

# William Merrill

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## RESEARCH INTERESTS

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*Broad:* NLP, deep learning, formal languages, computational and historical linguistics

*Narrow:* {Formal analysis, latent structure, compositional generalization} with neural networks

## PROFESSIONAL EXPERIENCE

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AI2	2019–	<b>Resident Researcher</b> on AllenNLP team
Google	2018	<b>Software Engineering Intern</b> <i>“Exceeds expectations” rating; return offer</i>
Boston College	2017	<b>Research Intern</b> in Language Learning Lab
New York University	2013–2015	<b>Research Intern</b> in Morphology Lab

## EDUCATION

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Yale University	2015–2019	<b>B.S.</b> with distinction in Computer Science <b>B.A.</b> with distinction in Linguistics Thesis: Sequential neural networks as automata <i>Cum laude; note of excellence on thesis</i>
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## ADVISORS AND AFFILIATIONS

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

## PUBLICATIONS

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- William Merrill, Vivek Ramanujan, Yoav Goldberg, Roy Schwartz, and Noah Smith. Parameter norm growth during training of transformers, 2020a.
- 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 2020b. 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 neu-

ral 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

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

## TEACHING ASSISTANT EXPERIENCE

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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

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### *Reviewing*

EACL	2021	4 reviews
EMNLP	2020	2 reviews
Neural Networks	2020	1 review

### *Organization and Teaching*

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

## SELECTED PUBLIC SOFTWARE

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- **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

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### *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

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- **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

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<i>AI/NLP</i>	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
<i>CS Theory</i>	Computational Complexity Theory Computability and Logic Systems Programming and Computer Organization Design and Analysis of Algorithms Data Structures and Programming Techniques
<i>Linguistics</i>	Formal Foundations of Linguistic Theory Syntax I Semantics I Phonology I Hybrid Grammars Indo-European Linguistics Old English Advanced Old English Seminar: Beowulf
<i>Math</i>	Introduction to Analysis Vector Calculus and Linear Algebra I Vector Calculus and Linear Algebra II

## LANGUAGES

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