

# YUSHI HU

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## EDUCATION

### University of Washington

Ph.D. in Electrical Engineering

Advisor: Prof. Mari Ostendorf

Research interests: Natural Language Processing, Speech Processing, Machine Learning

Seattle, WA

2021 – 2026

### University of Chicago

B.S. in Computer Science, Mathematics, B.A. in Economics

*summa cum laude*, Phi Beta Kappa

Chicago, IL

2017 – 2021

Related Coursework: Machine Learning, Deep Learning, Unsupervised Learning, Machine Learning Theory, Natural Language Processing, Speech Technologies, Parallel Computing, Networks and Distributed Systems, Database, OS, Algorithm, Optimization, Real Analysis, Complex Analysis, ODE, Stochastic Process.

## PUBLICATIONS

1. Shane Settle, Bowen Shi, **Yushi Hu**, and Karen Livescu. 2021. Joint Training of Whole-Word Embedding and Recognition Models. (under review)
2. S. R. Bakaul, **Y. Hu**, L. Stan, Q. Zhang, A. K. Petford-Long, N. Valanoor. 2021. Structural ripples and nanoscale bubble domains in freestanding ferroelectric-dielectric-ferroelectric heterostructure. (*under review*)
3. **Yushi Hu**, Shane Settle, and Karen Livescu. 2021. [Acoustic Span Embeddings for Multilingual Query-by-Example Search](#). In *IEEE Spoken Language Technology Workshop (SLT 2021)*.
4. **Yushi Hu**, Shane Settle, and Karen Livescu. 2020. [Multilingual Jointly Trained Acoustic and Written Word Embeddings](#). In *Proc. of Interspeech 2020*.
5. **Yushi Hu**, Tianye Wang, Yefeng Mei, Zhao Zhang and Chuangang Ning. 2016. [A simple setup to measure muon lifetime and electron energy spectrum of muon decay and its Monte Carlo simulation](#). In *物理与工程*, 2016.05

## RESEARCH EXPERIENCE

### Toyota Technological Institute at Chicago

Research Assistant, Speech and Language group

Advisor: Prof. Karen Livescu

Chicago, IL

Sep 2019 – Present

- **Multilingual Jointly Trained Acoustic and Written Word Embeddings**  
Acoustic word embeddings are vector representation of spoken word segments. We propose a method to jointly train acoustic and written word embedding models using phonetically transcribed data from multiple languages. We test our models on word discrimination tasks for twelve languages. Our method outperforms prior results on English and achieves good results on low-/zero- resource languages.
- **Acoustic Span Embeddings for Multilingual Query-by-Example Search**  
Query-by-example (QbE) search is the task of matching spoken queries to utterances within a search collection. We generalize multilingual acoustic word embeddings to acoustic span embeddings (ASE) and explore the application of ASE to QbE with arbitrary-length queries in multiple unseen languages. We evaluate our ASE-based system on the QUESST 2015 QbE task, finding that our method outperforms the best prior result while being 100x faster.
- **Joint Training of Whole-Word Embedding and Recognition Models**  
We improve acoustic-to-word (A2W) speech recognition systems by jointly training with acoustic and written word embeddings. We find that joint training consistently improves recognition performance, especially for lower-resource settings, and our best CTC-based models are competitive with prior CTC subword models of similar complexity.

### Argonne National Laboratory

Research Intern, Materials Science Division

Advisor: Dr. Saidur R. Bakaul

Lemont, IL

July 2018 – Aug 2018

- Modeled and simulated electromagnetic field in ferroelectric materials via MATLAB and Python. The simulation successfully explained the observed phenomena in ferroelectric-dielectric-ferroelectric heterostructure.

## Tsinghua University

Research Assistant, Department of Physics

Advisor: Prof. Chuangang Ning

Beijing, China

Mar 2015 – Feb 2017

- Introduced a way to measure the muon decay events via self-designed coincidental circuits, digital oscilloscope, and self-designed visual real-time control software. This resulted in \$100k savings compared to expensive nuclear physics modules. Constructed simulation of muons via C++ library GEANT4 by CERN to prove the system correctness.

## INDUSTRY EXPERIENCE

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### Learnable.ai

Boston, MA

Machine Learning Engineer Intern

Jun 2019 – Sep 2019

- Devised and implemented a new method for de-warping cell-shot document images based on single-view 3D-reconstruction and conformal mapping. Improved OCR performance in products.
- Designed and implemented models to automatically grade students' answers (in LaTeX). Devised a BERT-based system and a rule-based pattern matching system. Achieved 80% accuracy on real data. Proposed a semantic parsing-based system to further improve the performance.

## OPEN-SOURCED PROJECTS

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### Embedding-based query-by-example search

Implementation of the paper *Acoustic Span Embeddings for Multilingual Query-by-Example search* (Hu et al., 2021)

<https://github.com/Yushi-Hu/Query-by-Example>

### Multilingual acoustic word embeddings (developed with Shane Settle)

Implementation of the paper *Multilingual Jointly Trained Acoustic and Word Embeddings* (Hu et al., 2020)

<https://github.com/Yushi-Hu/Multilingual-AWE>

## AWARDS & HONORS

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ECE PhD Fellowship, University of Washington	2021
<i>summa cum laude</i> , University of Chicago	2021
Dean's List, University of Chicago	2018-2021
Gary Becker Scholar, University of Chicago	2020
ACM-ICPC Mid-Central Regional Finalist	2019
Jeff Metcalf Fellowship, University of Chicago	2018
1st Prize, 33rd Chinese Physics Olympiad	2016
2nd Place, China Team Captain, 29th International Young Physicists' Tournament	2016

## SKILLS

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**Programming Languages (proficient):** Python, C/C++, MATLAB, bash

**Programming Languages (capable):** Java, JavaScript, Node.js, Mathematica

**Frameworks and tools:** PyTorch, TensorFlow, OpenCV, NLTK, Spark

**Database Management:** SQL, Pandas

**Natural Languages:** Mandarin (native), English (fluent)