Aaron M. Mueller

CONTACT INFORMATION

Center for Language & Speech Processing
Johns Hopkins University
3400 N. Charles St., Hackerman 319
Baltimore, MD 21218-2608 (U.S.A.)

E-mail: amueller@jhu.edu
Website: aaronmueller.github.io
Code: github.com/aaronmueller

RESEARCH INTERESTS

- Multilingual natural language processing
- Interpretability and robust generalization
- Computational psycholinguistics (syntax and morphology)

EDUCATION

Johns Hopkins University — Baltimore, MD
Ph.D., Computer Science. — May 2023 (expected)
M.S.E., Computer Science. — May 2020
GPA: 3.9/4.0.
Advisors: Tal Linzen, Mark Dredze.

New York University — New York, NY
Visiting academic, Center for Data Science. — August 2021 – May 2023
Advisor: Tal Linzen.

University of Kentucky — Lexington, KY
B.S., Computer Science. *Honors*. — May 2018
B.S., Linguistics. *Honors*. — May 2018
GPA: 4.0/4.0. *Summa cum laude*.

INDUSTRY EXPERIENCE

Meta — Menlo Park, CA
Research Intern, AI Integrity — May 2022 – September 2022
Manager: Kanika Narang
- Research in retrieval-augmented generative models for few-shot question answering.
- Resulted in improved F1 on multiple QA and classification datasets using far fewer parameters than state-of-the-art pre-trained models.

Amazon Web Services (AWS) — Santa Clara, CA
Applied Scientist Intern, Lex — May 2021 – August 2021
Manager: Saab Mansour
- Research in pre-training methods for improving goal-oriented dialogue agents.
- Resulted in state-of-the-art few-shot intent classification accuracy (>30% 1-shot gains) and a publication at ACL.

Raytheon BBN Technologies — Cambridge, MA
Research Intern, Analytics & Machine Intelligence — May 2019 – August 2019
Manager: Ilana Heintz
- Implemented convolutional neural machine translation models rivaling our prior seq2seq model's BLEU with over 20% faster training and over 50% faster inference.
- Research in low-resource Ukrainian/Russian-English word alignment and entity linking.

PUBLICATIONS

REFEREED

1. **Aaron Mueller**, Robert Frank, Tal Linzen, Luheng Wang, Sebastian Schuster. "Coloring the Blank Slate: Pre-training Imparts a Hierarchical Inductive Bias to Sequence-to-sequence Models." In *Findings of the Association for Computational Linguistics (ACL)*, 2022.
2. **Aaron Mueller**, Jason Krone, Salvatore Romeo, Saab Mansour, Elman Mansimov, Yi Zhang, Dan Roth. "Label Semantic Aware Pre-training for Few-shot Text Classification." In *Proceedings of the Association for Computational Linguistics (ACL)*, 2022.
3. **Aaron Mueller**, Yu Xia, Tal Linzen. "Causal Analysis of Syntactic Agreement Neurons in Multilingual Language Models." To appear in *Proceedings of the Conference on Computational Natural Language Learning (CoNLL)*, 2022.
4. Alexandra DeLucia, Shijie Wu, **Aaron Mueller**, Carlos Aguirre, Mark Dredze, Philip Resnik. "BERNICE: A Multilingual Pre-trained Encoder for Twitter." To appear in *Proceedings of the Conference on Empirical Methods in Natural Language Processing (EMNLP)*, 2022.

5. **Aaron Mueller**, Mark Dredze. "Fine-tuning Encoders for Improved Monolingual and Zero-shot Polylingual Neural Topic Modeling." In *Proceedings of the North American Chapter of the Association for Computational Linguistics (NAACL)*, 2021.
6. **Aaron Mueller**, Zach Wood-Doughty, Silvio Amir, Mark Dredze, Alicia L. Nobles. "Demographic Representation and Collective Storytelling in the Me Too Twitter Hashtag Activism Movement." In *Proceedings of the Association for Computing Machinery (ACM) on Human-Computer Interaction (HCI), vol. CSCW1*, 2021.
7. Matthew Finlayson*, **Aaron Mueller***, Sebastian Gehrmann, Stuart Shieber, Tal Linzen, Yonatan Belinkov. "Causal Analysis of Syntactic Agreement Mechanisms in Neural Language Models." In *Proceedings of the Association for Computational Linguistics (ACL)*, 2021. [*Equal contribution]
8. Alexandra DeLucia*, **Aaron Mueller***, Xiang Lisa Li, João Sedoc. "Decoding Methods for Neural Narrative Generation." In *Proceedings of the Workshop on Generation Evaluation and Metrics (GEM) at Association for Computational Linguistics (ACL)*, 2021. [*Equal contribution]
9. **Aaron Mueller**, Garrett Nicolai, Panayiota Petrou-Zeniou, Natalia Talmina, Tal Linzen. "Cross-linguistic Syntactic Evaluation of Word Prediction Models." In *Proceedings of the Association for Computational Linguistics (ACL)*, 2020.
10. **Aaron Mueller**, Garrett Nicolai, Arya D. McCarthy, Dylan Lewis, Winston Wu, David Yarowsky. "An Analysis of Massively Multilingual Neural Machine Translation for Low-Resource Languages." In *Proceedings of the Language Resources and Evaluation Conference (LREC)*, 2020.
11. Arya D. McCarthy, Rachel Wicks, Dylan Lewis, **Aaron Mueller**, Winston Wu, Oliver Adams, Garrett Nicolai, Matt Post, David Yarowsky. "The Johns Hopkins University Bible Corpus: 1600+ Tongues for Typological Exploration." In *Proceedings of the Language Resources and Evaluation Conference (LREC)*, 2020.
12. Garrett Nicolai, Dylan Lewis, Arya D. McCarthy, **Aaron Mueller**, Winston Wu, David Yarowsky. "Fine-grained Morphosyntactic Analysis and Generation Tools for More Than One Thousand Languages." In *Proceedings of the Language Resources and Evaluation Conference (LREC)*, 2020.
13. Marten van Schijndel, **Aaron Mueller**, Tal Linzen. "Quantity Doesn't Buy Quality Syntax with Neural Language Models." In *Proceedings of the Conference on Empirical Methods in Natural Language Processing (EMNLP)*, 2019.
14. Arya D. McCarthy, Winston Wu, **Aaron Mueller**, Bill Watson, David Yarowsky. "Modeling Color Terminology Across Thousands of Languages." In *Proceedings of the Conference on Empirical Methods in Natural Language Processing (EMNLP)*, 2019.
15. **Aaron Mueller***, Yash Kumar Lal*. "Sentence-Level Adaptation for Low-Resource Neural Machine Translation." In *Proceedings of the Workshop on Technologies for Machine Translation of Low-Resource Languages (LoResMT) at Machine Translation Summit (MTSummit)*, 2019. [*Equal contribution]

NON-REFEREED

16. Julian Michael, Ari Holtzman, Alicia Parrish, **Aaron Mueller**, Alex Wang, Angelica Chen, Divyam Madaan, Nikita Nangia, Richard Yuanzhe Pang, Jason Phang, Samuel R. Bowman. "What do NLP Researchers Believe? Results of the NLP Community Metasurvey." *arXiv preprint*, in submission to *Transactions of the Association for Computational Linguistics (TACL)*, 2022.
17. **Aaron Mueller**, Mark Richard Lauersdorf, Kevin McGowan, Ramakanth Kavuluru. "Neural Machine Translation for Canadian French." *Undergraduate thesis*, 2018.

INVITED TALKS

Aaron Mueller. "What Generalizations do Sequence-to-sequence Models Learn from Multilingual Text? Insights from Translation and Syntactic Transformations." At the National Research Council of Canada (Ottawa, ON). March 4, 2022. Virtual talk.

Aaron Mueller. "Syntactic Agreement in Neural Language Models: How Well and Where Do They Perform Subject-Verb Agreement?" At Mila – Québec Artificial Intelligence Institute, Language & Understanding Group (Montréal, QC). March 22, 2021. Virtual talk.

Aaron Mueller*, Sebastian Gehrmann*. "Causal Mediation Analysis for Analyzing Neural Networks." At Google Fairness & Interpretability Research Group (New York, NY). March 17, 2021. Virtual talk. [*Equal contribution]

Aaron Mueller. "Causal Analysis of Syntactic Agreement Mechanisms in Neural Language Models." At Johns Hopkins University, Center for Language & Speech Processing Seminar (Baltimore, MD). February 12, 2021. Virtual talk.

Academic Research Experience

Johns Hopkins University — Baltimore, MD

Research Assistant, Center for Language & Speech Processing — August 2018 – Present
Advisors: David Yarowsky, Mark Dredze
- Research in neural machine translation, natural language generation, and massively multilingual NLP.

Research Assistant, Center for Language & Speech Processing — May 2016 – August 2016
Advisor: David Yarowsky
- Research in statistical machine translation for low-resource languages.
- Implemented a lemma-based English-Uyghur translation model, built a morphological generator for Crimean Tatar, and created parsers to extract translation tables from foreign editions of Wiktionary.

New York University — New York, NY

Visiting Academic, Center for Data Science — August 2021 – Present
Advisor: Tal Linzen
- Behavioral and causal probing into the (morpho)syntactic representations and abilities of neural language models and sequence-to-sequence models.

University of Massachusetts Amherst — Amherst, MA

Research Assistant, Statistical Social Language Analysis Lab — May 2017 – August 2017
Advisor: Brendan O'Connor
- Research in entity-event extraction.
- Integrated entity mention and relation systems into pre-existing sentence-level entity-event extraction model. Also integrated document-level information (e.g., noun coreferences) as features.

Fellowships and Awards

National Science Foundation Graduate Research Fellow — 2018 - 2023

Gaines Fellow — 2016 - 2018
Two-year fellowship. Requires the completion of a juried project, a thesis project, and a seminar in the humanities. ($5,000)

Patterson Scholar — 2014 - 2018
Awarded to University of Kentucky undergraduates who have earned National Merit semifinalist standing or better. ($80,000+)

Raymond F. Betts Scholar — 2017
Awarded to rising seniors conducting thesis research. Used funds to study Québec French in Montréal and Québec City during winter of 2017–2018. ($2,500)

Goldwater Scholarship (Honorable Mention) — 2017

Phi Beta Kappa — 2017

Linguistics Research Award — 2016
Awarded to an undergraduate to facilitate a year-long research project in linguistics. Used funds for a quantitative sociolinguistics project examining semantic shifts in gendered words in U.S. media over 200 years. ($500)

Teaching

Johns Hopkins University — Baltimore, MD

Teaching Assistant
- Machine Learning: AI System Design & Development. — Spring 2020

Mentoring

Master's students

Yash Kumar Lal (JHU. Now Ph.D. student at Stony Brook University.) — 2018–2019

Undergraduate researchers

Yu Xia (NYU. Now Master's student at New York University.) — 2021–2022

Matthew Finlayson (Harvard. Now predoctoral researcher at Allen Institute for AI.) — 2020–2021

Skills

Programming:
- Languages (expert): Python, C++, HTML, CSS, Javascript, Bash
- Machine Learning Toolkits: PyTorch (incl. HuggingFace, fairseq, sockeye), NLTK, Scikit-learn, numpy
- Version Control: DVCS (Git, Bitbucket)

Linguistic Tools:
Praat, AntConc, QGIS, Audacity

SERVICE	*Primary Reviewer*: ACL (2022, 2020), EMNLP (2022, 2019), NAACL (2021), CoNLL (2022), COLING (2020). *Secondary Reviewer*: TACL (2022).
LANGUAGES	English (native language), French (B2, Canadian).