Matthew Finlayson

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Education

Harvard University — *Cambridge, MA*
Bachelors in Computer Science and Linguistics — *Spring 2021*
3.89/4.0 overall GPA (4.0 major). Coursework: computational linguistics, artificial intelligence, data science, programming languages, theoretical computer science, machine learning, algorithms and data structures, functional programming, linear algebra, multivariable calculus, signals and systems, group theory, morphology, semantics, historical linguistics.

Papers and Research

Shieber Lab | Harvard — *Cambridge, MA*
Undergraduate researcher — *Spring 2020 – Present*

Causal Mediation Analysis of Syntactic Agreement in Neural Language Models.
Submission under review for ACL. We use causal analysis methods to identify neural language model components responsible for syntactic number agreement behavior and find, among other things, distinct context-dependent agreement mechanisms in GPT-2. Equally co-authored with Aaron Mueller, advised by Stuart Shieber, Yonathan Belinkov, Tal Linzen, Sebastian Gehrmann. Individual contributions:

- Independently designed the experimental setup, generated the data set.
- Independently implemented and ran the experiments on a GPU computing cluster.
- Analyzed the results and wrote the paper in equal collaboration with Mueller.

Learning formal languages with memory-augmented RNNs. *Fall 2020 – Present*
Ongoing research to find the theoretical expressive limits of RNNs when augmented with various memory structures such as stacks and queues. Advised by Stuart Shieber.

- Designed a novel RNN architecture equipped with an differentiable, invertible stack.
- Implemented the invertible stack RNN and showed it learns the Dyck-2 language.

Experience

Microsoft | Natural Language Experiences Team — *Redmond, WA*
Software engineer intern — *Summer 2020*
Improved and personalized text prediction behavior in Microsoft Office products for the Microsoft Office Natural Language Experiences team.

- Uncovered a major bug in prediction generation that increased the prediction trigger rate 2× without sacrificing prediction quality when fixed.
- Analyzed large amounts of telemetry data to discover user behavior.
- Designed and implemented algorithm to dynamically adjust text prediction behavior to match user behavior, improving accept rates both individually and in aggregate.

Harvard Computer Science Department — *Cambridge, MA*
Head teaching fellow — *Spring 2020 – Present*
Staffed courses COMPSCI 187: Computational Linguistics and Natural Language Processing and COMPSCI 51: Abstraction and Design in Computation.

- Designed course materials from scratch including labs and projects on topics including RNNs, LSTMs, HMMs, as methods for language modeling, trees, and seq-to-seq.
- Implemented course infrastructure for distributing, autograding students' work.
- Taught weekly section on functional, object-oriented, and imperative paradigms.

Hikma Health — *Boston, MA*
Software engineer intern — *Summer 2019*
Developed software as an intern at a nonprofit medical technology startup.

- Created from scratch a secure mobile app for doctors to interface with an electronic medical record system.
- Implemented an encrypted database, biometric authentication, online/offline synchronization scheme for mobile.

Other

Computer languages: Python, C++, OCaml, JavaScript
Human languages: English, Tagalog, some Spanish
Hobbies: mechanical keyboards, hiking, sailing, drawing