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
- Computational psycholinguistics (syntax & morphology)
- Machine translation

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: Mark Dredze, David Yarowsky.

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. **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.

5. **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.
6. 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]
7. 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]
8. **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.
9. **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.
10. 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.
11. 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.
12. 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.
13. 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.
14. **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

15. 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*, 2022.
16. **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.

RESEARCH PRESENTATIONS

Aaron Mueller. "Québec French and Language Technology." 2018 Betts & Rowland Scholar Awards Ceremony, Lexington, KY, April 4, 2018.

Aaron Mueller, Katherine Keith, Abram Handler, Su Lin Blodgett, Brendan O'Connor. "The Identification of Civilians Killed by Police with Supervised Entity-Event Extraction." UMass Amherst Research

Experience for Undergraduates (REU) Showcase. Amherst, MA. August 9, 2017.

Aaron Mueller, Raphael Finkel, Hilaria Cruz. "Documenting and Promoting the Chatino Language and Orthography." Juried Presentation in Satisfaction of the Requirements of the Gaines Fellowship. Lexington, KY. February 21, 2017.

Aaron Mueller, Huda Khayrallah, Winston Wu, David Yarowsky. "A Lemma-Based Approach for English-Uyghur Statistical Machine Translation." Refereed Abstract at the *9th Annual Conference of the Illinois Language and Linguistics Society (ILLS9)*. Urbana, IL. March 31, 2017.

Aaron Mueller, Mark Richard Lauersdorf. "Lexical and Semantic Shifts in the Linguistic Construction of Social Gender: A Corpus-Based Analysis of Written U.S. English." Poster. Refereed Abstract at the *9th Annual Toronto Undergraduate Linguistics Conference (TULCON9)*. Toronto, ON. March 5, 2016.

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 Kentucky — Lexington, KY

Research Assistant, Institutional Research & Advanced Analytics Team — May 2018 – August 2018

Advisors: Nathan Jacobs, Craig Rudick

- Implemented deep LSTMs to learn student and course profiles for grade prediction.
- Designed various ordinal loss functions.

Juried Project, Gaines Center — August 2016 – May 2017

Jurors: Hilaria Cruz, Raphael Finkel, Phil Harling

- Preservation and revitalization project for a low-resource indigenous language—Chatino—spoken natively by approximately 40,000 individuals.
- Trained ASR systems with Sphinx.
- Created and publicized Chatino language-learning resources, including open-source speech data, a speech corpus, and a website.

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 awarded to undergraduates based on academic performance, ability to conduct research, an interest in public issues, and a desire to enhance understanding of the human condition through the humanities. 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 students 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 a University of Kentucky 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)

National Merit Semifinalist 2014

TEACHING

Johns Hopkins University Baltimore, MD
Teaching Assistant
- Machine Learning: AI System Design & Development. Spring 2020

SKILLS

Programming:
- Languages (expert): Python
- Languages (proficient): 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

LANGUAGES

English (native language), French (B2, Canadian). Experience with German and Finnish through research.

INTERESTS AND HOBBIES

- Music: guitar (classical, electric), bass, banjo, synthesizer, MaxMSP, Ableton Live.
- Athletics: cold-weather/snow hiking, swing dance, contra.
- Hobbies: natural language learning, reading (philosophy, politics), city exploration.
- Cooking: Thai, French, German, Southern.