QIAN HUANG

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RESEARCH INTERESTS

Reasoning, Large Language Models, Pretraining, AI Scientific Discovery, AI Alignment, Interpretability, Graph Structure

EDUCATION

Stanford University *September 2021 - Present*
Computer Science Ph.D. Candidate

Cornell University *August 2017 - May 2021*
Bachelor of Arts in Computer Science and Mathematics, GPA: 4.1/4.3

PUBLICATIONS

- **Qian Huang***, Hongyu Ren*, Jure Leskovec. "Few-shot Relational Reasoning via Connection Subgraph Pretraining" **NeurIPS**, 2022.
- **Qian Huang***, Horace He*, Abhay Singh, Ser-Nam Lim, Austin Benson. "Combining Label Propagation and Simple Models Out-performs Graph Neural Networks." **ICLR**, 2021.
- **Qian Huang***, Horace He*, Abhay Singh, Yan Zhang, Ser-Nam Lim, Austin Benson. "Better Set Representations For Relational Reasoning."**NeurIPS**, 2020.
- **Qian Huang***, Horace He*, Abhay Singh, Yan Zhang, Ser-Nam Lim, Austin Benson. "Better Set Representations For Relational Reasoning." Proceedings of International Conference on Machine Learning (ICML): Object-Oriented Learning (OOL): Perception, Representation, and Reasoning workshop, 2020.
- **Qian Huang***, Isay Katsman*, Horace He*, Zeqi Gu*, Serge J. Belongie and Ser-Nam Lim. "Enhancing Adversarial Example Transferability With an Intermediate Level Attack." 2019 IEEE/CVF International Conference on Computer Vision (**ICCV**) (2019): 4732-4741.

AWARDS AND RECOGNITIONS

- 2022 Open Phil AI Fellowship
- 2020 CRA Finalist
- Phi Beta Kappa
- Dean's List, Cornell University
- Women in Machine Learning 2019 Travel Funding
- First prize in the 33rd Chinese Physics Olympiad
- Top 10 in 2015 China Young Physicists' Tournament
- National Physics Team Candidate for International Young Physicists' Tournament

PEER REVIEW SERVICE

NeurIPS 2021, NeurIPS 2022, ICLR 2022, ICLR 2023, ICML2023, NeurIPS 2023, and workshops.

RESEARCH EXPERIENCE

Stanford University September 2021 - Present
PhD Student *Palo Alto, CA*

- **Language Models as AI Research Agents (advised by Prof. Jure Leskovec & Percy Liang)**
We propose MLAgentBench, a suite of end-to-end Machine Learning research tasks for benchmarking

AI research agents that have access to a compute cluster, with automatic evaluation based on the artifacts produced (e.g. predictions). We also design an LLM-based research agent prototype that can automatically perform simple research processes and accomplish many tasks when based on GPT-4 with highly interpretable research plans. However, we highlight overall low success rates and key challenges such as long-term planning and hallucination. [arxiv soon]

- **Parsel: A Unified Natural Language Framework for Algorithmic Reasoning (advised by Prof. Noah D. Goodman & Nick Haber)**
  We introduce Parsel, a framework enabling automatic implementation and validation of complex algorithms with code LLMs, based on hierarchical function descriptions in natural language. Parsel can be used across domains requiring hierarchical reasoning, e.g. code synthesis, theorem proving, and robotic planning. Beyond modeling capabilities, Parsel allows problem-solving with high-level algorithmic designs, benefiting both students and professional programmers. [paper] [code]
- **Lexinvariant Language Models (advised by Prof. Percy Liang & Gregory Valiant)**
  Investigate lexinvariant language models that do not have fixed token embedding and therefore are invariant to lexical symbols. We show that such a language model still attains surprisingly comparable perplexity to a regular language model given a sufficiently long context context, both theoretically and empirically. We argue that it essentially learns to perform in-context Baysian deciphering and it can achieve significantly better performance over various synthetic reasoning tasks. [paper]
- **PRODIGY: Enabling In-context Learning Over Graphs (advised by Prof. Jure Leskovec & Percy Liang)**
  We enable in-context learning over graphs with a novel in-context task representation PromptGraph and a corresponding pretraining framework PRODIGY. We empirically demonstrate the strong in-context learning performance induced on tasks over citation networks and knowledge graphs, with on average 18% improvement upon contrastive pretraining (with hard-coded adaptation for in-context setup) and 33 % over standard finetuning with limited data. [paper] [code]
- **Few-shot Relational Reasoning via Connection Subgraph Pretraining (advised by Prof. Jure Leskovec)**
  Proposed a novel few-shot relational reasoning framework Connection Subgraph Reasoner (CSR), which can make predictions for the target few-shot task directly via self-supervised pretraining on subgraph matching. Demonstrated that CSR can achieve significant gains of up to 56% on the more challenging inductive few-shot tasks where the entities are also unseen during (pre)training. [paper] [code]

Cornell University Artificial Intelligence (CUAI) August 2018 - May 2021
Undergraduate Researcher *Ithaca, NY*

- **Combining Label Propagation and Simple Models Out-performs Graph Neural Networks (advised by Prof. Austin Benson)**
  Demonstrated that for most popular transductive node classification tasks, state-of-the-art GNN models can be out-performed by a shallow MLP prediction followed by the post-processing of two Label Propagation variants. This simple framework directly uses label information and drastically reduces the parameters and runtimes needed to achieve state-of-the-art. [paper] [code]
- **Better Set Representations For Relational Reasoning (advised by Prof. Austin Benson)**
  Demonstrated that a popular class of relational reasoning methods have the fundamental responsibility problem when learning to decompose input to set of entities. Developed a generally applicable Set Refiner Model (SRN) that resolves this issue through a simple inner optimization loop and improves the accuracy and robustness of relational reasoning systems on multiple domains. [paper] [code]
- **Intermediate Level Attack (advised Prof. Serge Belongie)**
  Proposed a novel attack method that improves the transferability of adversarial examples substantially through optimizing the perturbation of intermediate features. Conducted extensive experiments to show the effectiveness of the attack and provide some explanatory insights. [paper] [code] [talk]

Cornell University May 2018 - May 2019
Undergraduate Research Assistant *Ithaca, NY*

- **Bridging Recurrent Neural Networks and Hidden Markov Model (co-advised by Prof. Robert Kleinberg and Prof. Jon Kleinberg)** Experimented with using different recurrent models to learn from data generated by simple HMM. Analyzed the potential suboptimal local minimum solution that can be given by Expectation Maximization algorithm.
- **Analyzing Shortest Augmenting Path (SAP) algorithm (advised by Robert Kleinberg)** Analyzed the worst case bound of reassignments of SAP for the online bipartite matching with reassignment problem. Improved a major lemma to bound the total length of long augmented paths in SAP execution.

INDUSTRY EXPERIENCE

Google Deepmind, LLM Reasoning team June 2023 - Present
Student Researcher *Mountain View, CA*

- Improving LLM on inductive reasoning tasks.

Allen Institute for Artificial Intelligence, PRIOR team February 2021 - April 2021
Research Intern *Seattle, WA*

- Creating new datasets of objects motion scene paired with language description using AI2Thor
- Designing new explainable models for predicting the object motion and counterfactual scenario
- Proposed ideas for improving the current AI2Thor and contributed to other project discussions.

LinkedIn, Hire AI team May 2019 - August 2019
Machine Learning and Relevance Engineer Intern *Sunnyvale, CA*

- Improved upon the in production candidates ranking model about 5% over major metric by adding query keywords embedding.
- Demonstrated that keywords bring about 30% lift in feature coverage through usage analysis.
- Proposed ideas for improving the current model and contributed to other adjacent projects.

TEACHING EXPERIENCE

Introduction to Analysis of Algorithms (CS 4820) Jan 2019 - Dec 2019
Undergraduate Teaching Assistant *Ithaca, NY*

- Held weekly office hours to help a class of 200 students understand the course materials better.
- Graded student homework and exams for over 10 hours each week.

Data Structure and Functional Programming (CS 3110) August 2018 - Dec 2018
Undergraduate Teaching Assistant *Ithaca, NY*

- Prepared and delivered two recitation sessions for 30 students weekly.
- Held several meet-ups with each project group and graded student projects.

Discrete Structures (CS 2800) Jan 2018 - May 2018
Undergraduate Teaching Assistant *Ithaca, NY*

- Held weekly office hours to help a class of 400 students understand the course materials better.
- Graded student homework and exams for over 5 hours each week.

LEADERSHIP & COMMUNITY SERVICE

Cornell University Artificial Intelligence (CUAI) August 2018 - May 2021
Research Member & Co-President *Ithaca, NY*

- Supervise research projects pursued by 12 undergraduate members through weekly meetings.
- Organize weekly reading groups and promote discussion about the cutting-edge papers.
- Connect members with faculty and Cornell PhDs through luncheons and talks.

Cornell Data Science (CDS) project team Feb 2018 - Dec 2019
Intelligent System Team co-Lead *Ithaca, NY*

- Held weekly team meeting, reading group and four deep learning workshops for students at Cornell.
- Designed end-to-end DL model to synthesis mandarin storyteller voice and isolate background music.
- Developed an auto-summarization slack app based on knowledge graph generation and compression.

Association of Computer Science Undergraduates April 2018 - May 2021
Academic Officer *Ithaca, NY*

- Promoted undergraduate research by co-organizing Research Night panel and PhD poster session.
- Organized ACSU G-body meeting of around 100 people and weekly discussion of reading groups.
- Presented computing theory paper in the reading group with 30 students.

COURSES

Undergraduate Level Courses

- Numerical Analysis
- Intro to Differential Geometry
- Honors Linear Algebra
- Machine Learning for Data Sciences
- Developmental Psychology
- Biopsychology of Learning & Memory

Graduate Level Courses

- Computer Vision
- Foundations of Reinforcement Learning
- Statistical Distance for Modern Machine Learning
- Analysis of Algorithms
- Algorithmic Game Theory
- Advanced Compilers