William Merrill

https://lambdaviking.com/

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Research Interests

Natural language processing, computational linguistics, formal language theory, deep learning, parsing, interpretable AI, historical linguistics

Professional Experience

AI2	2019–	**Resident Researcher** on AllenNLP team
Google	2018	**Software Engineering Intern** *"Exceeds expectations" rating; return offer*
Boston College	2017	**Research Intern** in Language Learning Lab
New York University	2013–2015	**Research Intern** in Morphology Lab

Education

Yale University	2015–2019	**B.S.** with distinction in Computer Science **B.A.** with distinction in Linguistics Thesis: Sequential neural networks as automata *Cum laude; note of excellence on thesis*

Advisors and Affiliations

Noah Smith, Yoav Goldberg, Roy Schwartz	AllenNLP, AI2	2019–
Robert Frank, Dana Angluin	CLAY, Yale	2016–2019
Joshua Hartshorne, Sven Dietz	L3, Boston College	2017
Alec Marantz, Phoebe Gaston	MorphLab, NYU	2013–2015

Publications

William Merrill, Gail Weiss, Yoav Goldberg, Roy Schwartz, Noah A. Smith, and Eran Yahav. A formal hierarchy of RNN architectures. In *Proceedings of the 58th*

Annual Meeting of the Association for Computational Linguistics, pages 443–459, Online, July 2020. Association for Computational Linguistics. doi: 10.18653/v1/2020.acl-main.43. URL https://www.aclweb.org/anthology/2020.acl-main.43.

Lucy Lu Wang, Kyle Lo, Yoganand Chandrasekhar, Russell Reas, Jiangjiang Yang, Doug Burdick, Darrin Eide, Kathryn Funk, Yannis Katsis, Rodney Kinney, Yunyao Li, Ziyang Liu, William Merrill, Paul Mooney, Dewey Murdick, Devvret Rishi, Jerry Sheehan, Zhihong Shen, Brandon Stilson, Alex Wade, Kuansan Wang, Nancy Xin Ru Wang, Chris Wilhelm, Boya Xie, Douglas Raymond, Daniel S. Weld, Oren Etzioni, and Sebastian Kohlmeier. CORD-19: The COVID-19 open research dataset, 2020.

William Merrill. Sequential neural networks as automata. In *Proceedings of the Workshop on Deep Learning and Formal Languages: Building Bridges*, pages 1–13, Florence, August 2019. Association for Computational Linguistics. URL https://www.aclweb.org/anthology/W19-3901.

William Merrill, Lenny Khazan, Noah Amsel, Yiding Hao, Simon Mendelsohn, and Robert Frank. Finding hierarchical structure in neural stacks using unsupervised parsing. In *Proceedings of the 2019 ACL Workshop BlackboxNLP: Analyzing and Interpreting Neural Networks for NLP*, pages 224–232, Florence, Italy, August 2019a. Association for Computational Linguistics. URL https://www.aclweb.org/anthology/W19-4823.

William Merrill, Gigi Stark, and Robert Frank. Detecting syntactic change using a neural part-of-speech tagger. In *Proceedings of the 1st International Workshop on Computational Approaches to Historical Language Change*, pages 167–174, Florence, Italy, August 2019b. Association for Computational Linguistics. URL https://www.aclweb.org/anthology/W19-4721.

Yiding Hao, William Merrill, Dana Angluin, Robert Frank, Noah Amsel, Andrew Benz, and Simon Mendelsohn. Context-free transductions with neural stacks. In Tal Linzen, Grzegorz Chrupała, and Afra Alishahi, editors, *Proceedings of the 2018 EMNLP Workshop BlackboxNLP: Analyzing and Interpreting Neural Networks for NLP*, pages 306–315, Brussels, Belgium, November 2018. Association for Computational Linguistics. URL https://www.aclweb.org/anthology/W18-5433.

Jungo Kasai, Robert Frank, Pauli Xu, William Merrill, and Owen Rambow. End-to-end graph-based TAG parsing with neural networks. In *Proceedings of the 2018 Conference of the North American Chapter of the Association for Computational Linguistics: Human Language Technologies, NAACL-HLT 2018, New Orleans, Louisiana, USA, June 1-6, 2018, Volume 1 (Long Papers)*, pages 1181–1194, 2018. URL https://aclanthology.info/papers/N18-1107/n18-1107.

William Merrill. A semantics of subordinate clauses using delayed evaluation. *Toronto Undergraduate Linguistics Conference*, 2018. URL https://ling.auf.net/lingbuzz/003487.

Talks

BlackboxNLP	2018	*Context-free transductions with neural stacks*
Packer Symposium	2018	Neural networks, L2 acquisition, and the Voynich
CodeHaven	2018	Programming, language, and *The Book of Thoth*
TULCon	2018	*A semantics of subordinate clauses using delayed evaluation*

Teaching Assistant Experience

CPSC 477	Natural Language Processing	Spring 2019
CPSC 477	Natural Language Processing	Spring 2018
CPSC 470	Artificial Intelligence	Fall 2017

All courses were taught by Dragomir Radev at Yale

Service

Reviewing

EMNLP	2020	2 reviews
Neural Networks	2020	1 review

Organizing and Teaching

Yale Tangut Language Workshop	2018	Student workshop facilitator
Yale NACLO	2017	Student volunteer
Yale Kitan Language Workshop	2016	Student workshop facilitator
CodeHaven	2016–2018	Student volunteer
Splash at Yale	2016–2017	Student instructor

Selected Public Software

- **StackNN**: Differentiable stacks, queues, and dequeues in PyTorch
- **Voynich2Vec**: Word embedding analysis of the Voynich manuscript
- **The Book of Thoth**: A puzzle game with dynamic spell casting in Ancient Egyptian
- Contributor to open-source NLP framework **AllenNLP**

Blog Posts

NLP

- Capsule networks for NLP
- Review: Learning to transduce with unbounded memory
- Word2vec analysis of the Voynich manuscript

Translations

- The Wanderer (Old English)
- After Ragnarok (Old Norse)
- The Saga of Mary (Old Norse)

Awards and Grants

- DELFOL **student travel grant** presented by Naver Labs (2019)
- **Mellon grant** for senior thesis work, presented by Benjamin Franklin College at Yale University (2019)
- **Grace Hopper prize** for computer science finalist (2017)
- Buckley **open essay contest finalist** (2016)
- Yale College **freshman rap battle champion** (2016)
- **Rising scientist award** presented by the Child Mind Institute (2015)
- **National Merit Scholarship** letter of commendation (2013)
- **Study of American history award** presented by the Society of Mayflower Descendants (2013)
- National Latin Exam ***cum honore maximo egregio*** (2010)

Selected Coursework

AI/NLP	Selected Topics in Neural Networks
	Advanced Natural Language Processing
	Computational Vision and Biological Perception
	Neural Networks and Language
	Natural Language Processing
	Deep Learning Theory and Applications
	Computing Meanings
CS Theory	Computational Complexity Theory
	Computability and Logic
	Systems Programming and Computer Organization
	Design and Analysis of Algorithms
	Data Structures and Programming Techniques
Linguistics	Formal Foundations of Linguistic Theory
	Syntax I
	Semantics I
	Phonology I
	Hybrid Grammars
	Indo-European Linguistics
	Old English
	Advanced Old English Seminar: Beowulf
Math	Introduction to Analysis
	Vector Calculus and Linear Algebra I
	Vector Calculus and Linear Algebra II

Languages

- *Coding* Python, Java, C, Haskell, PyTorch, AllenNLP, *inter alias*
- *Modern* English (Native), Icelandic (Intermediate), Spanish (Basic), German (Basic)
- *Ancient* Latin, Old Norse, Old English