Elliot Schumacher, Ph.D.

OVERVIEW

I develop research 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.

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

EXPERIENCE

Curai Health | *Machine Learning Researcher*   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*   2017 - 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)*   2015-2017

- 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*   2013 - 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*   2011-2013
  - Provided technical support within Ohio State's Hospital system.

Ohio State University College of Medicine | *Mobile Services Student*   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

Extrinsically-Focused Evaluation of Omissions in Medical Summarization

E. Schumacher, D. Rosenthal, V. Nair, L. Price, G. Tso, A. Kannan. *In Submission (Link)*.

CONSCENDI: A Contrastive and Scenario-Guided Distillation Approach to Guardrail Models for Virtual Assistants

A. Yu, V. Nair, **E. Schumacher**, A. Kannan. *To appear at NAACL 2024 Main (Link)*.

DERA: Enhancing Large Language Model Completions with Dialog-Enabled Resolving Agents

V. Nair, **E. Schumacher**, G. Tso, A. Kannan. *In Submission (Link)*.

Generating medically-accurate summaries of patient-provider dialogue: A multi-stage approach using large language models   July 2023

V. Nair, **E. Schumacher**, A. Kannan. *The 5th Clinical NLP Workshop at ACL 2023 (Link)*.

On the Surprising Effectiveness of Name Matching Alone in Autoregressive Entity Linking   July 2023

E. Schumacher, J. Mayfield, M. Dredze. *MATCHING 2023 at ACL 2023 (Link)*.

Improving Zero-Shot Multi-Lingual Entity Linking   Dec 2022

E. Schumacher, J. Mayfield, M. Dredze. *Workshop on Multi-lingual Representation Learning (MRL) at EMNLP 2022 (Link)*.

Cross-Lingual Transfer in Zero-Shot Cross-Language Entity Linking   July 2021

E. Schumacher, M. Dredze, J. Mayfield. *ACL 2021 Findings. (Link)*.

Clinical Concept Linking with Contextualized Neural Representations   July 2020

E. Schumacher, A. Mulyar, M. Dredze. *ACL 2020. (Link)*.

Phenotyping of Clinical Notes with Improved Document Classification Models
Using Contextualized Neural Language Models.   Dec 2019

A. Mulyar, **E. Schumacher**, M. Rouhizadeh, M. Dredze. *Machine Learning for Health at Neurips. (Link)*.

Learning Unsupervised Contextual Representations for Medical Synonym Discovery   November 2019

E. Schumacher, M. Dredze. *JAMIA Open. (Link)*.

Discriminative Candidate Generation for Medical Concept Linking   May 2019

    E. Schumacher, M. Dredze. *AKBC 2019. (Link)*.

Predicting the Relative Difficulty of Single Sentences With and Without Surrounding Context.   Nov 2016

    E. Schumacher, M. Eskenazi, G. Frishkoff, K. Collins-Thompson. *EMNLP 2016. (Link)*.

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

TECHNICAL REPORTS AND PRESS COVERAGE

A Readability Analysis of Campaign Speeches from the 2016 US Presidential Campaign *March 2016*

    E. Schumacher, M. Eskenazi. *(Arxiv Link)*.

- **CMU Press Release**: *Most Presidential Candidates Speak at Grade 6 — 8 Level*
- **Selected Press Coverage**
    - **Huffington Post**: *Trump's Speeches Are At A Middle-School Reading Level, Study Says.*
    - **Washington Post**: *Trump's grammar in speeches 'just below 6th grade level,' study finds.*
    - **Pittsburgh Tribune-Review**: *Speeches dip below 6th-grade level, study says.*