CHENG QIAN

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EDUCATION

Tsinghua University, *Undergraduate* Sep 2020 – Present
B.Eng. in Computer Science and Technology

- **GPA: 3.90 / 4.00.**
- Selected Courses of **A & A+**: Linear Algebra, Introduction to Complex Analysis, Foundation of Object-Oriented Programming, Software Engineering, Introduction to Artificial Intelligence, Introduction to Modern Cryptogrophy, Fundamentals of Computer Graphics, A General Introduction to Economics, Writing and Communication.
- A member of **THUNLP** (THU Natural Language Processing Group), advised by Associate Professor Zhiyuan Liu.

PUBLICATIONS

- **Cheng Qian**, Chi Han, Yi R. Fung, Yujia Qin, Zhiyuan Liu, Heng Ji. *CREATOR: Disentangling Abstract and Concrete Reasonings of Large Language Models through Tool Creation*.
- Yujia Qin, Shengding Hu, Yankai Lin, Weize Chen, Ning Ding, Ganqu Cui, Zheni Zeng, Yufei Huang, Chaojun Xiao, Chi Han, Yi Ren Fung, Yusheng Su, Huadong Wang, **Cheng Qian**, Runchu Tian, Kunlun Zhu, Shihao Liang, Xingyu Shen, Bokai Xu, Zhen Zhang, Yining Ye, Bowen Li, Ziwei Tang, Jing Yi, Yuzhang Zhu, Zhenning Dai, Lan Yan, Xin Cong, Yaxi Lu, Weilin Zhao, Yuxiang Huang, Junxi Yan, Xu Han, Xian Sun, Dahai Li, Jason Phang, Cheng Yang, Tongshuang Wu, Heng Ji, Zhiyuan Liu, Maosong Sun. *Tool Learning with Foundation Models*.
- Yujia Qin*, **Cheng Qian***, Xu Han, Yankai Lin, Huadong Wang, Ruobing Xie, Zhiyuan Liu, Maosong Sun, Jie Zhou. *Recyclable Tuning for Continual Pre-training*. Findings of ACL 2023.
- Yujia Qin*, **Cheng Qian***, Jing Yi*, Weize Chen, Yankai Lin, Xu Han, Zhiyuan Liu, Maosong Sun, Jie Zhou. *Exploring Mode Connectivity for Pretrained Language Models*. EMNLP 2022.

RESEARCH EXPERIENCES

CREATOR: Disentangling Abstract and Concrete Reasonings of Large Language Models through Tool Creation Mar 2023 – Jun 2023

- Directed by Prof. Zhiyuan Liu, THUNLP, and Prof. Heng Ji, UIUC Blender Lab.
- Investigated into the Large Language Model's (LLM) ability to create useful tools for problem-solving; Devised the CREATOR framework, which leverages the model's tool creation ability through four stages including creation, decision, execution and rectification.
- Disentangled the LLM's abstract and concrete reasoning abilities which raised the performance on MATH and TabMWP benchmarks; Released the Creation Challenge dataset which aims to test the LLM's tool creation ability.
- First author. Paper submitted to EMNLP 2023.

Tool Learning with Foundational Models Jan 2023 - Apr 2023

- Survey paper. Collaborated with CMU, UIUC and NYU.
- Explored LLM's ability to utilize external tools in various scenarios; Formulated a general tool learning framework, in which the foundational model understands human instructions, adjusts its tool-using plan through reasoning, and effectively conquer the target tasks.

- Contributed to the survey paper writing; Conducted experiments and case studies under various scenarios including online shopping, cooking assistant, weather inquiry, and search engine.
- Contributor to the paper. Submitted to Nature Machine Intelligence, under review.

Recyclable Tuning for Continual Pre-training Aug 2022 – Jan 2023

- Directed by Prof. Zhiyuan Liu, THUNLP.
- Formulated the task of recyclable tuning as Pretrained Language Model (PLM) continually acquire fresh knowledge from emerging data, and explored how to make earlier adapted weights compatible with subsequent upgraded PLMs.
- Explored the parametric connections and functional similarity among continually pre-trained models; Proposed distillation-based and initialization-based tuning methods, which enables recyclable tuning in data-efficient and training efficient ways; Experimented on various NLP tasks and demonstrated the superiority of out method; Construct the first benchmark regarding to the field of recyclable tuning.
- Co-first author. Applying for an invention patent. Accepted as Findings of ACL 2023.
- Project selected to THU *Undergraduate Academic Advancement program* and won ￥30K support.

Exploring Mode Connectivity for Pre-trained Language Models Mar 2022 – Jul 2022

- Directed by Prof. Zhiyuan Liu, THUNLP.
- Analyzed the geometric connections of different minima in loss landscape through the lens of mode connectivity, which measures whether two minima can be connected with a low loss path.
- Explored how various hyperparameters and training data affect PLMs' mode connectivity; Discovered the role of pre-training in facilitating mode connectivity and pulling task boundaries closer; Investigated into how PLMs task knowledge change along the connected path quantitatively.
- Co-first author. Accepted by EMNLP 2022 main conference.
- Project established in THU *Student Research Training Program*.

SELECTED AWARDS & HONORS

- December-9th Scholarship, highest scholarship in Dept. of CST, **2 out of 180**. 2021
- Volunteering & Social Survey Excellence Scholarship, Dept. of CST, **2 out of 180**. 2022
- Awards of Excellent Student Cadre, Tsinghua University. 2021
- Second Prize in National Undergraduate Physics Competition, Beijing Physics Society. 2021
- Third Prize in THU Challenge Cup Academic Competition, Tsinghua University. 2022

SKILLS

English Skills

- TOEFL 115/120 (Reading 30, Listening 30, Speaking 26, Writing 29).
- GRE Verbal Reasoning 162/170, Quantitative Reasoning 170/170, Analytical Writing 4/6.

Technical Skills

- Proficient in C/C++, Python(PyTorch), LaTeX, Linux, Java, React.
- Familiar with various neural networks and state-of-the-art deep learning techniques.