Elliot Schumacher, Ph.D.

Background: Johns Hopkins Comp. Sci. Ph.D., Carnegie Mellon Masters
NLP/ML/AI, 3+ years industry experience, U.S. Citizen.
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OVERVIEW

I develop advances in **machine learning and large language models for real-world impact**. Much of my research, including during my Ph.D. at Johns Hopkins University and Curai Health, has focused on building natural language processing tools for healthcare. I also have experience in education and multilingual settings. In all cases, developing these systems required working with noisy data and specialized model training. Compelled by the recent advances in large language models, I am excited to make an impact in machine learning for domains previously thought impossible.

Interests: Natural language processing, machine learning, large language models, expert domains

EXPERIENCE

Curai Health | *Machine Learning Researcher* Nov. 2022 - Present

- **Natural Language Processing and Large Language Models** Developed and trained multiple approaches for applying large language models (LLMs) to domain-specific tasks, including summarization and conversational systems.
  - These efforts focused on production features and involved collaborations with domain experts and engineers.
  - Additionally, selected projects resulted in technical papers.
- **Evaluation of Summarization.** Designed and developed an approach to detect facts omitted from medical summaries.
  - The resulting system, MEDOMIT, not only identifies omitted facts but weighs them in relation to the differential diagnosis. An evaluation by medical experts showed it closely reflects expert judgments. *(Link)*
- **Safety in User Facing Applications.** Designed an approach to building robust guardrail systems to ensure LLMs do not output undesirable responses.
  - This included generating training data from a larger LLM and fine-tuning a smaller model that outperformed our baselines. Paper was accepted to NAACL 2024 main. *(Link)*
- **Improving Summarization Quality.** Designed an approach to improve summarization quality through LLM-powered dialogue. Expert annotators preferred these summaries over baseline summaries. (Link)

Johns Hopkins University | *PhD Student Researcher in Computer Science* Aug. 2017 - Oct. 2022

- **Information extraction for medical documents.** Focused on concept linking (linking mentions of medical concepts to an ontology) and medical tasks such as phenotyping (classifying whether a patient has a disease given their medical notes).
- **Entity linking in the crosslingual and multilingual settings.**
  - Designed a cross-lingual linker, which linked mentions of entities in non-English languages (e.g. Mandarin Chinese) to an English knowledge base, that can be trained in a zero-shot manner.
  - Designed a multi-lingual linker to transfer an English-trained entity linker to Chinese mentions and knowledge bases. This work was applied to a search task in SCALE 2021.
- **Domain transfer for Entity Linking.** Studying how to build entity linkers that can transfer across different domains. This includes work on medical, biomedical text, news, and forum data. While much recent work within entity linking has focused on Wikipedia data, performance often drops on other domains.

Amazon Search | *Research Intern* Fall 2020

- Interned with the Subjective Search group, working on search-related technologies.

Carnegie Mellon University | *Graduate Researcher (Masters)* Aug. 2015- Aug. 2017

- Worked on the DSCoVAR project, a Department of Education grant to build a Vocabulary Tutoring System.
- Developed a method of ranking the reading difficulty of a sentence for first language learners, by running a crowdsourcing task and modeling the data to find important features (see EMNLP 2016 paper).
- Built a pipeline that finds sentences with selected vocabulary words, and annotates them for difficulty and other information.

State Teachers Retirement System of Ohio | *Developer* Jan. 2013 - Aug. 2015

- Developed internal applications in Java and C#.
- Designed and implemented a web application for internal forms.

Ohio State University Wexner Medical Center | *Student Intern* 2011- Jan. 2013

- Provided technical support within Ohio State's Hospital system.

Ohio State University College of Medicine | *Mobile Services Student* Sept. 2009 - 2011

- Provided technical support for students in the College of Medicine

EDUCATION

Johns Hopkins University October 2022

Ph.D. in Computer Science, Center for Language and Speech Processing

Advisors: Dr. Mark Dredze, Dr. James Mayfield

Research area: Natural Language Processing and Information Extraction, with a Focus on Clinical and Multilingual Domains.

Carnegie Mellon University August 2017

Master of Science in Language Technologies, Language Technologies Institute

Advisors: Dr. Maxine Eskenazi, Dr. Kevyn Collins-Thompson

Research area: Natural Language Processing for Educational domain.

Ohio State University May 2014

Bachelors of Science in Computer & Information Science, and Linguistics *with Honors, Cum Laude*

PUBLICATIONS

Elliot Schumacher, Daniel Rosenthal, Varun Nair, Luladay Price, Geoffrey Tso, and Anitha Kannan. Extrinsically-focused evaluation of omissions in medical summarization. *In Submission*, 2023a. URL `https://arxiv.org/abs/2311.08303`.

Albert Yu Sun, Varun Nair, **Elliot Schumacher**, and Anitha Kannan. Conscendi: A contrastive and scenario-guided distillation approach to guardrail models for virtual assistants. *NAACL*, 2024. URL `https://arxiv.org/abs/2304.14364`.

Varun Nair, **Elliot Schumacher**, Geoffrey Tso, and Anitha Kannan. Dera: enhancing large language model completions with dialog-enabled resolving agents. *ClinicalNLP at NAACL*, 2024. URL `https://arxiv.org/abs/2303.17071`.

Varun Nair, **Elliot Schumacher**, and Anitha Kannan. Generating medically-accurate summaries of patient-provider dialogue: A multi-stage approach using large language models. *Clinical NLP at NAACL*, 2023. URL `https://aclanthology.org/2023.clinicalnlp-1.26/`.

Elliot Schumacher, James Mayfield, and Mark Dredze. On the surprising effectiveness of name matching alone in autoregressive entity linking. In *Proceedings of the First Workshop on Matching From Unstructured and Structured Data (MATCHING 2023)*, 2023b. URL https://aclanthology.org/2023.matching-1.6/.

Elliot Schumacher, James Mayfield, and Mark Dredze. Zero-shot cross-language transfer of monolingual entity linking models. In *Proceedings of the The 2nd Workshop on Multi-lingual Representation Learning (MRL) at EMNLP*, 2022. URL https://aclanthology.org/2022.mrl-1.4/.

Elliot Schumacher, James Mayfield, and Mark Dredze. Improving zero-shot multi-lingual entity linking. *ACL Findings*, 2021. URL https://aclanthology.org/2021.findings-acl.52/.

Elliot Schumacher, Andriy Mulyar, and Mark Dredze. Clinical concept linking with contextualized neural representations. *ACL*, 2020. URL http://elliotschu.com/papers/paper_concept_linking.pdf.

Andriy Mulyar, **Elliot Schumacher**, Masoud Rouhizadeh, and Mark Dredze. Phenotyping of clinical notes with improved document classification models using contextualized neural language models. *Machine Learning for Health (ML4H) at NeurIPS 2019*, 2019. URL https://arxiv.org/abs/1910.13664.

Elliot Schumacher and Mark Dredze. Learning unsupervised contextual representations for medical synonym discovery. *JAMIA open*, 2(4):538–546, 2019. URL https://academic.oup.com/jamiaopen/article/2/4/538/5612165.

Elliot Schumacher and Mark Dredze. Discriminative candidate generation for medical concept linking. *Automated Knowledge Base Construction*, 2018. URL https://openreview.net/forum?id=r1xP1W56pQ.

Elliot Schumacher, Maxine Eskenazi, Gwen Frishkoff, and Kevyn Collins-Thompson. Predicting the relative difficulty of single sentences with and without surrounding context. *EMNLP*, 2016. URL https://aclanthology.org/2020.acl-main.760/.

TEACHING EXPERIENCE

Johns Hopkins University *Fall 2018* Teaching Assistant for Machine Learning

- Responsibilities include holding office hours, writing homework assignments, and teaching recitation.
- Gave guest lectures on Decision Trees and Linear Regression.

SERVICE

Reviewer *ACL and ML4Health

- Ongoing service as a reviewer for the ACL Rolling Review and ML4Health
- Named Outstanding Reviewer, ACL 2022 (1 of 71 selected, top 2.4%).

Johns Hopkins University CLSP Recruiting Weekend

- Across all years of my Ph.D., I organized the CLSP Recruiting Weekend, including external event planning, collaboration with administrative staff and other students, and schedule preparation.
- I sought to provide a helpful and accurate snapshot of graduate student life at CLSP and in Baltimore