ZECHENG WANG

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Research Interests

- My undergraduate research focused on Natural Language Processing (dialogue systems, language modeling). Through my capstone project on modeling real-time translation with Reinforcement Learning, I became interested in RL.
- With expertise in Transformer, I am now working as a Research Assistant to further explore RL topics such as the impact of pre-training, cross-environment learning, and scalable sequence architectures (Transformer) in RL.

Education

- **New York University Shanghai**, B.S. in Computer Science; B.S. in Data Science (*magna cum laude*), 2023
  - Major GPA: 3.93
  - Cumulative GPA: 3.90

Honors and Awards

- Dean's List for Academic Year 2019, 2020, 2021, 2022
- Dean's Undergraduate Research Funding 2021, 2022
- Major honors in Computer Science

Work Experience

- **Research Assistant**, full-time, NYU Abu Dhabi, 2023 - present
  - Conduct thorough literature review to obtain insights for research projects on pre-training, cross-environment learning, and scalable architectures in Reinforcement learning
  - Design algorithms and experiments and implement codes to provide empirical support for research ideas
  - Present findings from literature review and experimental results to the group on a weekly basis
  - Write manuscripts for publication and technical reports for efficient communication with the group and collaborators

  Advisor: Prof. Keith Ross, NYU Abu Dhabi.

- **Teaching Assistant**, part-time, NYU Abu Dhabi, 2023 - present
  - Assist the course instructor with teaching the Machine Learning course
  - Design and grade assignment and exam questions covering both theoretical and coding aspects
  - Prepare and give lectures on coding (PyTorch) tutorial and answer questions from students

  Course Instructor: Prof. Keith Ross, NYU Abu Dhabi.

Publications

- **Z. Wang**, C. Wang, Z. Dong, K. Ross, "Pre-training with Synthetic Data Helps Offline Reinforcement Learning," (Submitted to ICLR 2024), 2023
- **Z. Wang** and Y. -C. Tam, "Suffix Retrieval-Augmented Language Modeling," ICASSP 2023 - 2023 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), Rhodes Island, Greece, 2023, pp. 1-5, doi: 10.1109/ICASSP49357.2023.10096450.
- Y. -C. Tam, J. Xu, J. Zou, **Z. Wang**, T. Liao and S. Yuan, "Robust Unstructured Knowledge Access in Conversational Dialogue with ASR Errors," *ICASSP 2022 - 2022 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), Singapore, Singapore,* 2022, pp. 6702-6706. doi: 10.1109/ICASSP43922.2022.9746741.

Presentations

- **Oral presentation** at IEEE International Conference on Acoustics, Speech and Signal Processing, June 2023: "Suffix Retrueval-Augmented Language Modeling," Rhodes Island, Greece.
- **Poster presentation** at *Tandon Research Excellence Exhibit,* Spring 2022: "AI for Scientific Research: Bio-treatment," NYU Tandon School of Engineering, New York.
- **Poster presentation** at *Undergraduate Research Symposium,* Fall 2021: "Knowledge-grounded Task-oriented Dialog Modeling on Spoken Conversations," NYU Shanghai, Shanghai, China.

Works in Progress

- *Why Pre-training with Synthetic Data Helps Offline Reinforcement Learning?*
  - Understand why simple synthetic data pre-training can give performance boost better than language pre-training on offline Reinforcement Learnning tasks
  - Utilize visualization strategies on model decision boundary and loss landscape with different pre-training strategies

  Advisor: Prof. Keith Ross, NYU Abu Dhabi

- *Cross-Environment Learning with Text Description and Scalable Transformer Architecture*

- Investigate the possibility of transferring knowledge between environments with raw state input by incorporating text description of the states and actions
- Experiment with Transformer which allows for scalable DQN framework on high dimensional action space and is potentially beneficial for knowledge transfer between environments

Advisor: Prof. Keith Ross, NYU Abu Dhabi

Selected Research Experience

- *Pre-training with Synthetic Data Helps Offline Reinforcement Learning*, NYU Abu Dhabi, 2023
  - Proposed a simple effective synthetic pre-training scheme for both Decision Transformer and MLP architectures
  - Achieved better performance with DT for d4rl MUJOCO datasets compared to the previous language pre-training scheme while consuming significantly less compute resources (3% pre-training resources, 67% fine-tuning)
  - Submitted the manuscript to ICLR 2024

  Advisor: Prof. Keith Ross, NYU Abu Dhabi

- *Suffix Retrieval-augmented Language Modeling.*, NYU Shanghai, 2022-2023
  - Proposed a novel approach for simulating bidirectionality in causal language modeling by retrieving prefix-suffix representations from external knowledge
  - Reduced perplexity by 20% on DSTC9 dataset compared to popular pretrained LM baselines.
  - Published the manuscript at ICASSP 2023.

  Advisor: Prof. Yik-Cheung Tam, NYU Shanghai

- *Capstone project: Simultaneous Machine Translation using Deep Reinforcement Learning*, 2022
  - Did extensive literature review on existing methods of Simultaneous machine translation (SiMT)
  - Proposed a framework for SiMT which applied on-policy reinforcement learning to control delay
  - Implemented an RL environment to learn the latency control given an online translation model

  Advisor: Prof. Keith Ross, NYU Abu Dhabi

- *AI for Scientific Research: Bio Treatment*, 2022
  - Approached vaccine efficacy prediction from a machine learning perspective
  - Implemented a flexible ML pipeline improving performance
  - Enhanced model interpretability on local and global scales

  Mentor: Dr. Sergey Samsonau, NYU Tandon School of Engineering

- *Course Project: Object Detection Competition,* 2022
  - Implemented an end-to-end object detection system emphasizing including self-supervised pretraining
  - Utilized various pretraining methods (VICReg, Barlow Twins) and architectures (Faster-RCNN & ResNet, DETR)
  - Ranked top 3 in class among 21 teams (graduate-level Deep Learning course)

  Instructor: Prof. Alfredo Canziani and Prof. Yann LeCun, NYU

- *Q&A Dialog System for Information Inquiry based on Similarity between Sentence Representations,* 2022
  - Designed a Q&A dialog system based on sentence embedding similarity computation between queries and knowledge
  - Finetuned SBERT models with data augmentation from structured knowledge and limited templates
  - Achieved 96.7% top-10 and 80.6% top-1 accuracy for noisy texts queries

  Advisor: Prof. Yik-Cheung Tam, NYU Shanghai

- *Knowledge-grounded Task-oriented Dialog Modeling on Spoken Conversations,* 2021
  - Designed a data augmentation algorithm simulating speech recognition errors for knowledge clustering classification
  - Implemented named entity linking and error correction algorithms with Elasticsearch improving performance
  - Co-authored paper published at ICASSP 2022 on our approach ranking 8th in DSTC 10 Track 2 at AAAI Workshop

  Advisor: Prof. Yik-Cheung Tam, NYU Shanghai

Relevant Coursework

- **Math:** *Econometrics, Probability and Statistics, Multivariable Calculus, Linear Algebra, Discrete Math.*
- **Computer Science:** *Reinforcement Learning, Natural Language Processing, Deep Learning, Machine Learning, Artificial Intelligence, Robotics, Computer Graphics, Algorithms, Databases, Data Structures.*

Leadership Experience

- **ML Lead & Advisor**, AI for Scientific Research, 2022-present
  Mentor: Dr. Sergey Samsonau, NYU Tandon School of Engineering

Relevant Skills

- Programming Languages: proficient in Python, basic understanding with Java, C, R Studio
- Machine Learning: PyTorch, Scikit-learn, OpenCV, Elasticsearch
- Systems: LINUX, SLURM
- Language: proficient in English, fluent in Chinese