

# Ruining Zhao

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Google Scholar

## EDUCATION

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**University of Illinois Urbana-Champaign**

Expected Graduation: Dec. 2023

*B.S. in Computer Science and Mathematics*

GPA: 3.98 / 4.0

**Core Courses:** Software Design, Data Structure, Computer Architecture, System Programming, Algs & Models of Comp, Deep Learning for Computer Vision, Database Management, Algorithms for Big Data, Communication Network

**Research Interests:** Natural Language Processing, Data Mining, HealthCare

## PUBLICATIONS

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- **Ruining Zhao**, Yizhu Jiao, Ming Zhong, Jiawei Han, “Event Knowledge Graph Based Temporal Reasoning”, (Intend to Submit) ARR Conference 2024
- Yizhu Jiao, Ming Zhong, Sha Li, **Ruining Zhao**, Siru Ouyang, Heng Ji, Jiawei Han, “Instruct and Extract: Instruction Tuning for On-Demand Information Extraction”, (Accepted by) EMNLP Conference 2023
- Sha Li, **Ruining Zhao**, Manling Li, Heng Ji, Chris Callison-Burch, Jiawei Han, “Open-Domain Hierarchical Event Schema Induction by Incremental Prompting and Verification”, (Accepted by) ACL Conference 2023
- Lihui Liu, **Ruining Zhao**, Boxin Du, Yi Ren Fung, Heng Ji, Jiejun Xu, Hanghang Tong, “Knowledge Graph Comparative Reasoning for Fact Checking: Problem Definition and Algorithms”, (Accepted by) IEEE Journal 2022

## RESEARCH HIGHLIGHTS

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### Temporal Reasoning

May. 2023 - Present

*Research Assistant, lead author, supervised by Prof. Jiawei Han*

Champaign, IL

- Built event graph by reasoning pair, such as cause-consequence, reparation-action, plan-execution, etc to construct complete and comprehensive event reasoning chain.
- Extracted implicit temporal knowledge, including temporal clues, logic chain, semantic meanings, and underlying patterns from diverse datasets via large language models.
- Leveraged augmented data on pre-trained language models T5 and PTNTIME to produce a robust generic temporal reasoning system, achieved 2% improvement with fine-tuning in average accuracy.

### Massively Multi-Culture Norm Discovery and Detection

Jan. 2023 - May. 2023

*Research Assistant, supervised by Prof. Heng Ji*

Champaign, IL

- Investigated norms discovery from real-world data sources in a massively multicultural setting, encompassing social cultural groups across 200+ countries worldwide, and different demographic subgroups.
- Crawled cultural data sources from social media including YouTube, reddit and cultural website ATLAS.
- Built norm discovery framework by norm frame population from single sentence norm assertion.
- Performed norm frame evaluation by both human assessment(alpha-beta testing) and quantitative assessment(Multi-cultural Q&A), compared performance with NLG models like T5, BlenderBot, etc on a Likert scale.

### Event Schema Induction

May. 2022 - Jan. 2023

*Research Assistant, supervised by Prof. Heng Ji*

Champaign, IL

- Leveraged the common reasoning capabilities of a large language model GPT-3 to build a recursive generalization and expansion framework that automated the creation of linear and hierarchical schema.
- Improved schema accuracy by implementing graph ensemble techniques such as removing temporal loops and node mapping, resulting in a 31.4% improvement of hierarchy relations.
- Developed algorithms for graph comparison, effectively detected event overlaps through decomposition, normalization, and semantic similarity analysis with the BERT model.

### Knowledge Graph Comparative Reasoning for Fact Checking

Jan. 2022 - Jan. 2023

*Research Assistant, supervised by Prof. Hanghang Tong*

Champaign, IL

- Proposed novel comparative reasoning framework over knowledge graph through knowledge segmentation extraction, applied structural and semantic embedding to such triple clues to discover anchor entities in knowledge graphs.
- Contributed to social relationship network analysis with given knowledge such as birthplace, live place ,and graduate university; defined both algorithms and concepts like commonality and consistency involved comparative reasoning.
- Implemented Graph Kernel-based reasoning models with a random walk with restart strategy, performed comparison reasoning experiments in both pairwise and collective manner, achieved 66.5 % and 85.8% averaged accuracy, respectively.

### Common Community Detection in Social Networks

August. 2022 - Jan. 2023

*Senior Thesis, supervised by Prof. Hanghang Tong*

Champaign, IL

- Conducted an extensive survey of state-of-the-art algorithms in common community detection from 2018 to 2023.
- Developed a structured taxonomy for categorizing algorithms and data structures in common community detection.
- Designed and executed validation experiments on large-scale datasets to assess algorithm effectiveness.

## Uber Rider Pattern Recognition

Research Assistant, affiliated with NCSA, supervised by Prof. Peter Christensen

May. 2022 - Jan. 2023  
Champaign, IL

- Contributed to Uber user behavior analyses of Home-Work ride choices in collaboration with economists.
- Conceived customer response tracking system with weakly-supervised text labeling pipeline, achieved 67% time reduction on data preparation stage by frequent response tool prediction and respond period estimation.
- Built a decision tree-based user classification system to extract user features, assisted pattern recognition and prediction of routine distribution by 65% accuracy improvement.

## Learning-Based Frequency Estimation Algorithms Report

Independent Study, supervised by Prof. Chandra Chekuri

Sep. 2022 - Dec. 2022  
Champaign, IL

- Led to research about the Count-Min sketch algorithms with learning models.
- Verified the efficiency of learning rate in training heavy hitter process.
- Proposed streaming and sketching algorithm for Neural Networks.

## WORK EXPERIENCE

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### CCC Intelligent Solutions. Inc

Data Scientist, AI Foundry | Pytorch, MongoDB

August. 2023 - Present  
Chicago, IL

- Developed an efficient data reader for 3 billion customer records, reducing RAM occupation by 64% through real-time querying from MongoDB at the batch level instead of relying on temporal file copies.
- Improved industry benchmark accuracy by 23% using transformer-based vision models to predict estimated costs and labor hours for damaged vehicle images with a regression layer.
- Achieved a 96% macro F1 score in predicting vehicle repair part codes by constructing a supervised text classification model with a custom tokenizer, embedding layer, and transformer encoder.
- Resolved job conflicts by implementing automatic shared memory monitoring and job priority controllers using the Volcano framework for Kubernetes-native batch scheduling.

### Course Assistant for Intro to Algorithms and Models of Computing

Course Assistant | Algorithm, Teaching

August. 2022 - Dec. 2022  
Champaign, Illinois

- Served as course assistant for a fundamental Computer Science course with class size of 200 students
- Led office hours to answer questions, walkthrough class materials, and assisted the assignment via mathematical proof and pseudo code implementation
- Improved system reliability by two-factor authentication with cloud-host user database and SMS verification on Firebase.
- Optimized system efficiency by 46% using parallel programming and automatic user activity detection algorithms.

### EZ Split Start-up

Full Stack SWE, founded by Blackstone | Swift, SQL, C++

May. 2022 - August. 2022  
New York City, NY

- Led as tech director to design a expenses split prototype with SwiftUI, attracted 5k+ stable customers.
- Utilize the OpenSSL for secure data transmission (HTTPS) and encryption of sensitive information with C++.
- Improved system reliability by two-factor authentication with cloud-host user database and SMS verification on Firebase.
- Optimized system efficiency by 46% using parallel programming and automatic user activity detection algorithms.

### ATLAS Internship - VR evaluation team

Web Developer & VR Software Evaluation | JavaScript, Drupal, HTML

Oct. 2021 - Dec. 2021  
Champaign, IL

- Designed the layout of VR software websites with product details and interactive animations
- Developed and tested VR softwares for Education work in U of I, aimed to bring the VR technologies in real class and promoted common use of VR

## PROJECTS HIGHLIGHTS

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### System Programming Project - Malloc

Independent Study | C, GCC, GDB, Shell

- Implemented memory allocation and management with C in restricted environment and optimize performance to achieve 98% of optimal speed.
- Developed parallel make project using a thread-safe data structure, resource allocation graphs with deadlock detection and synchronization functionality.

### Artificial Intelligence in Finance Technology

Independent Study | Python, PyTorch, TensorFlow

- Designed and developed a stock analysis model, containing credit risk scoring system, and trading market prediction pipeline including clustering and nearest-neighbor algorithms, and time-series analysis.
- Improved the robustness of the model by incorporating noisy functions and performing multi-factor analysis.

## AWARD

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- University of Illinois Urbana-Champaign Dean's List Honorary designation Dec. 2021 - Present
- Bronze Tablets, the campus-wide highest academic achievement May 2023
- CRA Outstanding Undergraduate Researcher Award (one of four nominees) Oct. 2022
- Second Award in Mathematical Contest In Modeling Oct. 2020