Rohan Bavishi

Senior Undergraduate, Computer Science, IIT Kanpur

rbavishi@iitk.ac.in | rohan.bavishi95@gmail.com
Webpage : `home.iitk.ac.in/~rbavishi`
Github : `github.com/rbavishi`
+91-73-180-18920

Education

Indian Institute of Technology Kanpur, Uttar Pradesh, India
Bachelor of Technology, Computer Science and Engineering, *Jul' 13 - Jul' 17 (Expected)*
GPA: 9.7/10 (Overall)

Research Interests

Program Analysis and Verification, Automated Debugging and Synthesis, Compiler Optimizations, Decision Procedures

Publications

Rohan Bavishi, Awanish Pandey, Subhajit Roy, "To Be Precise : Regression Aware Debugging", *Proceedings of the 2016 ACM International Conference on Object Oriented Programming Systems Languages & Applications* (OOPSLA), Amsterdam, Netherlands

Rohan Bavishi, Awanish Pandey, Subhajit Roy, "Regression Aware Debugging for Mobile Applications", *Proceedings of the 1^{st} International Workshop on Mobile Development* Mobile! 2016, Amsterdam, Netherlands *[Invited Paper]*

Awards & Achievements

Awarded the **SIGPLAN PAC Scholarship** for paper presentation at **OOPSLA '16**
Academic Excellence Award 2013-14, IIT Kanpur
Secured an **All-India-Rank of 202** in JEE Advanced 2013 amongst 150,000 candidates
Secured an **All-India-Rank of 175** in JEE Mains 2013 amongst 20,00,000 candidates
Secured an **All-India-Rank of 33** in AMTI-Mathematics Olympiad

Research Projects

Automated Debugging for Context-Free Grammars

Supervisor : Prof. Subhajit Roy *Nov '16 - Present*

- Output a concise set of counter-examples using clustering as compared to *cfganalyzer* to improve user-experience (esp. students) while debugging CFGs
- Clustering is based on the number of distinct errors present in the incorrect grammar
- Using a combination of abstractions and horn-clause solvers to achieve quality clustering

New Strategy for Analysis of Concurrent Programs via Sequentialization

Supervisor : Prof. Subhajit Roy *Aug '16 - Present*

- Using CSeq for code-to-code translation of concurrent programs into equivalent sequential ones
- Devising solving strategies to reduce verification time on existing backends like CBMC

Improving Bug Localization Using Interpolant-Based Proofs

Supervisor : Prof. Subhajit Roy *Jul '15 - Aug '16*

- Devised a new method to improve the quality of bug localizations, in terms of reduced superfluous program locations, for a given set of passing and failing test-cases
- Interpolants are constructed from passing tests to derive *soft* roadblocks. These roadblocks then discourage localizations violating these interpolants, thereby improving bug localization quality
- Upto 45% improvement in localization quality as compared to the state-of-the-art tool BugAssist.
- *Paper accepted in OOPSLA, one of the premier peer-reviewed conferences in Programming Languages*

Using SAT/QBF-Solvers to Detect Side-Channel Vulnerabilities in Hardware

Supervisors : Prof. Paolo Ienne and Mr. Andrew Becker *May '16 - Present*

- Summer internship project at the Processor Architecture Laboratory, EPFL, Switzerland
- Studied various side-channel attacks, mitigation techniques and their proofs of effectiveness using formal methods
- Developed a QBF-Encoding technique to verify whether a cryptographic circuit is secure against a popular side-channel attack based on fault-injection
- In the process of writing a paper and submitting to a peer-reviewed conference

Implementation of DirectFix in CBMC

Supervisor : Prof. Subhajit Roy *May '15 - Jul '15*

- Ported the described *Component-Based-Synthesis* algorithm in DirectFix to CBMC
- Reproduced the experimental results provided in the paper, and devised further optimizations
- Github Link

Academic Projects

Re-Inventing A Median Algorithm for Disk-Resident Data

Supervisor : Prof. Surender Baswana *Aug '14 - Nov '14*

- Re-invented a two-pass *deterministic* algorithm to find the median of large data-sets (approx. 1 TB)
- The algorithm developed was similar to the one described in the paper by Munro-Paterson (1980)
- Carried out extensive tests to evaluate the performance of the algorithm
- Report

Peer-to-Peer Dropbox

Supervisor : Prof. Subhajit Roy *Aug '13 - Nov '13*

- A linux application for backing-up and syncing files between two or more peers
- Users have a shared folder across different machines, with local copies. Changes made in any one copy are synced across all devices
- Linux *inotify* API used to track changes in the shared folder and *rsync* used to sync the modifications to ensure efficient transfer
- Multithreading with mutexes used to parallelize syncing and file-monitoring operations
- Github Link

Course Projects

End-to-End Compiler for Perl-like Language

Course : Compilers | Supervisor : Prof. Subhajit Roy *Jan '15 - Apr '15*

- Built an end-to-end compiler that takes a subset of the Perl language and outputs MIPS assembly
- Implemented Features such as *operator overloading*, *dynamic type-checking*, *variable function arguments*, *hashes*, *lists*, *type-based namespaces* etc.
- Github Link

Integer Superscalar Processor Simulator based on MIPS-R10K

Course : Computer Architecture | Supervisor : Prof. Mainak Chaudhuri *Jan '15 - Apr '15*

- Implemented a superscalar processor simulator based on the MIPS R10K architecture with support for integer instructions only
- Implemented support for Out-of-Order execution, multiple instruction issue and commit, precise interrupts and branch-misprediction rollback
- Configurable parameters supported such as issue width, number of functional units, branch-prediction algorithm, RAS/BTB size, active-list size etc.
- Performed experiments on various synthesized benchmarks to measure performance gains over an in-order processor design. Repeated the experiment with varying parameter configurations
- Report

TA/Mentor Experience

Academic Mentor | Course : Fundamentals of Computing
Instructor : Prof. Amey Karkare *Aug '14 - Apr '15*

- Course is equivalent to the *Introduction to Computing/Programming* course offered in US universities
- Tutored under-performing freshmen in fundamental concepts and devised problem-sets for practice
- Held informal doubt-clearing sessions and lectures

Tutor | Course : Fundamentals of Computing
Instructor : Prof. Vinay Namboodiri *Aug '16 - Nov '16*

- Course is equivalent to the *Introduction to Computing/Programming* course offered in US universities
- Official TA position given by the institute to help manage the course for around 400 students
- Worked with the instructor directly along with 11 other tutors in managing lectures, assignments and labs
- Prepared and vetted questions for quizzes and final examinations and graded answer scripts
- Responsible for tutoring a batch of 35-40 students and holding official lecture-cum-tutorials

Relevant Coursework

Theory
Introduction to Algorithms
Advanced Algorithms
Theory of Computation
Logic

Architecture
Computer Organization
Computer Architecture

Systems
Operating Systems
Compilers
Computer Networks
Computer Security (Ongoing)

Program Analysis
Program Analysis, Verification and Testing
Analysis of Concurrent Programs (Ongoing)

Computer Skills

Languages (Expert): C, Python, Bash
Languages (Proficient): C++, Verilog, Assembly (x86, MIPS)
SAT/SMT Solvers: MathSAT, Z3, Yices
Research Tools: CBMC (Proficient), KLEE, CSeq
Misc Tools: LaTeX

Extra Interests

Project Euler: Solved : 257/560 *(India Rank : 13)*
Hobbies: Competitive Programming, CTF & Wargames, Quizzing