

# Fangzheng (Frank) Xu

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## Research Interests

Large language models, code generation, digital agent, retrieval-augmented generation.

## Education

### Language Technology Institute, Carnegie Mellon University

Pittsburgh, Pennsylvania

PH.D. IN COMPUTER SCIENCE

Sep. 2019 - Present

- Advisor: Prof. Graham Neubig
- Research Interest: Large language models for both code generation and agents. The eventual goal is to enable users to use natural language to instruct and interact with the computers in the future. I put special emphasis on augmenting models with external knowledge, e.g. retrieval-augmented generation, non-parametric models..
- **Supported by IBM Ph.D. Fellowship since Fall 2022.**

### Shanghai Jiao Tong University

Shanghai, China

M.SC. IN COMPUTER SCIENCE

Sep. 2016 - Mar. 2019

- Thesis: *Indirect Supervision for Information Extraction*
- Research Interest: Natural language processing, text mining, knowledge graph, spatial-temporal data mining
- Advisor: Prof. Kenny Q. Zhu

### Shanghai Jiao Tong University

Shanghai, China

B.ENG. IN COMPUTER SCIENCE, HONOR DEGREE (IEEE HONORED CLASS)

Sep. 2012 - Jun. 2016

- Thesis: *Traffic Prediction for Urban Planning*
- **Best Bachelor's Thesis Award (Top 1% in SJTU & Top 1 in the CSE Department)**
- Advisor: Prof. Kenny Q. Zhu

## Honors & Awards

2022 IBM Ph.D. Fellowship

2018 Best Poster Award Honorable Mention, WWW

2017 2nd in emerging and rare entity recognition shared task, WNUT@EMNLP

2016 Best Bachelor's Thesis Award (Top 1% in SJTU & Top 1 in the CSE Department)

Lyon, France

Copenhagen

SJTU

## Academic & Professional Experience

### NeuLab, Carnegie Mellon University

Pittsburgh, PA

RESEARCH ASSISTANT

Aug. 2019 - Present

- Advisor: Prof. Graham Neubig
- Working on natural language processing, LLMs, code generation, retrieval-augmented models and web agents.

### Google Research

Boston, MA

STUDENT RESEARCHER

May. 2022 - Aug. 2022

- Mentor: Nicholas Monath, Andrew McCallum, Manzil Zaheer
- Working on instance-based machine learning models for sequence modeling.

### Microsoft Research Redmond

Virtual

RESEARCH INTERN

Jun. 2021 - Aug. 2021

- Mentor: Christian Bird, Shuvendu Lahiri, Todd Mytkowicz, Alexey Svyatkovskiy
- Working on automatic merge of code version control conflicts with reinforcement learning.

### Microsoft Research Asia

Beijing, China

RESEARCH INTERN

May. 2019 - Aug. 2019

- Mentor: Dr. Lei Ji, Dr. Nan Duan
- Worked on structured multimodal procedural knowledge acquisition and instruction summarization from narrative videos and texts.

## HCII, Carnegie Mellon University

Pittsburgh, PA

### VISITOR

Nov. 2018 - May. 2019

- Advisor: Prof. Jeffrey P. Bigham
- Worked on AI and human collaboration, enabling human by incorporating multimodal ML techniques, including NLP and CV into daily life. Help blind people perceive the world, construct knowledge and understand natural language queries with state-action graphs of user interface, help memorize and organize events from users' daily conversations, etc.

## ADAPT Lab, Shanghai Jiao Tong University

Shanghai, China

### RESEARCH ASSISTANT

Oct. 2015 - Mar. 2019

- Advisor: Prof. Kenny Q. Zhu
- Working on natural language processing, computational social science, information extraction, text mining, with papers published in various venues. I used to work on data mining, traffic prediction and urban computing as well.

## Teaching Experience

Sp. 2024 **Guest Lecture**, Advanced NLP (11-711)

CMU

Fall 2021 **Teaching Assistant**, Advanced NLP (11-711)

CMU

Fall 2016 **Teaching Assistant**, Database System Technology (SE305), in English

SJTU

## Publication

\* indicates equal contribution

### PAPERS

#### OpenDevin: An Open Platform for AI Software Developers as Generalist Agents

Web Agent Lead of OpenDevin Team.

*arXiv*, 2024

#### CodeRAG-Bench: Can Retrieval Augment Code Generation?

Zora Zhiruo Wang, Akari Asai, Xinyan Velocity Yu, [Frank F. Xu](#), Yiqing Xie, Graham Neubig, Daniel Fried.

*arXiv*, 2024

#### WebArena: A Realistic Web Environment for Building Autonomous Agents

[Frank F. Xu](#)\*, Shuyan Zhou\*, Hao Zhu, Xuhui Zhou, Robert Lo, Abishek Sridhar, Xianyi Cheng, Yonatan Bisk, Daniel Fried, Uri Alon, Graham Neubig.

*In International Conference on Learning Representations (ICLR)*, 2024

#### Why do Nearest Neighbor Language Models Work?

[Frank F. Xu](#), Uri Alon, Graham Neubig.

*In International Conference on Machine Learning (ICML)*, 2023

#### Hierarchical Prompting Assists Large Language Model on Web Navigation

Abishek Sridhar, Robert Lo, [Frank F. Xu](#), Hao Zhu, Shuyan Zhou.

*In Findings of the Association for Computational Linguistics: EMNLP*, 2023

#### Active Retrieval Augmented Generation

[Frank F. Xu](#)\*, Zhengbao Jiang\*, Luyu Gao\*, Zhiqing Sun\*, Qian Liu, Jane Dwivedi-Yu, Yiming Yang, Jamie Callan, Graham Neubig.

*In Proceedings of Conference on Empirical Methods in Natural Language Processing (EMNLP)*, 2023

#### A Systematic Evaluation of Large Language Models of Code

[Frank F. Xu](#), Uri Alon, Graham Neubig, Vincent J Hellendoorn.

*In Deep Learning For Code (DL4C) Workshop @ ICLR*, 2022

Also in *The 6th Annual Symposium on Machine Programming (MAPS) @ PLDI*, 2022

#### DocCoder: Generating Code by Retrieving and Reading Docs

Shuyan Zhou, Uri Alon, [Frank F. Xu](#), Zhengbao Jiang, Graham Neubig.

*In International Conference on Learning Representations (ICLR)*, 2023

#### MCoNaLa: A Benchmark for Code Generation from Multiple Natural Languages

Zhiruo Wang, Grace Cuenca, Shuyan Zhou, [Frank F. Xu](#), Graham Neubig.

*In The 17th Conference of the European Chapter of the Association for Computational Linguistics (EACL)*, 2023

#### Neuro-Symbolic Language Modeling with Automaton-augmented Retrieval

Uri Alon, [Frank F. Xu](#), Junxian He, Sudipta Sengupta, Dan Roth, Graham Neubig.

*In International Conference on Machine Learning (ICML)*, 2022

### **Capturing Structural Locality in Non-parametric Language Models**

Frank F. Xu, Junxian He, Graham Neubig, Vincent J. Hellendoorn.

*In International Conference on Learning Representations (ICLR), 2022*

### **In-IDE Code Generation from Natural Language: Promise and Challenges**

Frank F. Xu, Bogdan Vasilescu, Graham Neubig.

*In ACM Transactions on Software Engineering and Methodology (TOSEM), 2021*

### **Learning Structural Edits via Incremental Tree Transformations**

Ziyu Yao, Frank F. Xu, Pengcheng Yin, Huan Sun, Graham Neubig.

*In International Conference on Learning Representations (ICLR), 2021*

### **Data-to-Text Generation with Style Imitation**

Shuai Lin, Wentao Wang, Zichao Yang, Xiaodan Liang, Frank F. Xu, Eric Xing, Zhiting Hu.

*In Findings of the Association for Computational Linguistics: EMNLP, 2020*

### **A Benchmark for Structured Procedural Knowledge Extraction from Cooking Videos**

Frank F. Xu, Lei Ji, Botian Shi, Junyi Du, Graham Neubig, Yonatan Bisk, Nan Duan.

*In Proceedings of the First International Workshop on Natural Language Processing Beyond Text @ EMNLP, 2020*

### **Minimally Supervised Categorization of Text with Metadata**

Yu Zhang, Yu Meng, Jiaxin Huang, Frank F. Xu, Xuan Wang, Jiawei Han.

*In Proceedings of 43rd International ACM SIGIR Conference on Research and Development in Information Retrieval (SIGIR), 2020*

### **Incorporating External Knowledge through Pre-training for Natural Language to Code Generation**

Frank F. Xu\*, Zhengbao Jiang\*, Pengcheng Yin, Bogdan Vasilescu, Graham Neubig.

*In Proceedings of 58th Annual Meeting of the Association for Computational Linguistics (ACL), 2020*

### **How Can We Know What Language Models Know?**

Frank F. Xu\*, Zhengbao Jiang\*, Jun Araki, Graham Neubig.

*In Transactions of the Association for Computational Linguistics (TACL), 2020*

### **A Benchmark for Structured Procedural Knowledge Extraction from Cooking Videos**

Frank F. Xu, Lei Ji, Botian Shi, Junyi Du, Graham Neubig, Yonatan Bisk, Nan Duan.

*In Proceedings of the First International Workshop on Natural Language Processing Beyond Text @ EMNLP, 2020*

### **Parsimonious Morpheme Segmentation with an Application to Enriching Word Embeddings**

Ahmed El-Kishky, Frank F. Xu, Aston Zhang, and Jiawei Han.

*In Proceedings of IEEE International Conference on Big Data, 2019*

### **HiGitClass: Keyword-Driven Hierarchical Classification of GitHub Repositories**

Yu Zhang, Frank F. Xu, Sha Li, Yu Meng, Xuan Wang, Qi Li, Jiawei Han.

*In Proceedings of IEEE International Conference on Data Mining (ICDM), 2019*

### **StateLens: A Reverse Engineering Solution for Making Existing Dynamic Touchscreens Accessible**

Anhong Guo, Junhan Kong, Michael Rivera, Frank F. Xu, Jeffrey P. Bigham.

*In Proceedings of 32nd Annual ACM Symposium on User Interface Software and Technology (UIST), 2019*

### **AlpacaTag: An Active Learning-based Crowd Annotation Framework for Sequence Tagging**

Bill Y. Lin\*, Dong-Ho Lee\*, Frank F. Xu, Ouyu Lan, Xiang Ren.

*In Proceedings of 57th Annual Meeting of the Association for Computational Linguistics (ACL Demo), 2019*

### **Mining Cross-Cultural Differences and Similarities in Social Media**

Frank F. Xu\*, Bill Y. Lin\*, Kenny Q. Zhu, Seung-won Hwang.

*In Proceedings of 56th Annual Meeting of the Association for Computational Linguistics (ACL), 2018*

### **Automatic Extraction of Commonsense LocatedNear Knowledge**

Frank F. Xu\*, Bill Y. Lin\*, Kenny Q. Zhu.

*In Proceedings of 56th Annual Meeting of the Association for Computational Linguistics (ACL), 2018*

### **ExtRA: Extracting Prominent Review Aspects from Customer Feedback**

Zhiyi Luo, Shanshan Huang, Frank F. Xu, Bill Yuchen Lin, Hanyuan Shi, Kenny Zhu.

*In Proceedings of Conference on Empirical Methods in Natural Language Processing (EMNLP), 2018*

### **Empower Sequence Labeling with Task-Aware Neural Language Model**

Liyuan Liu, Jingbo Shang, Frank F. Xu, Xiang Ren, Huan Gui, Jian Peng, Jiawei Han.

*In Proceedings of Thirty-second AAAI Conference on Artificial Intelligence (AAAI), 2018*

### **ReQuest: Indirect Supervision for Relation Extraction using Question-Answer Pairs**

Zequiu Wu, Xiang Ren, Frank F. Xu, Ji Li, Jiawei Han.

*In Proceedings of The 11th ACM International Conference on Web Search and Data Mining (WSDM), 2018*

### **Mining Cross-Cultural Differences of Named Entities: A Preliminary Study**

Frank F. Xu\*, Bill Y. Lin\*, Kenny Q. Zhu.

*Presented on First Workshop on Knowledge Base Construction, Reasoning and Mining (KBCOM) at WSDM, 2018*

### **Entropy-Based Subword Mining with an Application to Word Embeddings**

Ahmed El-Kishky, Frank F. Xu, Aston Zhang, Stephen Macke, Jiawei Han.

*In Proceedings of the Second Workshop on Subword/Character Level Models (SCLem) at NAACL, 2018*

### **Open Information Extraction with Global Structure Constraints**

Qi Zhu, Xiang Ren, Jingbo Shang, Yu Zhang, Frank F. Xu, Jiawei Han.

*In Proceedings of The Web Conference (WWW Poster), 2018 (Best Poster Award Honorable Mention)*

### **Commonsense LocatedNear Relation Extraction**

Frank F. Xu\*, Bill Y. Lin\*, Kenny Q. Zhu.

*Presented on 6th Workshop on Automated Knowledge Base Construction (AKBC) at NIPS, 2017*

### **Multi-channel BiLSTM-CRF Model for Emerging Named Entity Recognition in Social Media**

Frank F. Xu\*, Bill Y. Lin\*, Zhiyi Luo, Kenny Q. Zhu.

*In Proceedings of the 3rd Workshop on Noisy User-generated Text (W-NUT) at EMNLP, 2017 (2nd place in the shared task)*

### **Transfer Learning for Traffic Speed Prediction: A Preliminary Study**

Frank F. Xu\*, Bill Y. Lin\*, Eve Q. Liao, Kenny Q. Zhu.

*In Proceedings of SmartIoT 2018 Workshop: AI enhanced IoT data processing for Intelligent Applications at AAAI, 2018*

### **Cross-region Traffic Prediction for China on OpenStreetMap.**

Frank F. Xu, Bill Y. Lin, Qi Lu, Yifei Huang and Kenny Q. Zhu.

*In Proceedings of the 9th ACM SIGSPATIAL International Workshop on Computational Transportation Science, 2016*

## **THESIS**

### **Indirect Supervision for Information Extraction**

Frank F. Xu

*Master's Thesis, Shanghai Jiao Tong University, 2019*

### **Traffic Prediction for Urban Planning**

Frank F. Xu

*Bachelor's Thesis (Best Thesis Award, Top 1 in CSE), Shanghai Jiao Tong University, 2016*

## **Professional Service**

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### **WORKSHOP ORGANIZER**

CMU Agent Workshop 2024 (<https://cmu-agent-workshop.github.io/>)

### **PROGRAM COMMITTEE MEMBER**

First Workshop on Natural Language Processing for Programming at ACL-IJCNLP 2021 (NLP4Prog)

First Workshop on Knowledge Base Construction, Reasoning and Mining at WSDM 2018 (KBCOM)

### **CONFERENCE REVIEWER**

ACM International Conference on Web Search and Data Mining (WSDM 2018)

The Web Conference (WWW 2018)

ACM SIGIR Conference on Research and Development in Information Retrieval (SIGIR 2018)

The Annual Meeting of the Association for Computational Linguistics (ACL 2018-2022)

Conference on Empirical Methods in Natural Language Processing (EMNLP 2021-2024)

The Conference on Neural Information Processing Systems (NeurIPS 2021-2024)

The International Conference on Learning Representations (ICLR 2022-2024)

ACL Rolling Review (monthly since July 2021)

### **JOURNAL REVIEWER**

IEEE Transactions on Artificial Intelligence

IEEE Transactions on Cybernetics

# Invited Talks

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May 2024   Language Models as Agents

*CMU Agent  
Workshop  
JetBrains s.r.o.*

Jan 2022   In-IDE Code Generation from Natural Language: Promise and Challenges