Saikat Dutta

Assistant Professor · Cornell University

saikatd@cornell.edu | https://www.cs.cornell.edu/~saikatd | @saikatdutta2012 | Saikat Dutta

Research Interests

My research interests are at the intersection of **Software Engineering** and **Machine Learning**. I am particularly interested in 1) developing novel techniques and tools to improve the reliability of Machine Learning-based systems, and 2) leveraging Machine Learning to tackle challenging Software Engineering tasks.

Education

University of Illinois Urbana-Champaign *Illinois, USA*
Ph.D. Computer Science *2017 - 2023*
- Thesis: Randomness-Aware Testing of Machine Learning-based systems
- Advisor: Dr. Sasa Misailovic

Jadavpur University *India*
Bachelor of Computer Science and Engineering *2011 - 2015*

Professional Experience

07/24 – Now	**Assistant Professor**, Cornell University, Ithaca, USA Computer Science, College of Computing and Information Science
08/23 – 06/24	**Visiting Assistant Professor**, Cornell University, Ithaca, USA Computer Science, College of Computing and Information Science
08/23 – 06/24	**Postdoctoral Researcher**, University of Pennsylvania, Philadelphia, USA **Advisor**: Prof. Mayur Naik
05/21 – 08/21	**Applied Research Intern**, Amazon Web Services, Seattle, USA **Mentor**: Dr. Willem Visser, **Manager**: Dr. Daniel Kroening. Developed automated techniques for testing deep learning compilers.
05/20 – 08/20	**Research Intern**, Microsoft Research, Redmond, USA **Manager**: Dr. Shuvendu Lahiri, **Mentor**: Dr. Madan Musuvathi. Harnessed program analysis, big code, and machine learning to significantly boost static analyzers for security and reliability.
06/15 – 06/17	**Software Engineer**, Microsoft India Development Centre, Hyderabad, India **Manager:** Karuna Koneru. Contributed to key developments for Bing and Cortana, including feature personalization, quality assurance, and continuous service monitoring.
05/14 – 06/14	**Software Development Engineer - Intern**, Microsoft India Development Centre, Hyderabad, India **Manager:** Anupama Mantha
12/14 – 01/15	**Research Intern**, IIT Kharagapur, West Bengal, India **Mentor:** Prof. Pallab Dasgupta
12/13-01/14	**Research Intern**, Indian Statistical Institute, West Bengal, India **Mentor:** Prof. Ansuman Banerjee
05/13-07/13	**Research Intern**, Indian Statistical Institute, West Bengal, India **Mentor:** Prof. Ansuman Banerjee

Publications

15 full conference papers (14 technical track, 1 industry track), 3 journal papers. 10 first-author papers.

Ph.D. Thesis

UIUC 2023 **T1.** Saikat Dutta. **Thesis title:** Randomness-Aware Testing of Machine Learning-based systems. **Advisor: Prof. Sasa Misailovic**. University of Illinois Urbana-Champaign.

Conference Publications

UAI 2023 **C15.** Zixin Huang, **Saikat Dutta**, and Sasa Misailovic. ASTRA: Understanding the Practical Impact of Robustness for Probabilistic Programs. *39th Conference on Uncertainty in Artificial Intelligence **(UAI) 2023***. Acceptance Rate 31% (243/778 papers).

ICSE 2023 **C14.** Steven Xia, **Saikat Dutta**, Sasa Misailovic, Darko Marinov, and Lingming Zhang. FASER: Balancing Effectiveness and Flakiness of Non-Deterministic Tests in Machine Learning Projects. *45th IEEE/ACM International Conference on Software Engineering **(ICSE) 2023***. Acceptance rate: 26% (208/796 papers).

ICSE-SEIP 2022 **C13.** **Saikat Dutta**, Diego Garbervetsky, Shuvendu Lahiri, and Max Shaefer. InspectJS: Leveraging Code Similarity and User-Feedback for Effective Taint Specification Inference for JavaScript. *44th International Conference on Software Engineering - Software Engineering in Practice **(ICSE-SEIP) 2022***.

ICST 2022 **C12.** **Saikat Dutta**, Anshul Arunachalam, and Sasa Misailovic. To Seed or Not to Seed? An Empirical Analysis of Usage of Seeds for Testing in Machine Learning Projects. *15th IEEE International Conference on Software Testing, Verification and Validation **(ICST) 2022***. Acceptance Rate: 28% (25/87 papers).

FASE 2022 **C11.** **Saikat Dutta**, Zixin Huang, and Sasa Misailovic. SixthSense: Learning to Debug Convergence Problems in Probabilistic Programs. *25th International Conference on Fundamental Approaches to Software Engineering **(FASE) 2022***. Acceptance Rate: 27% (17/62 papers).

ATVA 2021 **C10.** Zixin Huang, **Saikat Dutta**, and Sasa Misailovic. AQUA: Automated Quantized Inference for Probabilistic Programs. *19th International Symposium on Automated Technology for Verification and Analysis **(ATVA) 2021***. Acceptance Rate: 27% (19/71 papers).

ISSTA 2021 **C9.** **Saikat Dutta**, Jeeva Selvam, Aryaman Jain, and Sasa Misailovic. TERA: Optimizing Stochastic Tests in Machine Learning Projects. *30th ACM SIGSOFT International Symposium on Software Testing and Analysis **(ISSTA) 2021***. Acceptance rate: 22% (51/233 papers).

FSE 2021 **C8.** **Saikat Dutta**, August Shi, and Sasa Misailovic. FLEX: Fixing Flaky Tests in Machine Learning Projects by Updating Assertion Bounds. *29th ACM Joint European Software Engineering Conference and Symposium on the Foundations of Software Engineering **(ESEC/FSE) 2021***. Acceptance rate: 24% (97/396 papers).

ISSTA 2020 **C7.** **Saikat Dutta**, August Shi, Rutvik Choudhary, Zhekun Zhang, Aryaman Jain, and Sasa Misailovic. Detecting Flaky Tests in Probabilistic and Machine Learning Applications. *29th ACM SIGSOFT International Symposium on Software Testing and Analysis **(ISSTA) 2020***. Acceptance rate: 26% (43/162 papers).

FSE 2019 **C6.** **Saikat Dutta**, Wenxian Zhang, Zixin Huang, and Sasa Misailovic. Storm: Program Reduction for Testing and Debugging Probabilistic Programming Systems. *27th ACM Joint European Software Engineering Conference and Symposium on the Foundations of Software Engineering **(ESEC/FSE) 2019***. Acceptance rate: 24% (74/303 papers).

FSE 2018 **C5.** **Saikat Dutta**, Owolabi Legunsen, Zixin Huang, and Sasa Misailovic. Testing Probabilistic Programming Systems. *26th ACM Joint European Software Engineering Conference and Symposium on the Foundations of Software Engineering **(ESEC/FSE) 2018***. Acceptance rate: 21% (61/289 papers).

ASPSCC 2015 **C4.** Soumi Chattopadhyay, **Saikat Dutta**, and Ansuman Banerjee. A Framework For Fast Service Verification and Query Execution for Boolean Service Rules. *In 9th Asia-Pacific Services Computing Conference **(APSCC) 2015***.

ATS 2015 **C3.** **Saikat Dutta**, Soumi Chattopadhyay, Ansuman Banerjee, and Pallab Dasgupta. A New Approach For Minimal Environment Construction for Modular Property Verification. *In 24th IEEE Asian Test Symposium, **(ATS) 2015***.

NAS 2015 **C2.** **Saikat Dutta**, Moumita Das, and Ansuman Banerjee. Enhancing Branch Prediction Using Software Evolution. *In 10th IEEE International Conference on Networking, Architecture and Storage **(NAS) 2015***.

FACS 2013 **C1.** N. Jain, **Saikat Dutta**, Ansuman Banerjee, Anil K. Ghosh, Liuhua Xu, and Huibiao Zhu. Using Daikon to Prioritize and Group Unit Bugs. *10th International Symposium In Formal Aspects of Component Software, **(FACS) 2013***.

Journal Publications

STTT 2024 **J3.** Zixin Huang, **Saikat Dutta**, and Sasa Misailovic.Debugging Convergence Problems in Probabilistic Programs via Program Representation Learning with SixthSense. *The International Journal on Software Tools for Technology Transfer **(STTT) 2024***.

ISSE 2022 **J2.** Zixin Huang, **Saikat Dutta**, and Sasa Misailovic. Automated Quantized Inference for Probabilistic Programs with AQUA. *Innovations in Systems and Software Engineering: A NASA Journal **(ISSE NASA) 2022***.

TSE 2017 **J1.** B. Nongpoh, R. Ray, **Saikat Dutta**, and Ansuman Banerjee. Autosense: A Framework for Automated Sensitivity Analysis of Program Data. *IEEE Transactions on Software Engineering **(TSE) 2017***. Invited for presentation at **ESEC/FSE 2017**.

Awards, Fellowships, & Grants

Awards

2024 **Gemma Academic Program Cloud Credit Award**, Google *$5000*

Fellowships

2022-23 **Mavis Future Faculty Fellowship**, College of Engineering, UIUC *$2000*
2020-22 **Facebook PhD Fellowship**, Facebook *$42,000/yr*
2018-19 **3M Foundation Fellowship**, 3M *$10,000*

Travel Grants

2022 **Travel Grant for ICSE**, SIGSOFT CAPS
2019 **Travel Grant for ESEC/FSE**, SIGSOFT CAPS
2018 **Travel Grant for ESEC/FSE**, SIGSOFT CAPS
2018 **Travel Grant for the Midwest Programming Languages Summit**
2015 **Travel Grant for POPL**, PLMW

Presentations

Invited Talks

9. November 2023. *Randomness-Aware Testing of Machine Learning-Based Systems* at CS Systems Seminar, **Rutgers University**.
8. June 2023. *Randomness-Aware Testing of Machine Learning-Based Systems* at Group Seminar, **UC Berkeley**.
7. March 2023. *Randomness-Aware Testing of Machine Learning-Based Systems* at **EECS, MIT**.
6. March 2023. *Randomness-Aware Testing of Machine Learning-Based Systems* at **CS, Cornell University**.
5. March 2023. *Randomness-Aware Testing of Machine Learning-Based Systems* at **CS, University of Waterloo, Waterloo, Canada.**
4. Feb 2023. *Randomness-Aware Testing of Machine Learning-Based Systems* at **CS, University of Wisconsin, Madison**.
3. Feb 2023. *Randomness-Aware Testing of Machine Learning-Based Systems* at **ECE, Purdue University, West Lafayette**.
2. Feb 2023. *Randomness-Aware Testing of Machine Learning-Based Systems* at **CS, Iowa State University** (Virtual).
1. Jan 2023. *Randomness-Aware Testing of Machine Learning-Based Systems* at Software Engineering Seminar, **ECE, UT Austin** (Virtual).

Contributed Presentations

11. *InspectJS: Leveraging Code Similarity and User- Feedback for Effective Taint Specification Inference for JavaScript* at **ICSE 2022** (Virtual)
10. *To Seed or Not to Seed? An Empirical Analysis of Usage of Seeds for Testing in Machine Learning Projects* at **ICST 2022** (Virtual).
9. *Flex: Fixing Flaky Tests in Machine-Learning Projects by Updating Assertion Bounds* at **FSE, 2021** (Virtual).
8. *TERA: Optimizing Stochastic Regression Tests in Machine Learning Projects* at **ISSTA, 2021** (Virtual).
7. *Detecting Flaky Tests in Probabilistic and Machine Learning Applications* at **ISSTA, 2020** (Virtual).
6. *Storm: Program Reduction for Testing and Debugging Probabilistic Programming Systems*, Midwest Programming Languages Summit, 2019 at Purdue University, West Lafayette.
5. *Storm: Program Reduction for Testing and Debugging Probabilistic Programming Systems* at **FSE, 2019** (Tallinn, Estonia).
4. *Testing Probabilistic Programming Systems* at **FSE, 2018** (Lake Buena Vista, Orlando).
3. *Testing Probabilistic Programming Systems*, Midwest Programming Languages Summit, 2018 at University of Wisconsin-Madison.
2. **Poster Presentation** at 1st Conference on Probabilistic Programming: **ProbProg, 2018** (Boston).
1. *Minimal environment construction for modular property verification* at **ATS, 2015** (Mumbai, India).

Guest Lectures

7. Ensuring the reliability of Machine Learning-based systems in the presence of randomness, EE382V (Software Testing in the Era of Nondeterminism), **The University of Texas at Austin**, Fall 2022
6. Flaky Tests in Machine Learning Projects - based on TERA [C9] and FLEX [C8],CS 521 (Topics in Programming Languages: Approximate And Probabilistic Programming Systems), **UIUC**, Spring 2022
5. *Detecting and Fixing Flaky Tests in Machine Learning Projects*, CS 527 (Topics in Software Engineering), **UIUC**, Fall 2021
4. *Detecting Flaky Tests in Probabilistic and Machine Learning Applications*, CS 598sm (Approximate and Probabilistic Computing across the System Stack), **UIUC**, Fall 2020
3. Led the discussion on *Gen: A General-Purpose Probabilistic Programming System with Programmable Inference*, CS 598sm (Approximate and Probabilistic Computing Across the System Stack), **UIUC**, Fall 2020
2. *Control Flow Analysis*, CS 526 (Advanced Compiler Construction), **UIUC**, Spring 2020

1. *Dependence Analysis*, CS 526 (Advanced Compiler Construction), **UIUC**, Spring 2020

Teaching Experience

Fall 2024 **Lecturer**, CS 6158: Software Engineering in the Era of Machine Learning — *Cornell University*
Spring 2020 **Teaching Assistant**, CS 526: Advanced Compiler Construction — *UIUC*

Research Advising

Cornell University

Students mentored at Cornell:

- Nathan Chu (BS, Cornell University)
- Rohan Kalluraya (BS, Cornell University; via Cornell BURE Program)
- Alex Kang (BS, Cornell University)
- Sofia Gill (BS, Cornell University; via Cornell BURE Program)

Students mentored via external collaborations:

- Shanto Rahman (PhD, UT Austin)
- M M Abid Naziri (PhD, NCSU)

UIUC+ Summer Research Program 2024

- Linghao Zhang (BS, Wuhan University)
- Shreya Rao (BS, UIUC)
- Benjamin Wu (BS, Purdue University)
- Vedant Ramesh Nimje (BS, Veermata Jijabai Technological Institute, Mumbai)
- Varun Viswanath (BS, Dwarkadas J Sanghvi College of Engineering)
- Stefan Milenkovic (BS, University of Belgrade)
- Junkai Huang (BS, Tsinghua University)

University of Pennsylvania

Mentored several students as a postdoc at the University of Pennsylvania.

- Ziyang Li (PhD, University of Pennsylvania)
- Alaia Solko-Breslin (PhD, University of Pennsylvania)
- Mayank Keoliya (PhD, University of Pennsylvania)
- Avishree Khare (PhD, University of Pennsylvania)
- Neelay Velingker (PhD, University of Pennsylvania)
- Liam Dodds (BS, University of Pennsylvania)
- Amish Sethi (BS, University of Pennsylvania)
- Jesse Zong (BS, University of Pennsylvania)
- Edward Liu (BS, University of Pennsylvania)
- Nathan Zhang (BS, University of Pennsylvania)

- Akash Kaukuntla (BS, University of Pennsylvania)

Remote Mini-Crowd Undergraduate Summer Research Program 2023

Co-organized with Prof. Darko Marinov a remote program for 16 undergraduate and high school students in Summer 2023.

- Muhammad Salman Abid (BS, Habib University, Pakistan; grad school: Cornell CS)
- Sugam Adhikari (BS, Islington College, Nepal)
- Faustino Aguilar (University of Panama, Panama)
- Ryed Badr (BS, UIUC, USA)
- Asha Boyapati (Monta Vista High School, USA)
- Xuyan Cheng (BS, Dickinson College, USA; grad school: Ohio State)
- Mehzabin Haque (BS, University of Dhaka, Bangladesh)
- Choiyin Li (Beanstalk International Bilingual School Chengdu, China)
- Licheng Lin (BS, Zhejiang University, China)
- Lu Liu (BS, University of Washington, USA)
- Que Liu (BS, University of Shanghai for Science and Technology, China)
- Rohit Sai Naidu (Dublin High School, USA; undergrad school: UC Berkeley)
- Asif Zubayer Palak (BS, BRAC University, Bangladesh)
- Mrigank Pawagi (BS, Indian Institute of Science, India)
- Ronghui Qi (BS, Wuhan University, China; grad school: Michigan MS)
- Vedant Rathi (Adlai E Stevenson High School, USA; undergrad school: Illinois)
- Hao Wang (Peking University, China; grad school: UC Berkeley)
- Md Wahiduzzaman (BS, BRAC University, Bangladesh)

University of Illinois Urbana-Champaign

As a PhD student at University of Illinois Urbana-Champaign, I mentored and collaborated with two junior PhD, one masters, and 17 undergraduate students (including four women undergraduates):

- Xinyu Chen (BS, UIUC, USA)
- Steven Xia (PhD, UIUC; Co-authored [C14])
- Rutvik Choudhary (PhD, UIUC; Co-authored [C7])
- Peilun Zhang (MS, UIUC)
- Rem Yang (BS, UIUC)
- Süleyman Ateş (BS, Middle East Technical University, Turkey)
- Selim Kuzuku (BS, Middle East Technical University)
- Muhammet Emin Cihangeri (BS, Middle East Technical University)
- Furkan Genç (BS, Middle East Technical University)
- Steven Pan (BS, UIUC)
- Ankitha Damisetty (BS, UIUC)
- Sanjana Sarkar (BS, UIUC)
- Anshul Arunachalam (BS, UIUC; Co-authored [C12])

- Jeeva Selvam (BS, UIUC; Co-authored [C9])
- Hakan Tekgul (BS, UIUC; Co-advised on Undergraduate Thesis)
- Enguang Fan (BS, UIUC)
- Aryaman Jain (BS, UIUC; Co-authored [C9,C7])
- Zhekun Zhang (BS, UIUC; Co-authored [C7])
- Wenxian Zhang (BS, UIUC; Co-authored [C6])
- Zixin Huang (BS, UIUC; Co-authored [C5])

Service

2025 **Program Committee**, International Symposium on Software Testing and Analysis (ISSTA)
2024 **Proposal Review Panel**, One remote panel at National Science Foundation (NSF)
2024 **Program Committee**, Automated Software Engineering (ASE)
2024 **Program Committee**, Machine Learning and Systems (MLSys)
2022 **Reviewer**, IEEE Transactions on Software Engineering (TSE)
2022 **Shadow PC**, 19th International Conference on Mining Software Repositories (MSR)
2021 **Artifact Evaluation Committee**, 42nd ACM SIGPLAN Conference on Programming Language Design and Implementation (PLDI)
2020 **Artifact Evaluation Committee**, 35th ACM SIGPLAN Conference on Object-oriented Programming, Systems, Languages, and Applications (OOPSLA)
2020 **Mentor**, Undergraduate Research Apprenticeship Program, University of Illinois Urbana-Champaign
2019-21 **Presenter**, *Engineering Research Fair* for undergraduates, University of Illinois Urbana-Champaign

Open-Source Contributions

ProbFuzz `https://www.probfuzz.com`. ProbFuzz detects bugs in Probabilistic Programming Systems.

Storm `https://github.com/uiuc-arc/Storm`. Storm automatically minimizes fault-exposing programs and data for probabilistic programming systems.

FLASH `https://github.com/uiuc-arc/flash`. Flaky tests caused by the usage of different sequences of random numbers produced in each execution, which is common in Machine Learning libraries that implement stochastic algorithms.

FLEX `https://github.com/uiuc-arc/flex`. FLEX automatically fixes flaky tests caused due to randomness of stochastic algorithms in Machine Learning libraries.

TERA `https://github.com/uiuc-arc/tera`. TERA reduces the execution time of stochastic regression tests in Machine Learning libraries.

SixthSense `https://github.com/uiuc-arc/sixthsense`. SixthSense is a learning-based approach for predicting the convergence of probabilistic programs. SixthSense indicates likely program features that contribute to non-convergence.

AQUA `https://github.com/uiuc-arc/aqua`. AQUA is a tool for performing Bayesian inference for probabilistic programs using symbolic techniques.