Madhurima Chakraborty

| Software+ML Engineer | **M.S.** and **Ph.D.** (to be) in Computer Science| LinkedIn | Google Scholar | GitHub | Email |

Broadly interested in applying Machine Learning and LLMS to fundamental aspects of programming languages, software engineering applications; particularly developing structured code analysis and automated software testing or debugging techniques. **I am actively seeking full-time Machine Learning Engineer or Applied Scientist positions.**

ACHIEVEMENTS

- **ACM Student Research Competition** Grand Finals, 2022 - Third Place, Graduate Category.
- **SPLASH Student Research Competition**, 2021 - Winner, Graduate Category.
- **Dean's Distinguished Fellowship** from the University of California, Riverside, 2019

EXPERIENCE

Research Intern 06/2022 - 09/2022
Microsoft Research *Seattle, WA, USA*

Code Defect Detection using LLMs: Investigated the application of machine learning to detect source-sink vulnerabilities in code using static analysis techniques and large language models. Developed a neural modeling framework to identify sanitized and unsanitized data flows for various Common Weakness Enumeration (CWE) vulnerabilities.

Computing Scholar 06/2024 - 09/2024
Lawrence Livermore National Lab *Seattle, WA, USA*

Formal Specification Support for Compiler: Developed program analysis capabilities in the ROSE compiler to automatically summarize pre and post-conditions of functions for C++ and Ada code.

Graduate Researcher 09/2019 - Present
University of California, Riverside *Riverside, CA, USA*

- *Data-driven Call Graph Optimizer*: Trained a neural model to identify specific call types generated by dynamic call-graphs that are otherwise difficult for static call graph generators to capture, subsequently enhancing the static call graph with these relations to improve recall rates.
- *Call Graph Performance Optimization*: Developed and implemented a novel technique for improving static call graph analysis in JavaScript, addressing performance challenges for real-world programs. Achieved impressive speed-up results in experimental evaluations on large Node.js-based programs and medium-sized web and mobile benchmarks, with minimal impact on recall and precision.
- *Call Graph Evaluation*: Developed an automated technique to assess the significance of root causes in call graph unsoundness for JavaScript applications. Evaluated the performance of state-of-the-art call graph construction methods on web applications, identifying areas for improvement and offering valuable insights for analysis design.

Product Specialist 01/2018 - 05/2019
Cognizant Technology Solutions *Kolkata, WB, India*

- Migrated legacy mainframe-based applications to Java APIs, leveraging Java and H-Base, enhancing system efficiency and performance.
- Demonstrated strong software engineering skills in handling large codebases and integrating old systems into modern environments.

Senior Systems Engineer 08/2015 - 12/2017
Infosys Limited *Bhubaneshwar, Odisha, India*

- Led the development and maintenance of high-performance Mainframe applications.
- Implemented new features and performance improvements using COBOL, JCL, and DB2.

SELECTED PUBLICATIONS

1. **Chakraborty, Madhurima,** Peter Pirkelbauer, and Qing Yi."Towards Safer code: Type-based Pre-condition and Post-condition Analysis" [in submission].
2. **Chakraborty, Madhurima,** Peter Pirkelbauer, and Qing Yi."FormalSpecCpp: A Dataset of C++ Formal Specifications Created Using LLMs" [in submission].
3. **Chakraborty, Madhurima**, Aakash Gnanakumar, Manu Sridharan, and Anders Møller. "Indirection-Bounded Call Graph Analysis." In 38th European Conference on Object-Oriented Programming (ECOOP 2024).
4. **Chakraborty, Madhurima**, Renzo Olivares, Manu Sridharan, and Behnaz Hassanshahi. "Automatic root cause quantification for missing edges in javascript call graphs." In 36th European Conference on Object-Oriented Programming (ECOOP 2022).
5. **Chakraborty, Madhurima.** "A study of call graph effectiveness for framework-based web applications." In Companion Proceedings of the 2021 ACM SIGPLAN International Conference on Systems, Programming, Languages, and Applications: Software for Humanity, pp. 13-15. 2021. [**SPLASH Student Research Competition: Winner, Graduate Category**]
6. **Chakraborty, Madhurima**. "SPLASH: G: A Study of Call Graph Effectiveness for Framework-Based Web Applications." [**ACM Student Research Competition Grand Finals: Third Place, Graduate Category**]

EDUCATION

Ph.D. in Computer Science, **University of California, Riverside** 09/2019-present
Thesis: Enhancing JavaScript Static Analysis: Accurate Call Graphs, Performance Optimization, and Promise Bug Detection

ACCOLADES/INVOLVEMENTS

Academic Achievements

- 2023: Selected to attend the Twelfth Summer School on Formal Techniques at SRI.
- 2021: Selected to attend the Programming Language Implementation Summer School.
- 2020: Recognized a bug during DeepCode's Bug Bounty program at DeepCode.ai.
- 2018: Awarded the Google Nanodegree Scholarship for Front End Web Developer by Google India & Udacity.
- 2018: Shortlisted for the International Women's Hackathon by Hackerearth.

Professional Recognitions

- 2018: Received the 1 Star Award at Cognizant Technology Solutions for exceptional performance.
- 2017: Earned the Insta Award at Infosys Limited for the successful implementation of a high-visibility project.
- 2017: Recognized with the Insta Award at Infosys Limited for excellent analytical skills.
- 2016: Acknowledged as a High Performer Trainee at Infosys Limited, awarded to the top 10% of employees.

Extracurricular and Leadership

- 2017: Achieved the Division-level Public Speaking Champion title at Toastmasters International.
- 2017: Earned the Triple Crown Award at Toastmasters International.

Synergistic Activities

- Program Committee: SAS'22 (AEC), PLDI'24 (AEC), SPLASH'24 (SV Co-Chair)
- Reviewer: ECML PKDD'22, MSR'25, TechDebt'25, TOSEM, TNNLS
- Panelist: PLMW (SPLASH'25)
- Mentor: Open Source Day Summer 21.
- Student Volunteer: PLDI'20, SPLASH'20, ESEC/FSE'23.

KEY SKILLS

Programming: Python, C/C++, JavaScript, TypeScript, Bash
ML Libraries: Pytorch
Tools: Git, Docker