Mrigank Pawagi

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RESEARCH INTERESTS

I am broadly interested **software engineering** and **programming languages**, with a focus on software verification and quality, as well as the intersection of these areas with generative AI. I also like exploring the implications of these topics on computer science education.

EDUCATION

Indian Institute of Science, Bengaluru Oct'22 – Present
Pursuing Bachelor of Technology in Mathematics and Computing. **GPA**: 9.9/10.0. I was a recipient of the Chander Mohini and Jeewan Kapoor Merit Prize (2022-23) for obtaining the highest CGPA in the first year. I am also a Reliance Foundation Undergraduate Scholar.

Vishwa Bharati Public School, Noida Apr'08 – Jun'22
Completed secondary (99.5%) and senior-secondary (99.8%) education under CBSE. Some other examinations that I took during high school are the Joint Entrance Examination: Main (AIR 367) and Advanced (AIR 410), Kishore Vaigyanik Protsahan Yojana (AIR 134), SAT (Math: 800, EBRW: 700), and the Duolingo English Test (145/160).

RESEARCH EXPERIENCE

SOFTWARE ENGINEERING

Whole-repository Code Translation and Validation
Under Review. Work with researchers at UIUC, IBM Research and Cornell. Neuro-symbolic approach for whole-repository code translation from Java to Python. I led the development of a technique for validating translated code fragments in isolation using language interoperability. This allows continuous validation during the translation process and provides bug localization. Part of this work was done during an in-person *Summer Research Internship at the Thomas M. Siebel Center for Computer Science, UIUC* (May'24 – Jul'24). I was hosted by Prof. Darko Marinov.

GlueTest: Testing Code Translation via Language Interoperability
Appearing at *ICSME NIER 2024*. Second author among 17, with Prof. Darko Marinov (UIUC) and Prof. Saikat Dutta (Cornell). Technique for validating code translation by running untranslated tests on translated code using language interoperability with GraalVM's Polyglot API. We demonstrate our approach on Apache Commons CLI and Apache Commons CSV, translated from Java to Python. I led the translation of the libraries, development of the interoperability code, and writing scripts for coverage analysis. Another paper detailing our collaborative research model is under preparation.

GuardRails: Automated Suggestions for Clarifying Ambiguous Purpose Statements
Presented at *COMPUTE 2023*. Co-authored with Prof. Viraj Kumar (IISc). Tool for automatically suggesting tests to clarify ambiguous specifications for functions, by utilizing Large Language Models and property-based testing. Available as a VSCode extension.

PROGRAMMING LANGUAGES

Deriving Performance Benchmarks from Python Applications
Working with Prof. Ben Greenman (UUtah) as a *Summer of Reproducibility '24* fellow funded by UCSC OSPO. We are extracting performance benchmarks from real Python applications to analyse the impact of shallow and advanced typing on the performance of Meta's Cinder python.

COMPUTER SCIENCE EDUCATION

Probeable Problems: Encouraging Students to Ask Clarifying Questions
Presented at *ICER 2024*. Co-authored with Prof. Viraj Kumar (IISc). Methodology for training students to identify and resolve ambiguities in specifications by asking clarifying questions. "Probeable Problems" are code-writing tasks with intentionally incomplete specifications. I led the evaluation of the study by writing scripts for analyzing submitted code and questions, and interpreting the results.

OTHER PROJECTS

PropertyEval: Benchmarking LLM Code Generation using Property-Based Testing
Presented as a poster at *ISEC'24*. Work with Prof. Viraj Kumar (IISc). We present property-based testing as a more thorough approach than existing methods for benchmarking LLM code-generation, and also provide a semi-automated approach for creating property-based tests. Enabled several open-source contributions to the *EvalPlus* benchmark.

VSCode Extension for Prutor
Work with Prof. Amey Karkare (IIT Kanpur) and Prof. Viraj Kumar (IISc). Developed a VSCode extension for Prutor, an intelligent tutoring system for programming used for CS1 courses in IISc and IIT Kanpur. Allows students to access and submit programming assignments from within VSCode, and collects important telemetry.

LEADERSHIP

Automatically Generating Refute Excercises (AGReE)
Guided a group of 3 junior students in developing a tool for using LLMs to automatically generating refute-exercises for programming assignments, with advice from Prof. Viraj Kumar (IISc).

HinglishEval: LLM Code Generation Benchmarks Based on Native Languages
Appearing at *COMPUTE 2024*. Guided a group of 5 junior students in developing a benchmark for LLM code generation from prompts in *Hinglish* and evaluating several open-source and commercial models on this benchmark.

International Genetically Engineered Machine (iGEM)
I led a group of around 10 students in the Dry Lab of IISc's iGEM'23 team. We presented our work in-person at the iGEM 2023 Grand Jamboree at Paris, France. I further proposed and secured funding for an iGEM'24 team dedicated to software projects, and acted an advisor to the team.

OTHER SELECTED TOOLS

PBT4Automata
Python tool for testing finite automata and context-free grammars for equivalence with regular expressions or python functions. Uses property-based testing and provides counter-examples in case of mismatches.

SELECTED PRODUCTS

Kronologue Web application for optimizing everyday-life schedules using an evolutionary algorithm.

EcoGo Platform for supporting local eco-friendly businesses and encouraging consumers to purchase sustainably.

LocalQueue Virtual marketplace to help digitalize local businesses.

TattleGEN Crowdsourced platform for fact-checking.

WebME Simulation-based game for cybersecurity awareness.

SELECTED TALKS

- Guest Speaker in CoderDojo India's meetup, and in CoderDojo India's information session for Coolest Projects.
- Panel member for discussion on "Is Mobile Humane?" at mBillionth Awards South Asia 2018, DEF India.

SERVICE AND TEACHING

- Student Volunteer, AI-ML Systems '23
- Designed and delivered *Hands-on Python* (HoP101), a hands-on python programming course for beginners, to around 10 rising sophomores in IISc.
- Tutor at Schoolhouse.world for middle and high school mathematics and science. Conducted nearly 50 sessions impacting over 50 students from 9 countries. Received over 90 positive ratings.