KUSH JAIN

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RESEARCH INTERESTS: My research focuses on developing new machine learning techniques for code and test generation. I am also interested in machine learning for software engineering and classical software testing.

EDUCATION

Carnegie Mellon University – School of Computer Science August 2021 – May 2025
Doctor of Philosophy, Computer Science, advisor: Claire Le Goues
Research Areas: artificial intelligence for code, LLMs for code, fuzzing, mutation testing
Thesis: Exploiting Test Structure to Enhance Language Models for Software Testing

University of Texas at Austin August 2018 – May 2021
Batchelor of Science, Computer Science, advisor: Milos Gligoric

PUBLICATIONS (* = equal contribution)

[1] TestForge: Feedback-Driven, Agentic Test Suite Generation
Kush Jain, Claire Le Goues
International Conference on Software Engineering (submitted ICSE 2026)

[2] TestGenEval: A Real World Unit Test Generation and Test Completion Benchmark
Kush Jain, Gabriel Synnaeve, Baptiste Rozière
International Conference on Learning Representations (ICLR 2025)

[3] Example Generation for OpenAPI Specifications using Large Language Models
Kush Jain, Kiran Kate, Jason Tsay, Claire Le Goues, Martin Hirzel
Automation of Software Test (AST 2025)

[4] Are Large Language Models Memorizing Bug Benchmarks?
Daniel Ramos, Claudia Mamede*, **Kush Jain*,** Paulo Canelas*, Catarina Gamboa*, Claire Le Goues
International Workshop on Large Language Models for Code (LLM4Code 2025) - Best Paper Award

[5] Syntax Is All You Need: A Universal-Language Approach to Mutant Generation
Sourav Deb, **Kush Jain*,** Rijnard Von Tonder, Claire Le Goues, Alex Groce
Foundations of Software Engineering (FSE 2024)

[6] CAT-LM: Training Language Models on Aligned Code and Tests
Nikitha Rao*, **Kush Jain***, Uri Alon, Claire Le Goues, Vincent Hellendoorn
Automated Software Engineering (ASE 2023)

[7] Contextual Predictive Mutation Testing
Kush Jain, Uri Alon, Alex Groce, and Claire Le Goues
Foundations of Software Engineering (FSE 2023)

[8] Mind the Gap: The Difference Between Coverage and Mutation Score Can Guide Testing Efforts
Kush Jain, Goutamkumar Tulajappa Kalburgi, Claire Le Goues, Alex Groce
International Symposium on Software Reliability Engineering (ISSRE 2023)

[9] Looking for Lacunae in Bitcoin Core's Fuzzing Efforts
Alex Groce, **Kush Jain**, Rijnard van Tonder, Goutamkumar Tulajappa Kalburgi, and Claire Le Goues
International Conference on Software Engineering (ICSE 2022)

[10] Registered Report: First, Fuzz the Mutants
Alex Groce, Goutamkumar Tulajappa Kalburgi, Claire Le Goues, **Kush Jain**, and Rahul Gopinath
International Fuzzing Workshop (FUZZING 2022)

[11] Programming and Execution Models for Parallel Bounded Exhaustive Testing
Nader Al Awar, **Kush Jain**, Christopher J. Rossbach, and Milos Gligoric
Conference on Object-Oriented Programming, Systems, Languages, and Applications (OOPSLA 2021)

[12] mCoq: Mutation Analysis for Coq Verification Projects
Kush Jain, Karl Palmskog, Ahmet Celik, Emilio Jesus Gallego Arias, and Milos Gligoric
International Conference on Software Engineering Tool Demonstrations Track (ICSE 2021)

WORK EXPERIENCE

Facebook AI Research – *AI Research Intern;* Paris, France June 2024 – October 2024
- Applied my code-test pretraining technique to large models, showing that it works at scale
- Released a new benchmark for unit test generation across large scale projects with complex dependencies

IBM TJ Watson – *AI Research Intern;* Yorktown Heights, New York June 2023 – August 2023
- Developed a novel LLM prompting approach that produces correct and diverse OpenAPI parameter examples
- Improved state of the art in a wide range of domains including fuzzing, dialog systems and human API understanding

Amazon Lab126 – *Software Engineering Intern;* Sunnyvale, California June 2021 – August 2021
- Developed a webapp to manage the approval process for all prototype devices at Amazon
- Migrated data to DynamoDB and integrated unified authentication

Amazon Lab126 – *Software Engineering Intern;* Sunnyvale, California June 2020 – August 2020
- Developed a device search service for prototype devices using AWS lambda, ElasticSearch, API gateway and Database Migration Service to serve over 30 million requests a month, while dramatically improving existing search functionality in a schema change tolerant way, leveraging federated authentication

VISA Inc. – *Software Engineering Intern;* Austin, Texas June 2019 – August 2019
- Developed a dashboard to track health of core IT services using NodeJS, React and PowerShell. In the first two months of production, proactively detected five major outages, preventing over 250 support tickets
- Implemented a customized link shortener for VISA's internal network, using NodeJS, React and SQL.

OpsHub Inc. – *Software Engineering Intern;* Palo Alto, California June 2018 – August 2018
- Prototyped an Angular dashboard to visualize multi-system KPI's using the company's integration platform
- Proof of concept was successful, and company is looking to fully develop the product

OpsHub Inc. – *Software Engineering Intern;* Palo Alto, California June 2017 – August 2017
- Developed a model to analyze the riskiness of a source code file and to predict the number of bugs expected
- Got 70% accuracy and had visibility to improve it further by bringing in data from additional systems

PRESENTATIONS
- Contextual Predictive Mutation Testing. Presented at Foundations of Software Engineering, 2023
- Analyzing the Difference Between Code Coverage and Mutation Score. Presented at International Symposium on Software Reliability Engineering, 2023
- Mutation Analysis for Coq Verification Projects. Presented at Amazon Lab 126, 2021

SERVICE

- Sub-reviewer for the International Conference on Software Engineering, 2023 (ICSE 2023)
- Student volunteer at the International Conference on Software Engineering, 2022 (ICSE 2022)

OPEN SOURCE CONTRIBUTIONS

FuzzBench: added our fuzzers that fuzz mutants first and then run normal fuzzing over the benchmarks – https://github.com/google/fuzzbench

mCoq: mutation analysis tool for Coq verification projects, used by around a dozen developers from around the world – https://github.com/EngineeringSoftware/mcoq

SMUM-Checkin: open source code of our digital recordkeeping system used by Santa Maria Urban Ministry – https://github.com/UnconditionedLife/smum