

Fraol Batole

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EDUCATION

Tulane University <i>Ph.D., Computer Science, GPA: 4.0/4.0</i>	New Orleans, Louisiana <i>Aug 2024 - Present</i>
Iowa State University <i>MSc., Computer Science, GPA: 3.62/4.0</i> <i>Relevant Coursework: Advanced Software Engineering, Machine Learning</i>	Ames, Iowa <i>May 2024</i>
Addis Ababa Science and Technology University <i>BSc, Software Engineering, GPA: 3.75/4.0</i> <i>Graduated Magna cum laude</i> <i>Founded Innovation Club</i>	Addis Ababa, Ethiopia <i>September 2014 - June 2018</i>

RESEARCH EXPERIENCE

Laboratory for Software Engineering, Tulane University <i>Graduate Research Assistant</i>	New Orleans, Louisiana <i>February 2021 to Present</i>
<ul style="list-style-type: none">Led research initiatives in collaboration with IBM and JetBrains Research, developing novel static analysis techniques to enhance LLMs in software engineering tasks, focusing on code generation and code refactoring.Developed and released MM-Assist, an IntelliJ IDEA plugin that leverages LLMs for automated code refactoring, achieving 4x performance improvement over existing solutions.Driving LLM research on Google Cloud Platform as a Research Innovator'23, developing smaller models for code.	

SELECTED RESEARCH PROJECTS

LLM, IDE, and Semantic Embedding to Assist Move Method Refactoring <i>A collaboration project with JetBrains Research</i>	Tulane University <i>August 2024 to present</i>
<ul style="list-style-type: none">Developed MM-Assist, an LLM-powered IntelliJ plugin for automated MoveMethod refactoring, achieving 73% accuracy and 4x improvement over existing tools through hallucination filtering and RAG.	
A Comprehensive Study on LLM-based Agent Bug Characteristics <i>Under submission</i>	Tulane University <i>August 2024 to present</i>
<ul style="list-style-type: none">Conducted first comprehensive study of LLM-based agent system bugs by analyzing 1,016 bug reports, revealing tool integration (45%) and model integration (16%) as primary challenges.	
Decomposing Sequential neural networks to enable reuse <i>Presented at ICSE'23</i>	Iowa State University <i>February 2022 to September 2022</i>
<ul style="list-style-type: none">Proposed the first approach to decompose RNNs (Vanilla, LSTM, GRU) into reusable modules, enabling model modifications without retraining while maintaining performance (-0.6% accuracy impact).	

TECHNICAL SKILLS

Programming Languages: Python, Java
Data Analysis Techniques: Pandas, NumPy
Machine Learning Libraries: TensorFlow/Keras, Pytorch, Hugging Face Libraries
Agentic Libraries: LangChain, LangGraph, CrewAI
Research Areas: Software Engineering, Large Language Model (LLM), LLM-based agents

PUBLICATIONS

Conference Paper:

- Abhiram Bellur, **Fraol Batole**, Mohammed Raihan Ullah, Malinda Dilhara, Yaroslav Zharov, Timofey Bryksin, Kai Ishikawa, Haifeng Chen, Masaharu Morimoto, Motoura Shota, Takeo Hosomi, Tien N Nguyen, Hridesh Rajan, Nikolaos

Tsantalis, Danny Dig. "LLM, IDE and Semantic Embedding to Assist Move Method Refactoring" – International Conference on Software Maintenance and Evolution (ICSME'25).

2. **Fraol Batole**, David OBrien, Tien N Nguyen, Robert Dyer, and Hridesh Rajan. "An LLM-Based Agent-Oriented Approach for Automated Code Design Issue Localization." Proceedings of the 47th International Conference on Software Engineering (ICSE'25).
3. Sayem Imtiaz, Astha Sing, **Fraol Batole**, and Hridesh Rajan. "IRepair: An Intent-Aware Approach to Repair Data-Driven Errors in Large Language Models" In 32nd ACM International Conference on the FSE 2025.
4. Abhiram Bellur, **Fraol Batole** "IDE Native, Foundation Model Based Agents for Software Refactoring" 2nd IDE Workshop co-located with the 47th IEEE/ACM International Conference on Software Engineering.
5. Sayem Imtiaz, **Fraol Batole**, Astha Sing, Breno Cruz, Rangeet Pan, and Hridesh Rajan. "Decomposing RNN to enable reuse." Proceedings of the 45th International Conference on Software Engineering (ICSE). 2023.

Preprint:

6. **Fraol Batole**, David OBrien, Steven Vo, Tien N Nguyen, and Hridesh Rajan. "A Comprehensive Study on LLM-based Agent Bug Characteristics" – Under Submission
7. **Fraol Batole**, Ruchira Mank, Tien N Nguyen, Robert Dyer, and Hridesh Rajan. "Typestate-based Fault Localization of API Usage Violations in a Deep Learning Program" – Under Minor Revision
8. **Fraol Batole**, Smit Patel, Aashish Yadavally, Tien N Nguyen, and Hridesh Rajan. "CAPS: Code Abstraction Pre-training Strategy for Large Language Models" – Under Submission
9. Samuel W. Flint, Robert Dyer, **Fraol Batole**, and David OBrien "Do LLMs Generate Code with Type Annotations?" – Under Submission
10. David OBrien, **Fraol Batole**, Robert Dyer, Tien N Nguyen, and Hridesh Rajan. "Issue-Based Programming Language Evolution" – Under Submission

ADDITIONAL EXPERIENCE

CS Department, Iowa State University

Ames, Iowa

Graduate Teaching Assistant

January 2021 to May 2022

- Taught principles of programming, debugging, and test case development to over 80 students, adapting teaching methods to accommodate diverse learning styles.

MED Innovation

Addis Ababa, Ethiopia

Software Engineer

August 2019 to November 2019

- Collaborated with a cross-functional team of 2 members to design and implement the integration of an existing customer relationship management (CRM) system using Spring Boot and Vaadin.
- The integrated CRM system resulted in a 10% increase in the company's customer retention rate within 2 months, providing measurable business value.

Kifiya Financial Service

Addis Ababa, Ethiopia

Software Engineering Intern

January 2017 to August 2017

- Identified and proposed user experience (UX) improvements for 2 projects, collaborating with the design team to create intuitive and user-friendly interfaces.

Academic Service

International Conference on Mining Software Repositories (MSR)

2025

Junior Program Committee, Technical Track

Deep Learning for Code Workshop at NeurIPS

2025

Reviewer, Research Track

Automated Software Engineering (ASE) Journal

2025

Reviewer

AWARDS AND PROFESSIONAL DEVELOPMENT

- Awarded **1.5 million Access credits** from an NSF-funded program for advanced computing **February 2024**
- Awarded a Google Cloud Research Credits program (\$12,000) **June 2023**
- Selected for **the Google Cloud Research Innovator program'23** **March 2023**
- Contributor at Towards AI **December 2022**
- Black in AI Travel grant to attend NeurIPS'22 **November 2022**
- Student Volunteer at SPLASH'21 Conference (Chicago, IL) **November 2021**