

Tianyi Zhang

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HIGHLIGHTS

- Expertise:**
 - Natural Language Processing** 4 years in MSE and beyond
 - Human Cognition** 6 years in B.S., M.Ed.
- Research Experience:**
 - 4 projects in 4 years:
 - Event Extraction DARPA BETTER, USA, 20-22, publication [6]
 - Schema Induction DARPA KAIROS, USA, 22, leader, publication [5]
 - Natural to Symbolic Translation AI2, USA, 23, member & leader, publication [2,3]
 - Pretraining with NL-KG Reconstruction University of Bonn, Germany, 24 fall, publication [1]
- Research Interests:**
 - Understanding and Reasoning in Natural and Symbolic Language
 - Language Model Pretraining, Multimodality
 - Other human cognition and NLP related fields, including Robotics, CV
 - Happy to explore and confident to work well in varied tasks

EDUCATION

- University of Pennsylvania** | Philadelphia, America Sept. 2018 – Dec. 2022
 - MSE in Data Science GPA: 3.97/4.00
 - Advisor: Prof. Chris Callison-Burch
 - M.Ed. in Learning Science and Technology GPA: 3.91/4.00
 - Advisor: Prof. Yasmin B. Kafai
- Beijing Normal University** | Beijing, China Sept. 2014 – Jul. 2018
 - B.S. in Educational Technology GPA: 88/100
 - Advisor: Prof. Qian Fu

PUBLICATIONS

- [1] **Zhang, T.**, Mai, F., Flek, L., Pretraining Language Models with NL-KG-NL Reconstruction Loop. Paper in writing.
- [2] **Zhang, T.** *, Zhang, L. *, Hou, Z., Wang, Z., Gu, Y., Clark, P., Callison-Burch, C., and Tandon, N. (2024). PROC2PDDL: Open-Domain Planning Representations from Texts. In Proceedings of the Second Workshop on Natural Language Reasoning and Structured Explanations (NLRSE) (oral + poster).
- [3] Zhang, L., Jansen, P., **Zhang, T.**, Clark, P., Callison-Burch, C., Tandon, N. (2024). PDDLEGO: Iterative Planning in Textual Environments. In Proceedings of the 13th Joint Conference on Lexical and Computational Semantics (*SEM).
- [4] Jin, M., Kaul, M., Ramakrishnan, S., Jain, H., Chandrawat, S., Agarwal, I., **Zhang, T.**, Zhu, A., Callison-Burch, C. (2024). WorldWeaver: Procedural World Generation for Text Adventure Games using Large Language Models. In Proceedings of the 4th Wordplay: When Language Meets Games @ ACL 2024.
- [5] **Zhang, T.** *, Tham, I. *, Hou, Z. *, Ren, J., Zhou, L., Xu, H., Zhang, L., Martin, L., Dror, R., Li, S., Ji, H., Palmer, M., Brown, S., Suchocki, R., and Callison-Burch, C. (2023). Human-in-the-Loop Schema Induction. In Proceedings of the 61st Annual Meeting of the Association for Computational Linguistics (Volume 3: System Demonstrations) (poster).
- [6] **Zhang, T.**, Sulem, E., Roth, D. Question-Answering Data Augmentation for Argument Role Labeling.

RESEARCH EXPERIENCE

- **Lamarr Institute at University of Bonn** Sept. 2024 –
Pretraining Language Model through Unsupervised Text and Knowledge Graph Loop
 - To enhance model's understanding and reasoning abilities on downstream tasks
 - Design pretraining pipeline imitating human learning: encoding-memorization-decoding
 - Train encoder-decoder LMs on masked knowledge tuples and NL-KG-NL reconstruction objectives
 - Improve faithfulness and interpretability of black-box LMs
 - Publication [1]: "Pretraining Language Models with NL-KG-NL Reconstruction Loop."
- **NLP Group at UPenn** May. 2022 – Jun. 2023
Natural to Symbolic Reasoning
 - To reason on events unfold: infer events with fine-grained entity-state
 - Translate open-domain Natural Language text (wikiHow) to Symbolic Language (PDDL) with GPT-4
 - Decompose the task into three stages: extraction, inference, and translation
 - Identify strong text extraction and entity-state inference abilities with complex wikiHow text (~5000 words)
 - Acknowledge a weak translation capability to predefined symbolic predicates
 - Improve the entity-state tracking using CoT and instructions on translation.
 - Publication [2][3]: "PROC2PDDL: Open-Domain Planning Representations from Texts."
Event Schema Induction
 - To understand event relations: (semi-) automatically create event schema in high quality
 - Design the scaffolds (cause, plan, procedure, effect, etc.) for GPT-3
 - Apply SRL and constituency parsing to summarize and extract structured events
 - Build schema graphs by adding temporal relations to the events
 - Iteratively prompt LM and merge graphs
 - Design interface for human - GPT interactive schema generation
 - Improve accuracy and efficiency (1 hour to 15 mins per schema) and adopted by the UIUC group
 - Publication [5]: "Human-in-the-Loop Schema Induction."
- **Cognitive Computation Group at UPenn** Mar. 2020 – Dec. 2022
Event Extraction
 - To understand atomic events: extract events with 'who does what to whom'
 - Identify and classify event triggers using sequence tagging
 - Design a pipeline: BIO identify - event type classify model to replace the joint model
 - Improve performance with transfer learning on target language dataset, e.g., OntoNotesArabic
 - Identify and classify event arguments using QA
 - Design fixed questions for each argument role and convert the argument role labeling task to the Question-Answering task
 - Build a pipeline model: has/no answer classification + has answer identification to replace has-and-no-answer joint model
 - Improve performance with transfer learning on auxiliary QA datasets, e.g., SQuAD, QAMR
Event Data Augmentation
 - To overcome the deficiency of event annotation data
 - Design a pipeline approach: answer extraction (AE) and question generation (QG)
 - Train AEwSRL-QG Bert-T5 model to extract QA pairs from unlabeled event text
 - Evaluate the augmented data on QA event extraction model
 - Prove the effectiveness of the data augmentation approach (8k synthetic data exceeds 80k SQuAD data test on the ACE)
 - Publication [6]: "Question-Answering Data Augmentation for Argument Role Labeling."

WORK EXPERIENCE

- **Visiting Scholar** **Lamarr Institute** | University of Bonn, Germany Sept. 2024 – Dec. 2024
Advised by Prof. Lucie Flek
See the Research Experience section for details
- **Research Assistant** **NLP Group** | University of Pennsylvania, America May. 2022 – Jun. 2023
See the Research Experience section for details
Cognitive Computation Group | University of Pennsylvania Mar. 2020 – Dec. 2022
See the Research Experience section for details
- **Teaching Assistant** **CIS522 Deep Learning** | University of Pennsylvania, America Jan. 2022 – May. 2022
 - Design course materials and teach deep learning models in CV, NLP, RL, etc.
 - Hold Office Hours and group discussions each week.
- **Data Analyst** **SciStarter** | Philadelphia, America Sep. 2018 – Apr. 2019
 - Use the Python Pandas package to clean and analyze email log-in data (30,000 records).
 - Find the highest possibility of emails being checked is between 9 a.m. to 3 p.m., and within 1 day (over 80%). The most attractive topics are love, games, and high tech. The royalty of the subscriber is 50%.