NARUTATSU (EDWARD) RI

wl2787@columbia.edu

EDUCATION

Columbia University, School of Engineering and Applied Science **Sep. 2020 – May 2024**
B.S. Candidate in Computer Science, GPA: 3.98/4.00.
Egleston Scholar (Top 1% of undergraduate engineering applicants).
Ezoe Memorial Foundation Academic Scholarship (Full-ride scholarship)

PUBLICATIONS

[1] *Do Language Models Explain Themselves? Counterfactual Simulatability of Natural Language Explanations*
Yanda Chen, Ruiqi Zhong, **Narutatsu Ri**, Chen Zhao, He He, Kathleen McKeown, Jacob Steinhardt, Zhou Yu
arXiv Preprint, 2023.

[2] *Enhancing Few-shot Text-to-SQL Capabilities of Large Language Models: A Study on Prompt Design Strategies*
Linyong Nan, Yilun Zhao, Weijin Zou, **Narutatsu Ri**, Jaesung Tae, Ellen Zhang, Arman Cohan, Dragomir Radev
arXiv Preprint, 2023. Submitted to EMNLP 2023.

[3] *IdEALS: Idiomatic Expressions for Advancement of Language Skills*
Narutatsu Ri, Bill Sun, Sam Davidson, Zhou Yu
arXiv Preprint, 2023. Submitted to EMNLP 2023.

[4] *Contrastive Loss is All You Need to Recover Analogies as Parallel Lines*
Narutatsu Ri, Fei-Tzin Lee, Nakul Verma
Accepted to ACL 2023 (RepL4NLP).

[5] *A Dialogue System Implemented with Latent Parameters*
Weida Li, Chie Hieida, Takayuki Nagai
Journal of Proceedings of the Annual Conference of JSAI, 2019.

RESEARCH EXPERIENCE

Columbia University Department of Computer Science **May 2023 – Present**
Researcher, with Daniel Hsu

- Research on the theoretical capabilities of transformers in effectively generalizing to out-of-domain distribution shifts.
- Exploring mechanistic interpretability of transformers and their role in statistical model selection, investigating how their internal mechanisms can provide insights into the selection process.

Columbia University Department of Computer Science **Jan. 2021 – Present**
Researcher, with Nakul Verma

Analogy Recovery in High-Dimensional Embedding Space

- Designed *CWM (Contrastive Word Model),* word embedding model with simple contrastive learning objective with analogy recovery performance competitive with popular word embedding models with 50× training efficiency.
- Conducted theoretical analysis on CWM and proved intrinsic relationship between the geometric formation of analogies and word co-occurrence statistics.

Other Topics

- Conducted theoretical research focused on the sample complexity of label metric learning.
- Developed a word embedding technique based on t-SNE and demonstrated its competitive performance on word similarity tasks through empirical analysis.
- Experimentally enhanced the deep embedded clustering algorithm by incorporating a local structure preserving property, resulting in improved clustering performance.

Columbia University Natural Language Processing Lab **Aug. 2022 – May 2023**
Researcher, with Zhou Yu

- Research on word choice improvement and developing phrasal recommendation language models.
- Research on the counterfactual simulatability of explanations generated by large language models. Developed a novel framework for defining simulatability and designed infrastructure for training large language models. Created an Amazon Mechanical Turk task to gather extensive data for evaluating the performance of models.

The University of Tokyo International Research Center for Neurointelligence **May 2022 – Sep. 2022**
Visiting Researcher, with Mingbo Cai

- Conducted an in-depth analysis of the manifold structure in contextualized BERT embeddings, uncovering and examining a notable horseshoe effect present in these embeddings.
- Designed and developed a novel framework capable of predicting and decoding syntactic information from raw fMRI brain activity specifically for movie scene descriptions.

University of Electro-Communications iSYSLab **Oct. 2017 – Jun. 2019**
Special Researcher, with Takayuki Nagai

- Proposed idea to a professor and conducted independent research focused on developing a dialogue system that leverages latent syntactic and semantic information for generating responses.
- First high school student in history to be accepted as a presenter at the 33rd Annual Conference of the Japanese Society for Artificial Intelligence, the largest annual AI conference in Japan.

WORK EXPERIENCE

Columbia University Department of Computer Science **Jul. 2022 – May 2023**
Head Teaching Assistant, Machine Learning (COMS 4771)

- Tested out of COMS 4771 (Graduate Machine Learning course) during sophomore year.
- Teaching Assistant for the Summer 2022, Fall 2022 (Head TA), and Spring 2023 (Head TA) semesters.

Project Thryving, DATAFLUCT, INC. **Jul. 2021 – Jul. 2022**
Software Engineer, Subcontractor

- Received invitation from to join data analytics team based on recognized skills and expertise.
- Designed and developed an interactive business intelligence dialogue system that effectively analyzes trends and identifies anomalies in corporate sales data, providing valuable insights for informed decision-making.

AWARDS & HONORS

Dean's List	**2020 – 2023**
Tau Beta Pi candidate	**2022, 2023**
Egleston Scholar	**2020**
Ezoe Memorial Foundation Academic Scholarship (Selected as 1 out of 5 students among thousands of applicants)	**2019**
University Robotics Competition (RoboCup Japan Open) Winner	**2018**
S-ISEF Finalist	**2018**
National Programming Contest Silver Medal	**2017**

COURSEWORK

Graduate Coursework:

- *Computer Science*: Machine Learning (Skipped), Unsupervised Learning, Advanced Algorithms, Natural Language Processing, Computational Learning Theory, Dialog Systems, Geometric Data Analysis, Robot Learning
- *Mathematics*: Probability Theory, Advanced Linear Algebra

Undergraduate Coursework:

- *Computer Science:* Data Structures, Fundamentals of Computer Systems, Computer Science Theory (Skipped)
- *Mathematics:* Real Analysis, Ordinary Differential Equations

SKILLS

Programming Languages

- C++, Python, Java, HTML/CSS, MySQL

Tools

- PyTorch, HuggingFace, TensorFlow, Keras, Android Studio, LaTeX