinder Singh   2018–Current

University of Pennsylvania   Philadelphia, PA
Masters of Computer and Information Technology, GPA: 3.81/4.00   2015–2016

St. John's College   Annapolis, MD
B.A. in Philosophy / History of Mathematics, GPA: 3.48/4.00   2005–2010

Thesis: "Continuity in Dedekind's *Essays on the Theory of Numbers*"

Work Experience

University of Michigan (MuJoCo, Robotics, Deep RL)   Ann Arbor, MI
Research Engineer under Satinder Singh   Fall 2017

Applied reinforcement learning to simulated robotic grasping using MuJoCo (click for video of block manipulation).

Google (Data Science, Machine Learning)   Mountain View, CA
Intern with Android Location and Context Team   Summer 2017

Used machine learning to determine the most battery-efficient times for Android location scans.

Apple (Natural Language Processing, Deep Learning)   Cupertino, CA
Intern with Siri Natural Language Team   Summer 2016

Built attention-based deep learning algorithms in Torch to improve sentence classification.

United States Marine Corps
Intelligence Officer (Rank: Captain)   2010-2015

Established a new intelligence section that oversaw intelligence analysis and security management.

Teaching

Graduate Student Instructor at University of Michigan
Helped develop brand new Programming Languages course (EECS 490). This course covers the   Spring 2020
design and use of modern programming languages, starting from mathematical first principles.

Extracurricular Activities

Philosophy and Literature Reading Group   2019 - Current

Read *Ulysses* (Jamed Joyce), volumes 1 and 2 of *In Search of Lost Time* (Marcel Proust), *The Invisible Man* (Ralph Ellison), and essays by Gilles Deleuze, Walter Benjamin, Ralph Waldo Emerson, and Michel de Montaigne.

Turing *Entscheidungsproblem* Reading Group   Fall 2020 - Summer 2021

Led reading group on *The Annotated Turing: A Guided Tour Through Alan Turing's Historic Paper on Computability and the Turing Machine* (Charles Petzold).

Staff Mentor with University of Michigan Mentorship Program   2018–2019

Organized and led mentorship activities with 6-8 undergraduates