Akash Banerjee

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Contact

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Languages

English, Hindi, Bengali

Programming Languages

C
C++, JAVA
C#, JavaScript
Python
Flex/Bison
LLVM, GOTO
Git, GDB, LaTeX

Education

2018–Pres **M.Tech.** in Computer Science and Engineering - 9.43/10 CGPA — IIT Hyderabad

2013–2017 **B.Tech.** in Computer Science and Engineering - 8.37/10 CGPA — RERF, Kolkata

Interests

Software Verification
Exploring techniques for formal verification of programs like Symbolic Execution, Abstract Interpretation, etc.

SAT Solvers
Studying and exploring techniques and encodings to make SAT/MaxSAT solvers more efficient

Compiler Optimizations
Using novel techniques and engineering principles for optimizing software systems.

Skills

Programming Ability
Skilled in C, C++ and able to adapt quickly to new languages

Frameworks
LLVM compiler infrastructure, MLIR, CBMC

Tools
Git, LaTeX, GDB, LLDB, Eclipse

System Engineering
Build, maintain and troubleshoot modern systems

Visual Design
Well versed with design tools such as Blender, Autodesk Maya, Adobe Photoshop, Unity etc.

Projects

Apr. - 2020 **BPI Enhancements** — IIT Hyderabad
Proposed and implemented improvements to the Branch Probability Information pass in LLVM to allow better static profling leading to speed-up of up to 1.07x, as part of the course project for Advanced Compiler Optimizations - CS6240.
Accepted as a poster in EuroLLVM-20 held at Paris, France.

Oct. - 2019 **Loop Acceleration** — IIT Hyderabad
Added a loop acceleration module to the Pinaka verifer for quick detection of counter-examples in loops simulating polynomial functions. Pinaka is developed by IITH Software Verifcation Group which won the third-fastest verifer position in SV-COMP'20 Floats sub-category, amongst other positions and was the only entry from Indian academia.
Commended by Prof. B.S. Murty, Director of IIT Hyderabad and Dr. R.P. Nishank, The Union Cabinet Minister for Education, Govt. of India for this work.

Sep. - 2019 **LLVM2GOTO** — IIT Hyderabad
I co-created a tool which translates LLVM IR to CBMC-GOTO. LLVM supports multiple front-ends like C, C++, FORTRAN, Swift, etc., which get converted to LLVM-IR. CBMC is a tool to verify programs which has its own GOTO IR, this tool translates LLVM-IR to GOTO IR, allowing us to potentially verify all the languages that are supported by LLVM's front-end.

Aug. - 2019 **COOL Compiler** IIT Hyderabad
Designed and implemented a compiler for the COOL language to generate LLVM IR as part of the course project for Advanced Compiler Design - CS CS6240.

Mar. - 2019 **SAT Solvers** IIT Hyderabad
Implemented highly optimized DPLL and CDCL SAT solvers with watch literals and lazy data structures, and an encoder for MaxSAT using Totalizer encoding as part of the course Constraint Programming - CS6483.

Nov. - 2018 **Hybrid Mutual Exclusion in Distributed Systems** IIT Hyderabad
An efficient implementation of a hybrid mutual exclusion algorithm for distributed systems by combining Raymond's and Maekawa's algorithms by multiplexing between them when communicating within clusters and across clusters, based on load, latency and throughput. As part of the course project for Distributed Computing - CS5320.

Nov. - 2018 **Thin Slicing in GOTO** IIT Hyderabad
Implemented thin-slicing in CBMC-GOTO. Slicing is a beneficial tool in debugging large programs, by only presenting the relevant sections of code, allowing the programmer to focus and debug more efficiently. As part of the course project for Compiler Engineering - CS6383.

Oct. - 2018 **Bitcoin Wallet** IIT Hyderabad
Created a BTC wallet application which can create and manage BTC addresses, and also handle transactions with support for both single and multisig authorization. This was done as part of the course project for Blockchain-Theory & Practice - CS5543.

Aug. - 2018 **Dynamic peer to peer communication system in C** IIT Hyderabad
Created a tool to dynamically establish connections between nodes, where clients and servers may connect and disconnect at any time, and all nodes are automatically synchronized as long as at least any one server node is available, throughout the duration. This was done as part of the course Distributed Computing - CS5320.

Feb. - 2017 **Game - A Lost Tale** RERF
Developed a 3D visual game in Unity-Game engine using Blender with 3d modelling, animation, world design, lighting and particle systems. A video showing the game is available here. As part of a summer project during B.Tech.

Co-Curricular

Jan. - 2020 **Teaching Assistant** IIT Hyderabad
Helped in grading and evaluating assignments for the CS6483-Constraint Programming course

Aug. - 2019 **Webpage Moderation** sat-smt.in
Maintainer for the Indian SAT+SMT School website :https://sat-smt.in

Jul. - 2019 **FMUpdate-India 2019** fmindia.cmi.ac.in
Organizing team member at the Formal Methods Update Meeting 2019

Jun. - 2019 **System Security** COEP Pune
Attended ACM India Summer School on Detection and Analysis of Malware

Sep. - 2016 **IBM C Certificate** IBM
Received IBM C Programming Certification

Hobbies

Technology
An avid follower of the latest technological advancements in engineering

Gaming
Competitively play MMO games, and also design games

Photography
In the top 10% of contributors at Unsplash

Fishkeeping
Enjoy building and maintaining nature Aquascapes

Astrophysics
Curious about the Cosmos and the pale blue dot we live in