Curriculum Vitae

Aman Goel *Ph.D. Student, CSE, University of Michigan*

Basic Information

4^{th} Year Ph.D. Student (adviser: Prof. Karem Sakallah)
Computer Science & Engineering
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Research Interests

My research interests include exploring reliability & security of complex systems, and developing automated reasoning algorithms for ensuring system correctness. I also have a keen interest in programming languages, data structures & algorithms, machine learning and web systems. My current work focuses on automatic verification of distributed systems.

Education

University of Michigan, Ann Arbor, USA *Aug 2016 - Present*
Ph.D. student, Computer Science & Engineering
Grade Point Average: **3.96/4**

IIT Madras, India *July 2011 - May 2016*
Bachelor of Technology, Electrical Engineering
Master of Technology, Microelectronics & VLSI
- Grade Point Average: **9.23/10**
- Minor: Industrial Engineering (GPA: 9.33/10)

Recent Research Experience

Developer of I4 *Aug 2018 - Present*
I4 is a tool for automatic, push-button verification of distributed systems
– Performs automated correctness checking and bug-hunting for distributed systems
– Uses formal methods and symmetry to simplify and automate verification tasks
– Uses state-of-the-art SMT solvers (Z3, Yices 2) to derive proof guarantees or to compute counterexample traces

Developer of AVR *Sep 2016 - Present*
AVR is a tool for automatic verification of state-transition systems
– Successfully applied on hardware and software systems
– Uses SMT solvers to perform word-level formal verification
– Uses data abstraction for scaling unbounded property verification

Contributor to Open-source Tools *Sep 2016 - Present*
Yices 2 - a state-of-the-art SMT solver
Yosys - an open-source framework for design synthesis

Contributor to Commercial Tools *Summer 2019 @ Haifa, Israel*
JasperGold
– A state-of-the-art formal verification platform from Cadence
– Developed word-level verification engines for JasperGold
– Worked with Cadence SVG (systems verification group) and developed algorithms for automatically solving hard verification tasks

Others
CAV 2020 AEC *2019 - Present*
– Member of artifact evaluation committee (AEC) for International Conference on Computer-Aided Verification (CAV) 2020

SSFT 2018 *Summer 2018 @ Menlo Park, CA*
– Invited participant at Summer School on Formal Techniques (SSFT) 2018 hosted by SRI

Skills

Good knowledge of *C++, C, Python, Verilog, Shell scripting*
Working knowledge of *MATLAB, Java, HTML, CSS, JavaScript, SQL, LLVM*
Good understanding of *SAT / SMT solvers*

Selected Publications

I4: Incremental Inference of Inductive Invariants for Verification of Distributed Protocols
Ma, Haojun, **Aman Goel**, Jean-Baptiste Jeannin, Manos Kapritsos, Baris Kasikci, and Karem A. Sakallah. In Proceedings of the 27th Symposium on Operating Systems Principles (*SOSP*), ACM, 2019.

Towards Automatic Inference of Inductive Invariants
Ma, Haojun, **Aman Goel**, Jean-Baptiste Jeannin, Manos Kapritsos, Baris Kasikci, and Karem A. Sakallah. In Proceedings of the Workshop on Hot Topics in Operating Systems (*HotOS*), pp. 30-36. ACM, 2019.

Model checking of Verilog RTL using IC3 with syntax-guided abstraction
Aman Goel, and Karem Sakallah. In NASA Formal Methods Symposium (*NFM*), pp. 166-185. Springer, Cham, 2019.

Empirical evaluation of IC3-based model checking techniques on Verilog RTL designs
Aman Goel, and Karem Sakallah. In 2019 Design, Automation Test in Europe Conference Exhibition (*DATE*), pp. 618-621. IEEE, 2019.

iitRACE: A memory efficient engine for fast incremental timing analysis and clock pessimism removal
Peddawad, Chaitanya, **Aman Goel**, B. Dheeraj, and Nitin Chandrachoodan. In 2015 IEEE/ACM International Conference on Computer-Aided Design (*ICCAD*), pp. 903-909. IEEE, 2015.

Teaching Experience

Graduate Student Instructor

University of Michigan:

EECS 281 Data Structures & Algorithms	*Aug - Dec 2017 & 2018*
EECS 478 Logic Synthesis & Optimization	*Jan - Apr 2018*
EECS 579 Digital System Testing	*Aug - Dec 2019*

IIT Madras:

EE 5311 Digital IC Design	*Aug - Nov 2015*
EE 5332 Mapping Signal Processing Algorithms to DSP Architectures	*Jan - May 2016*

Selected Courses

University of Michigan

- *Advanced Algorithms*
- *Advanced Compilers*
- *Formal Verification*
- *AI Foundations*
- *Web Systems*

IIT Madras

Computer Science:

- *Data Structures & Algorithms*
- *Design Verification*
- *Computational Engineering*
- *Digital Systems Testing*
- *Computer Organisation*
- *CAD Systems*

Mathematics & Operations Research:

- *Combinatorial Optimization*
- *Probability Foundations*
- *Fundamentals of Operational Research*
- *Decision Modelling*

Honors

- Recipient of Dwight F. Benton fellowship at University of Michigan for 2016-17
- Recipient of research travel grant and Israel travel award for 2019
- Branch position 2 in Electrical Engineering at IIT Madras (*Silver medalist*)
- Won international 3^{rd} place in TAU Contest at ICCAD 2015 for Incremental Timing Analysis
- Recipient of *best undergraduate research project* at Pan IIT Research Expo 2014
- Recipient of *Electronics for You* prize for best academic performance at graduate level
- Won *National Award* for the Empowerment of Persons with Disabilities 2013 for Solar Charger for Hearing Aid Devices

Former Short Projects

- *MPUC: Compiler for Memristor Arrays* *Jan - Apr 2017*
  Developed a compiler for coarse-grained architecture of memristor arrays
- *Systolic Arrays in Bluespec Aug - Nov 2015* Designed and analyzed different architectures of matrix-matrix multiplication using systolic arrays using Xilinx ISE
- *Radiation Pattern Measurement System for Automotive Radar* *May - July 2014*
  Wireless Connectivity Solutions, Texas Instruments
  Developed an automatic radar positioning system for radar modules testing
- *String Matching Problem & Variants* *Mar - May 2014*
  Surveyed the historical Knuth-Morris-Pratt (KMP) algorithm and other similar variants to find all occurrences of a given pattern string in a text
- *Voice to Text Converter* *Mar 2013*
  Developed software that converts voice input in a language to text field in other chosen language using available softwares of Google Voice Recognition and Google Translate
- *SPICE Circuit Simulator* *Aug - Nov 2012*
  Developed a circuit solver in C similar to SPICE for solving linear circuits

Other Activities

- *Lunch & Lab program* *2016 - Present*
  Encourage and guide undergraduate students towards CS major, programming and graduate studies
- Voluntary blood donor

Hobbies

Swimming, Water Polo, Skating (ice & roller), Soccer