Ziyang Li

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EDUCATION

- **University of Pennsylvania** — Philadelphia, PA
  Ph.D. Computer and Information Science, Advisor: Mayur Naik; GPA: 4.0 — *Jul 2019 – Present*

- **University of California – San Diego** — La Jolla, CA
  B.S. Computer Science (3.9/4.0); B.S. Mathematics (3.7/4.0); GPA: 3.6 — *Sep 2015 – Jun 2019*

RESEARCH INTEREST

My research spans the fields of programming languages (PL) and machine learning (ML). I am particularly interested in neurosymbolic approaches which integrates traditional symbolic reasoning frameworks with machine learning models, jointly improving natural perception and reasoning capabilities. I design the programming language, Scallop, which is a neurosymbolic language based on Datalog, that can be integrated with PyTorch framework, supporting differentiable logical reasoning. I apply neurosymbolic methods to various domains including computer vision (CV), natural language processing (NLP), program analysis, computer security, robotics, and etc.

PUBLICATIONS

- **Understanding the Effectiveness of Large Language Models in Detecting Security Vulnerabilities**
  Avishree Khare, Saikat Dutta, Ziyang Li, Alaia Solko-Breslin, Rajeev Alur, Mayur Naik
  [arXiv]

- **LASER: Neuro-Symbolic Learning of Semantic Video Representations**
  Jiani Huang, Ziyang Li, Mayur Naik, David Jacobs, Sernam Lim
  [arXiv]

- **Relational Programming with Foundation Models**
  Ziyang Li, Jiani Huang, Jason Liu, Felix Zhu, Eric Zhao, William Dodds, Neelay Velingker, Rajeev Alur, Mayur Naik
  AAAI Conference on Artificial Intelligence (AAAI 2024)

- **Improved Logical Reasoning of Language Models via Differentiable Symbolic Programming**
  Jiani Huang, Hanlin Zhang*, Ziyang Li, Mayur Naik, Eric Xing*
  ACL-Findings 2023

- **Scallop: a Language for Neurosymbolic Programming**
  Ziyang Li, Jiani Huang, Mayur Naik
  Programming Language Design and Implementation (PLDI 2023). [Code] [arXiv]

- **Scallop: From Probabilistic Deductive Databases to Scalable Differentiable Reasoning**
  Jiani Huang, Ziyang Li*, Binghong Chen, Karan Samel, Mayur Naik, Le Song, Xujie Si*
  NeurIPS 2021. [Code]

- **ARBITRAR: User-Guided API Misuse Detection**
  Ziyang Li, Aravind Machiry, Binghong Chen, Mayur Naik, Ke Wang, Le Song
  IEEE Security and Privacy (S&P) 2021. [Paper] [Code] [Talk]

- **HOPPITY: Learning Graph Transformations to Detect and Fix Bugs in Programs**
  Elizabeth Dinella, Hanjun Dai, Ziyang Li, Mayur Naik, Le Song, Ke Wang
  International Conference on Learning Representations (ICLR) 2020, **Spotlight**. [Paper]

Workshop Papers:

- **Scallop: From Probabilistic Deductive Databases to Scalable Differentiable Reasoning**
  Jiani Huang*, Ziyang Li*, Binghong Chen, Karan Samel, Mayur Naik, Le Song, Xujie Si
  AIPLANS Workshop @ NeurIPS 2021

- **Numerical Reasoning over Legal Contracts via Relational Database**
  Jiani Huang, Ziyang Li, Ilias Fountalis, Mayur Naik
  DBAI Workshop @ NeurIPS 2021

In Submission:

- **Beyond Differentiability: Neurosymbolic Learning with Black-Box Programs**
  Alaia Solko-Breslin, Ziyang Li, Neelay Velingker, Rajeev Alur, Mayur Naik
  In Submission

- **DISCRET: A Self-Interpretable Framework for Treatment Effect Estimation**
  Yinjun Wu, Neelay Velingker, Ziyang Li, Kan Chen, Mayank Keoliya, Mayur Naik, Qi Long, Eric Wong, Emily Getzen, Ravi Parikh
  In Submission

- **Bityr: A Pluggable Framework for Learning Types from Binaries**
  Ziyang Li, Anton Xue, Hanjun Dai, Rajeev Alur, Aravind Machiry, Mayur Naik
  In Submission

- **Weighted Contrastive Learning for Scene Graph Generation**
  Yinjun Wu, Adam Stein, Ziyang Li, Mayur Naik
  In Submission

RESEARCH EXPERIENCES

- **Research Assistant, UPenn PEARL**   University of Pennsylvania
  Advisor: Mayur Naik   *July 2019 – Present*

- **Undergraduate Research Assistant, UCSD PL**   Univerysity of California – San Diego
  Advisor: Sorin Lerner   *Sep 2018 – Jun 2019*

- **Undergraduate Research Assistant, UCSD VISCOMP** Univerysity of California – San Diego
  Advisor: Ravi Ramamoorthi   *Mar 2018 – Jun 2019*

- **Undergraduate Research Intern, UCSD Design Lab**   Univerysity of California – San Diego
  Advisor: Scott Klemmer   *Jun 2017 – Jun 2018*

WORKING EXPERIENCES

- **Relational AI** *Research Intern*   Virtual, *May 2021 – August 2021*
- **Visa, Inc.** *Research Intern, Mentor: Ke Wang*   Virtual, *May 2020 – July 2020*
- **Coursera, Inc.** *Front-end Engineer Intern*   Mountain View, CA, *Jun 2018 - Sep 2018*
- **Deep Media, Ltd.** *Full-stack Engineer Intern*   Shenzhen, China, *Sep 2016 – Jan 2017*
- **Yobs Technology** *Full-stack Engineer Intern*   Los Angeles, CA, *Jan 2016 – Sep 2016*
- **Easyhin** *Front-end Engineer Intern*   Shenzhen, China, *Aug 2015 – Sep 2015*

FELLOWSHIPS

- **KPCB Fellows 2018** *Engineering Fellows (<2%)*   San Francisco, *June 2018*

Teaching Experiences

- **Teaching Assistant** *CIS 547, Software Analysis*   University of Pennsylvania, *Fall 2020, Fall 2021*
- **Tutor** *CSE 190, Virtual Reality Technology*   University of California – San Diego, *Spring 2019*
- **Tutor** *CSE 165, 3D User Interaction*   University of California – San Diego, *Winter 2019*
- **Tutor** *CSE 130, Programming Language*   University of California – San Diego, *Fall 2018*
- **Tutor** *CSE 163, Advanced Computer Graphics*   University of California – San Diego, *Spring 2018*
- **Tutor** *CSE 167, Intro to Computer Graphics*   University of California – San Diego, *Winter 2018*
- **Tutor** *CSE 12, Data Structure*   University of California – San Diego, *Winter 2017*

Selected Side-Projects

Rendering, Animation, and Simulations:

- **Fourier Depth of Field**: Fourier transform based depth of field analysis for RayTracer. [Github]
- **Rotamina**: Character animator and simulator with GUI. Written in C++. [Github]
- **MPM-RS**: Material point method for simulating fluid and soft-body dynamics. Written in Rust. [Github]
- **AoSoA Storage**: Array-of-struct-of-array storage system for high performance parallel computing with Kokkos and Cabana. Designed for physics simulation applications. Used by UPenn CG Group. [Github]

Video Games and VR Applications:

- **VR Piano**: VR Application for recording virtual characters playing the Piano, connecting MIDI keyboards and body tracking systems. Written in Unity.
- **Naruhodo**: An 3D story puzzle game engine made in Unity for easy level design. [Github]
- **Neon Ping Pong**: VR Ping Pong Game written in C++. [Website] [Video]
- **Space Escape**: VR Room Escape Puzzle Game settled in Space Station. Developed in Unity. [Website] [Video]

Web Applications:

- **inso.link**: A mirror download site for OSU! beatmaps for Chinese players. Hosted and maintained since 2016 and has 30K users while supporting >2M downloads. [Website] [Status Site]
- **saemanga.com**: A minimalistic online manga reader. Had >1K users. (2016-2020, currently out-of-service)

Programming Languages and Program Analysis Tools

- **Probabilistic DataLog Engine**: A probabilistic datalog engine with high performance optimizations oriented towards machine learning applications. Written in Rust.
- **Under-constrained Symbolic Execution Engine**: High performance under-constrained symbolic execution engine for LLVM IR written in Rust. Used in Arbitrar.
- **LLVM IR Binding for Rust**: Safe LLVM Binding for Rust. Used in Arbitrar. [Github]
- **Geometry Sketchpad**: Geometry sketching GUI application written in Rust. [Github]
- **Menhera**: A TypeScript-like functional programming language compiler written in OCaml. [Github]

Skills

- **Languages**: Rust, C++/C, Python, C#, TypeScript/JavaScript, OCaml, Java, Haskell, Coq
- **Libraries/Engines/Tools**: PyTorch, Unity, Unreal Engine 4/5, React, ExpressJs, Asp.net
- **Design**: Adobe Photoshop, Final Cut Pro, Premiere, After Effects, Illustrator, Blender, Cinema 4D
- **Audio/Music**: Logic Pro, Ableton

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