Ellis L. Brown, II

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Interests

My research interests lie in artificial intelligence at the intersection of machine learning, computer vision, and robotics. Currently, I am particularly excited about self-supervised learning, intrinsic motivation, and open-endedness. I am keen to draw inspiration from intelligence in humans and nature—especially as a goal-post rather than a blueprint. My goal is to develop intelligent agents that use common sense to generalize and continually adapt robustly and efficiently, allowing them to be *safely* deployed in the real world.

Education

Carnegie Mellon University **Pittsburgh, PA**
M.S., Computer Science *(expected) May 2023*
- Advised by Professors Deepak Pathak and Alexei Efros
- Coursework: Deep Reinforcement Learning for Robotics; Visual Learning & Recognition; Deep Reinforcement Learning & Control; Advanced Intro Machine Learning; Philosophical Foundations of Machine Intelligence; Math Fundamentals for Robotics; Distributed Systems; Intro to Computer Systems

Stanford University **Palo Alto, CA**
Non-Degree Graduate Student, Computer Science *Jun. 2020*
- Coursework: Engineering Design Optimization

Columbia University **New York, NY**
Non-Degree Graduate Student, Computer Science *May 2019*
- Coursework: Mathematics of Deep Learning

Vanderbilt University **Nashville, TN**
B.S., Computer Science; B.A., Mathematics *May 2017*
- Advised by Professor Maithilee Kunda

Experience

Academia

Robotics Institute, Carnegie Mellon University
Graduate Student Researcher, Advised by Professors Deepak Pathak and Alexei Efros *2022–Pres.*
- Researching self-supervised learning, curiosity-driven exploration, and generalization.
- Led CMU's involvement in DARPA's Machine Common Sense program in collaboration with Computer and Cognitive Scientists from UC Berkeley, MIT, and UMich. Developed embodied agents that solve a suite of interactive retrieval tasks; brought team "MESS" (Model-building, Exploratory, Social-learning Systems) first place in the fifth evaluation.

Department of Computer Science, Vanderbilt University
Undergraduate Student Researcher, Advised by Professor Maithilee Kunda *2016–2018*
- Developed a computational cognitive architecture of human attention during spatiotemporal visual search.
- Contributed to the development of the Toybox Dataset for small sample learning and hand-object interaction.

Industry

BlackRock AI Labs
Advised by Professors Mykel Kochenderfer, Stephen Boyd, and Trevor Hastie.
Founding team member and culture carrier. Launched bi-weekly reading group. Co-launched external website.

Research Engineer | Palo Alto, CA *2020–2021*
- Formulated the securities lending process as a Markov decision process; designed and wrote a multi-agent lending market simulator for the learning and evaluation of policies; showed that learned policies outperform the rule-based policy used by the lending desk.
- Open-sourced two Julia packages for separable optimization problems. Presented at JuliaCon 2021. [blog, talk]

Machine Learning Engineer | New York, NY *2018–2019*

- Proposed a model of portfolio "operational risk"—decomposable into an interpretable set of factors. Built a Spark ETL pipeline that extracts 3k+ features from various portfolio management systems and outputs daily predictions for all portfolios in the firm.
- Designed a system to automatically identify and parse complicance rules in legal documents; previously performed by 30+ FTEs.

BlackRock

Software Engineer | New York, NY *2017*

- Built an ETL pipeline to ingest daily mutual fund reference data using Apache Storm.

Software Engineering Intern | New York, NY *2016*

- Won intern hackathon with a NLP system to extract contract terms from legal documents during new client onboarding.

Open-Source

JuliaFirstOrder/{ **PiecewiseQuadratics.jl**, **SeparableOptimization.jl** } *2021*

- Co-authored Julia packages for solving the problem of minimizing a sum of piecewise-quadratic functions subject to affine equality constraints via a derivative of the Alternating Direction Method of Multipliers (ADMM). Formed the JuliaFirstOrder organization.

amdegroot/**ssd.pytorch** ★ 4.7k ⑂ 1.7k *2017*

- Co-authored the canonical PyTorch implementation of the Single Shot MultiBox Detector, a real-time object detection framework using a single network, 3 months after PyTorch's alpha release.

Publications

Conference

2022 Alexander Li*, **Ellis Brown***, Alexei Efros, Deepak Pathak. *Internet Curiosity: Directed Unsupervised Learning on Uncurated Internet Data. ECCV 2022 Workshop, "Self Supervised Learning: What is Next?"*

2018 **Ellis Brown**, Soobeen Park, Noel Warford, Adriane Seiffert, Kazuhiko Kawamura, Joe Lappin, and Maithilee Kunda. SpatioTemporal Template-based Search: An Architecture for Spatiotemporal Template-Based Search. *Sixth Annual Conference on Advances in Cognitive Systems*, Stanford, CA.

Journal

2018 **Ellis Brown**, Soobeen Park, Noel Warford, Adriane Seiffert, Kazuhiko Kawamura, Joe Lappin, and Maithilee Kunda. An Architecture for Spatiotemporal Template-Based Search. *Advances in Cognitive Systems, Volume 6*, 101-118. [paper]

Reports

2022 Alvin Shek, **Ellis Brown**, Nilay Pande, David Noursi. Self-Supervised Representation Learning via Curiosity-Driven Exploration. Robotics Institute, Carnegie Mellon University, Pittsburgh, PA. [report]

2021 **Ellis Brown**, Aaron M. Roth. Scaling Interpretable Reinforcement Learning via Decision Trees to Minecraft. Robotics Institute, Carnegie Mellon University, Pittsburgh, PA. [report]

2020 **Ellis Brown**. Securities Lending Policy Optimization. Computer Science Department, Stanford University, Palo Alto, CA. [report, video]

2019 **Ellis Brown***, Melanie Manko*, Ethan Matlin*. Modeling Uncertainty in Bayesian Neural Networks with Dropout. Department of Electrical Engineering and Computer Science, Columbia University, New York, NY. [report, slides]

*equal contribution

Talks

2021 Linearly Constrained Separable Optimization (oral), *JuliaCon 2021 JuMP-dev track*. [talk]

2019 Modeling Uncertainty in Bayesian Neural Networks with Dropout: the effect of weight prior and network architecture selection (poster), *American Indian Science and Engineering Society National Conference 2019*, Madison, WI. [poster]

2018 SpatioTemporal Template-based Search: An Architecture for Spatiotemporal Template-Based Search (oral), *Sixth Annual Conference on Advances in Cognitive Systems*, Stanford, CA. [slides]

2017 Computational Cognitive Systems to Model Information Salience (oral), *American Indian Science and Engineering Society National Conference 2017*, Denver, CO. [slides, link]

Awards and Honors

- *Scholar*, Lighting the Pathways to Faculty Careers for Natives in STEM, AISES — *2021–Pres.*
- *Scholar*, Computer Science Research Mentorship Program, Google Research — *2021*
- *3rd Place,* Graduate Student Research Competition, AISES National Conference — *2019*
- *1st Place*, BlackRock Intern Hackathon — *2016*
- (2x) *Academic All-American*, USA Water Polo — *2012, 2013*

Scholarships

- Intel Growing the Legacy Graduate Scholarship — *2021–Pres.*
- Osage Nation Higher Education Graduate Scholarship — *2021–Pres.*
- Osage Nation Higher Education Scholarship — *2013–2017*

Extracurricular Activities

American Indian Science & Engineering Society (AISES)

Volunteer — *2019–2021*

- Mentored an undergraduate AISES student studying CS through the 2020–2021 Full Circle Mentorship Program.
- Reviewed scholarships for the 2020 AISES Undergraduate Scholarship.
- Judged posters for Undergraduate Student Research Competition at the 2019 National Conference.

Code/Interactive

Mentor — *2018*

- Advised and tutored (weekly) an underprivileged high schooler interested in CS; helped prepare college applications.

Vanderbilt Admissions

Tour Guide — *2014–2016*

- Led weekly campus tours to groups of 10-50+ prospective students and families.

Kappa Sigma Fraternity (Kappa Chapter)

Social Chairman — *2014–2016*

- Managed $90k annual budget; planned & executed dozens of large-scale events; served on Executive Council.

Water Polo

Captain & President, Vanderbilt Club Team (2014 SEC Champions) — *2014–2016*

- Coordinated and led a team of 20+ players through a 10 week season with 2+ travel tournaments.

Trainee, USA Olympic Development Program — *2010–2013*

- Trained in the United States National Team Pipeline program. Competed in Junior Olympics.