Tianyi Zhang

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HIGHLIGHTS

- **Expertise:** Human Cognition; Natural Language Processing; 6 years in B.S., M.Ed.; 4 years in MSE and beyond
- **Research Experience:** 4 projects in 4 years:
  - Event Extraction — Synopsis: DARPA BETTER, 20-22, member, publication [5]
  - Schema Induction — DARPA KAIROS, 22-23, leader, publication [1]
  - Natural to Symbolic Translation — AI2, 23, member & leader, publication [2,3]
  - Pretraining with NL-KG Reconstruction — University of Bonn, 24 fall, ongoing
- **Research Interests:** Reasoning in Natural & Symbolic Language; Other human cognition and NLP related fields; 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

- **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: Towards Open-Domain Symbolic Planning"

  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 [1]: "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 [5]: "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%.