Yugesh Ajit KOTHARI
Software Systems | Formal Methods & Verification | Programming Languages

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🎓 EDUCATION

2017-2021*	Bachelor of Technology - Computer Science and Engineering - **Indian Institute of Technology Kapnur**
	Cummulative Grade Point/CGPA : **9.53/10.0**
2017	High-School ISC Diploma - Hill Top School, Jamshedpur, **97.0% score**

⭐ HONOURS & AWARDS

2018, 2019	**Academic Excellence Award** - for outstanding academic achievement in respective year
2017-21	**Aditya Birla Scholarship** - Among 15 candidates across all IITs
2017	**Kishore Vaigyanik Protsahan Yojana** Scholarship
2017	**All India Rank 193** Joint Entrance Examination Mains, **1.5 million candidates**
2017	**All India Rank 120** Joint Entrance Examination Advanced, **200,000 candidates**
2017	**Gold Medal** Indian National Physics Olympiad
2016	**All India Rank 30** National Science Talent Search Examination
2016	**National Standard Examination** Physics	Chemistry	Astronomy **Top 6 in state**

💻 WORK EXPERIENCE

Present
Jan 2020

Research Assistant, MAX PLANCK INSTITUTE FOR SOFTWARE SYSTEMS, Kaiserslautern, Germany
Practical Formal Methods, **Dr. Maria Christakis**
> Formalized and designed a new Abstract Interpretation based approach to verify hybrid software.
> Implemented a symbiotic framework by extending an Abstract Interpretation engine called crab and used it to formally verify a software with a Neural Network for safety properties.
> This work is currently *under review* at TACAS (ETAPS '21).

`Seahorn` `Crab` `Clam` `C++` `Abstract Interpretation` `Program verification`

Sept 2020
Jun 2020

Research Intern, ECOLE POLYTECHNIQUE FÉDÉRALE DE LAUSANNE, Lausanne, Switzerland (remote)
Network Architecture Lab, **Prof. Katerina Argyraki**
> Extended Bolt to give run time performance guarantees for Software Network Functions by analysing them at LLVM-IR level allowing performance predictions to be more portable (predicting performance agnostic of underlying hardware).
> Used KLEE for exhaustive symbolic execution and computed software level metrics in LLVM to compare relative predictions with x86. Implemented proof-of-concept for the Bridge and NAT Network Functions.
> A report of the work can be found here.

`KLEE` `BOLT` `LLVM` `eBPF` `Software Performance`

Jun 2020
May 2020

Software Development Intern, MASTERCARD, Pune, India (remote)
 github.com/mc-internship/covid19visualizer
> Built a dashboard to track updates and developments of rising COVID-19 cases in India.
> Implemented strong, industry standard devops principles to create production ready code with support for Continuous Integration and Continuous Deployment.
> A blueprint of the CI/CD pipeline can be seen here. Project can be see here (no longer actively maintained).

`COVID-19` `Web Development` `DevOps`

July 2019
May 2019

Research Intern, PURDUE UNIVERSITY, West Lafayette, Indiana, USA
Purdue Formal Methods Reseach Lab, **Prof. Roopsha Samanta**
> Developed infrastructure to transpile a parsed C program to a Static-Single-Assignment form Boolean Program; with intent to reason about program behaviour using an SMT-solver like Z3.
> Worked on formalizing a novel framework for statement-level multi-line automated program repair using **CPAChecker** that leverages lazy predicate abstraction for automated reasoning about incorrect program behaviour and a code synthesizer to suggest repairs based on satisfying models from a pMaxSAT query.

`Java` `Ant` `Antler` `CPAChecker` `Z3` `Program Repair`

| July 2018
May 2018 | **Member of Technical Staff, Nutanix, Bangalore, India**
› Worked on CALM, Nutanix's application-orchestration tool that allows clients to manage state and replicas of their applications and VMs at all stages in the deployment cycle.
› Implemented from scratch a task for their suite that allows users to configure and authenticate to third-party rEST servers to fetch any information and set as properties on machine as per the deployment requirement.
› Work included adding a web-UI component (ReactJs), embedded document models at the backend (Python) and a GoLang based task executor instance on their proprietary execution framework.
› Received returning offer for internships in later breaks. |

Python Javascript ReactJs GoLang micro-service architecture

</> Projets

Undergraduate Research Project   Sep-Dec 2020

Explored the smack tool-chain, and fixed the Angelic Verifier within corral for current version of smack. Identified benchmarks for buffer-overflow bugs, and currently working on developing an AV Property Language to detect buffer-overflows.

Smack Corral Boogie Angelic Verification

Program Analysis and Verification - CS639   Sep-Nov 2020

github.com/yugeshk/CS639   github.com/yugeshk/CS639-Assignments

Used Angelic Verification to analyze WebAssembly programs for memory safety bugs.
Implemented multiple control-flow and dataflow analysis techniques for a subset of the python grammar.

Faint Variable Analysis CFG construction AST parsing

Oz Intepreter - Course Project for CS350   Oct-Nov 2018

github.com/yugeshk/CS350

A minimal interpreter for Oz as part of my coursework for CS350 (Principles of Programming Languages). A declarative-concurrent interpreter based on the Kernel language (management of the SAS, Multi-stack, execution environment, etc.

Oz programming-languages functional-programming

Microsoft Code.Fun.Do - National winner   May 2018

WorldNewSense

Machine learning hackathon project that used the NLTK library for Natural Language Processing and Sentiment Analysis to summarize, filter and present news articles on World Politics filtered by topics and countries; scraped and analyzed over a year's news data to predict relations between countries.

Django NLP Heroku jQuery D3.js

Life@IITK - Programming Club, IIT Kanpur - Project Team Lead   May 2019-Present

github.com/life-iitk

Unified web-app for all activities, updates and personal schedule (including individual academic and non-academic student-body updates) at IIT Kanpur. End-to-end implementation of prototype developed as *Personalized Notification Portal*. Managing deployment as micro-services on college VMs.

ReactJs Django CentOS Nginx Dockers Software-development project-management

Software Development Lab Project   Aug 2019

github.com/yugeshk/hotel-management

Developed a hotel management portal using LAMP technologies that allows different end-users (i.e., manager, employees and customers) to perform different actions like complaint management, room booking and servive, salary management etc.

Linux Apache2 MySql php docker-compose web-hosting

SAT Solver - Complimentary Sudoku generator-solver for validity   Oct 2018

github.com/yugeshk/CS202

SAT solvers, one implemented using custom heuristics using the semantic-tableaux approach another using randomized techniques. A logic based sudoku solver and generator that encodes a sudoku in DIMACS format to check for validity of the solver. Bench-marked various types of encodings against miniSAT.

Python SAT-solvers Formal-Methods Computer-logic

☰ Technical Skills

Programming	C++, Python, Java, GoLang, Bash and Shell Scripting, Haskell, OCaml
Software	KLEE, Seahorn, Smack, Corral, Emscripten
Web	JavaScript, NodeJs, MongoDB, ReactJs, Django, PostgreSql, GraphQL
Misc.	Git, Travis CI, Jira, Jenkins, Puppet, Dockers, Nginx, LaTeX, Heroku

✓ Relevant Coursework

Program Verification & Testing	Operating Systems	Principles of Programming Languages
Fundamentals of Computing*	Theory of Computation	Data Structures and Algorithms
Advanced Algorithms	Introduction to Machine Learning	**Parallel & High Performance Computing**
Software Development Lab	Systems Programming Lab	Mathematics for Computer Science
Convex Optimization	Probability and Statistics	Logic In Computer Science
Introduction to Real Analysis	Partial Differential Equations	Linear Algebra and ODE
Computer Networks#	Compiler Construction#	**Analysis of Concurrent Programs**#

* ≡ Outstanding   # ≡ Upcoming   **bold** ≡ Graduate course

🎓 Positions of Responsibility

July 2019
May 2019

Overall Coordinator, Summer of Code, IIT Kanpur | ⤤ IITK-SoC
> Organized and coordinated an industry funded Summer of Code program at IIT Kanpur that trained 100 students in Full Stack Development, with end projects aimed at creating societal impact.
> Structured program curriculum, lectures and timeline. Served as mentor to students during the coding phase.

Apr 2020
Apr 2019

Coordinator, Programming Club, IIT Kanpur
> Coordinator for all student-organized programming activities at IIT Kanpur - organized workshops, gave lectures, and mentored projects.
> Started a now popular 8 languages in 8 weeks summer project at IIT Kanpur - covering all major paradigms : procedural, object-oriented, functional and logic programming.

Apr 2019
Aug 2018

Academic Mentor, Counselling Services, IIT Kanpur
> Student volunteer for **teaching** and helping freshers with the course Fundamentals of Computing.

Present
Jan 2019

Systems Administrator, Student Servers, IIT Kanpur
> Manage a couple CentOS VMs, that run multiple campus software, nginx reverse proxies, dockerized microservices and database clusters.

Apr 2019
Jul 2018

Software Manager, Techkriti - Technical Festival, IIT Kanpur
> Overall manager of all programming and software related events for Techkriti '19. Designed problem statements and conducted 4 programming events, that saw a participation of over 2000 students.

Present
Aug 2018

Student Member, Departmental Undergraduate Committee, CSE, IIT Kanpur
> Student member nominated to departmental committee that handles all undergraduate academic policies.