SUVAM MUKHERJEE

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My interests lie in designing algorithms and building tools to help programmers rapidly develop *reliable*, *efficient,* and *secure* software. During my postdoc, I have been working on the Coyote project, which is being used by several teams in Microsoft Azure for writing reliable cloud services. I have applied Machine Learning techniques to significantly improve upon the state-of-the-art in controlled concurrency testing. I helped design a framework which allows developers to write performant cloud microservices which are fault-tolerant by design. I am also working on a project that allows developers to write fully verified smart contracts for the Ethereum blockchain. In my PhD thesis, I developed efficient static analyses for multithreaded programs. For a part of my work, I was awarded the Radhia Cousot Young Researcher Best Paper Award at the 24th Static Analysis Symposium, New York City.

EXPERIENCE

DECEMBER 2017 – PRESENT
POSTDOCTORAL RESEARCHER, MICROSOFT RESEARCH INDIA

AUGUST 2017 – NOVEMBER 2017
SOFTWARE ENGINEER, ARISTA NETWORKS

EDUCATION

JULY 2017
PhD + MS (Computer Science),
Computer Science and Automation, Indian Institute of Science (IISc).
Thesis: **Efficient Static Analyses for Concurrent Programs**
CGPA: 6.3 out of 8

JULY 2011
Bachelor of Technology (Computer Science),
Institute of Engineering and Management, India.
CGPA: 9.02 out of 10

PUBLICATIONS

OOPSLA 2020
Learning-based Controlled Concurrency Testing
joint work with Pantazis Deligiannis (Microsoft Research), Arpita Biswas (IISc, Bangalore), Akash Lal (Microsoft Research) [Tech Report] [OOPSLA 2020 Artifact Evaluated]

ECOOP 2019
Reliable State Machines: A Framework for Programming Reliable Cloud Services
joint work with Nitin John Raj (IIIT Hyderabad), Krishnan Govindraj (Microsoft Research), Pantazis Deligiannis (Microsoft Research), Chandramouleswaran Ravichandran (Microsoft Azure),

Akash Lal (Microsoft Research), Aseem Rastogi (Microsoft Research), Raja Krishnaswamy (Microsoft Azure) [PDF] [Talk Video]

AAMAS 2019

Fairness Through the Lens of Proportional Equality (extended abstract)
joint work with Arpita Biswas (IISc, Bangalore) [PDF]

HVC 2017

RATCOP: Relational Analysis Tool for Concurrent Programs (tool paper)
joint work with Oded Padon (TAU, Israel), Sharon Shoham (TAU, Israel), Deepak D'Souza (IISc, Bangalore), Noam Rinetzky (TAU, Israel) [PDF]

SAS 2017 (*winner* **Radhia Cousot Young Researcher Best Paper Award**)
Thread-Local Semantics and its Efficient Sequential Abstractions for Race-Free Programs
joint work with Oded Padon (TAU, Israel), Sharon Shoham (TAU, Israel), Deepak D'Souza (IISc, Bangalore), Noam Rinetzky (TAU, Israel) [PDF]

VMCAI 2017

Detecting all High-Level Dataraces in an RTOS Kernel
joint work with Arun Kumar (IISc, Bangalore), Deepak D'Souza (IISc, Bangalore) [PDF]

FFM 2015

Efficient Shape Analysis of Multithreaded Programs

UNDER SUBMISSION

Ensuring Fair Predictions under Prior Probability Shifts
joint work with Arpita Biswas (IISc, Bangalore) [arXiv]

ONGOING PROJECTS

Microsoft One Engineering System [link]

I am contributing features to various Azure services that enable teams throughout Microsoft to ship secure and compliant software.

Coyote [link]

Coyote (previously called P#) is an open-source framework that allows developers to build efficient and reliable asynchronous applications. The framework is being used by several teams in Microsoft Azure to design and implement in-production cloud services. I have contributed to developing a distributed runtime that allows developers to write cloud microservices that are fault-tolerant by construction, with low compromise on performance. I have also applied machine learning techniques to significantly improve upon the state-of-the-art in controlled testing techniques for concurrency bugs.

Verified Smart Contracts

In this project, we built a framework which helps developers to write fully verified smart contracts. We target smart contracts written for the Ethereum blockchain, and are in the process of open-sourcing the framework.

COVID-19 Regulation Checker [link]

This is an independent project, where I leverage the Z3 constraint solver to address the *conformance problem* (are two government orders imposing COVID-19 restrictions compatible with each other?) and *query problem* (given a set of government orders, how can a citizen find out which services are exempted from COVID-19 restrictions?).

COMPUTING EXPERIENCE

- Programming Languages:
  - *Imperative*: Java, C#, Solidity, C
  - *Scripting*: Python, JavaScript
  - *Functional*: F*
- Frameworks: Coyote, R, Soot Java Analysis Framework, Apron Numerical Abstract Domain Library, Spin Model Checker, Z3 SMT Solver.

INTERNSHIPS

- Technical University Munich, Germany, with Prof. Helmut Seidl (2015)
- Tel-Aviv University, Israel, with Prof. Mooly Sagiv (2015)

PROFESSIONAL SERVICES

- PhD Symposium Committee Member, ISEC 2020
- Reviewer/Sub-reviewer: CODS-COMAD 2021, Harvard AI4SG 2020, VSTTS 2019, CAV 2017, VMCAI 2017, VMCAI 2016, SETTA 2016, CAV 2015
- Artifact Evaluation Committee: SAS 2020, SAS 2019
- Microsoft Research India RF Reviewing Committee 2019 (for hiring Research Fellows)
- Organizing Committee: FSTTCS 2015
- Teaching Assistant: Automata Theory and Computability (Aug-Dec, 2012) and Program Analysis and Verification (Aug-Dec, 2013).

TALKS

- Learning-based Controlled Concurrency Testing, *October 2019*, Microsoft Research, Redmond.
- Reliable State Machines,
  - *June 2019*, Microsoft Research, Cambridge.
  - *July 2019*, Software Engineering Research in India, Indian Institute of Science.
- Efficient Static Analyses for Concurrent Programs, *May 2017*, MathWorks Bangalore.
- Proving an RTOS Kernel free of Data Races, *July 2016*, Bosch Research and Technology Center, Bangalore.
- Static Analyses of Concurrent Programs, *March 2015*, Research Seminar on Advanced Topics in Programming Languages, Tel-Aviv University, Israel.
- Program Analysis and Verification, *June 2013*, Undergraduate Summer School, Indian Institute of Science.

AWARDS & ACHIEVEMENTS

- "Microsoft Coyote" project selected for presentation at the Microsoft TechNext 2020, Redmond.
- The "Reliable State Machines" project selected for presentation at the Microsoft TechFest 2019, Redmond.
- Radhia Cousot Young Researcher Best Paper Award at the 24th Static Analysis Symposium, 2017, Courant Institute of Mathematical Sciences, New York University, USA.
- Institute of Engineering and Management Young Alumnus Award, 2017.
- Winner of the Doctoral Colloquium award at the 6th Institute for Development and Research in Banking Technology (IDRBT) 2016, Hyderabad. Prize includes 50,000 INR and a citation.
- Selected for the Marktoberdorf Summer School 2015, on the "Verification and Synthesis of Correct and Secure Systems", August 4-16, 2015, Marktoberdorf, Germany.
- Partial funding from the NATO Advanced Study Institute for attending the Marktoberdorf Summer School, 2015.
- ACM SIGPLAN Grant for attending Programming Languages Mentoring Workshop (PLMW) 2015 (Co-located with Principles of Programming Languages conference 2015)
- Won the Best Student Award, 2011, at the Institute of Engineering and Management. The award confers the accolade "Gem of the Institute of Engineering and Management".

EXTRA-CURRICULAR

- Music (trained in Western classical piano, Indian classical vocals and tabla)
- Elocution and debate
- Table tennis
- Hiking