Hari Govind V K

PhD student at the University of Waterloo

2269885264 | hgvk94@gmail.com | hgvk94.github.io | hgvk94

Research

Word level Model Checking

Z3, SMT, Constraint Solving, Constrained Horn Clauses   *February 20 - August 20*

- Spacer is a model checking engine used to discharge software verification and theorem proving queries.
- Extended Spacer to efficiently reason about software programs with fixed-precision numbers and complicated hardware designs by coming up with new algorithms for predecessor computation and lemma generalization.
- Implemented on top of Z3: an open source automated theorem prover framework in C++.
- Publication: **Vediramana Krishnan H.G.**, Fedyukovich G., Gurfinkel A. "Word Level Property Directed Reachability". In: International Conference in Computer Aided Design (2020).

Software Model Checking

Z3, SMT, Constraint Solving, Constrained Horn Clauses   *February 19 - January 20*

- A constant source of frustration in using Spacer is its instability: apparently trivial changes to the input can have adverse effect on Spacer's performance. Part of the reason is that Spacer is very tightly coupled to the underlying SMT solver.
- Introduced a new technique (Global guidance) to guide Spacer towards a good proof, thereby decoupling it from the underlying solver.
- Publication: **Vediramana Krishnan H.G.**, Chen Y., Shoham S., Gurfinkel A. "Global Guidance for Local Generalization in Model Checking". In: Computer Aided Verification (2020).

Hardware Model Checking

May 18 - February 19

- Worked on Avy: an open source model checking tool for verifying functional correctness of digital circuits.
- Designed and implemented a new algorithm that uses the principle of k-induction to guide generalizations during search.
- Made an exponential speed up on a class of benchmark instances.
- Publications:
  Vediramana Krishnan H.G., Vizel Y., Ganesh V., Gurfinkel A. "Interpolating Strong Induction". In: Computer Aided Verification (2019).
  Hari Govind V K. "Strong Induction in Hardware Model Checking". Master's thesis.

SAT solvers

C++, bash   *February 2016 - April 2017*

- Implemented 7 different branching heuristics inside the Minisat Boolean SATisfiability Solver.
- Conducted an empirical study of these branching heuristics.
- Publication: Liang J.H., **Vediramana Krishnan H.G.**, Poupart P., Czarnecki K., Ganesh V. "An Empirical Study of Branching Heuristics Through the Lens of Global Learning Rate". In: Theory and Applications of Satisfiability Testing (2017).
- Runner up for the best student paper award.

Education

PhD in Electrical And Computer Engineering   *Ontario, Canada*

University Of Waterloo   *September 2019 - Present*

- Supervisor: Prof. Arie Gurfinkel.
- Relevant courses: Programming Languages Foundations in Agda, Introduction to Symbolic Computation

MASc in Electrical And Computer Engineering   *Ontario, Canada*

University Of Waterloo   *September 2017 - August 2019*

- Supervisors: Prof. Arie Gurfinkel and Prof. Vijay Ganesh.
- Relevant courses: Automated Program Verification, Computer-aided Reasoning, Convex Optimization.
- GPA: 91%.

B.Tech in Electronics and Communication Engineering   *Thiruvananthapuram, India*

College Of Engineering Thiruvananthapuram   *June 2012 - July 2016*

- GPA: 84%.

Professional Experience

Teaching Assistant   *Waterloo, Canada*
                                                                                                                     Jan. 2018 - Aug. 2019

- Handled 5 undergraduate courses and 1 graduate course
- Gave tutorials for a data structures and algorithms course.
- Handled theory and lab sections of a compilers course.
- Responsible for setting up and grading assignments and exams.

Software Engineer at Zoho Corporation   *Thenkasi, India*
JAVA, SERVER APIS   *Aug. 2016 - June 2017*
- Implemented webhooks for Zoho Desk using Apache Kafka for easy integration with other services. Webhooks are asynchronous means of keeping client updated with the server's state without the client itself having to make costly network calls.
- Designed and implemented RESTfull APIs for Zoho Desk to enable loose coupling between the server and client.

Personal Projects

Probabilistic Program Verification
PYTHON, Z3   *September 2018 - December 2018*
- Designed a system to encode probabilistic programs as a set of Probabilistic Constrained Horn Clauses (PCHC).
- Implemented a novel technique to solve PCHCs by reducing them to Constrained Horn Clauses.

ENF identification
MATLAB, SIGNAL PROCESSING TOOLBOX   *December 2015-January 2016*
- Determined the geographic location of an audio clip by accurately extracting Electrical Network Frequency (ENF) signal from the clip and comparing it with ENF signals recorded directly from different power lines.

Quadcopter
MICROCONTROLLER PROGRAMMING, EMBEDDED C   *September 2015*
- Programmed a PID control loop on a quadcopter to stabilize its flight.

Awards

Faculty of Engineers Award (FOE)   *Waterloo, Canada*
PRESENTED BY ECE DEPARTMENT, UNIVERSITY OF WATERLOO   *Winter 2020*
- Merit driven scholarship based on comparing accomplishments of peer researchers in the department.
- One among 24 students to receive this award.

Club Activities

RoboCET (Robotics Club Of CET)   *Thiruvananthapuram, India*
SECRETARY   *June 2015 - April 2016*
- Conducted a hands on workshop on gesture controlled robotics for 60 undergraduates.
- Taught quadcopter design and stability to undergraduates as part of a two day workshop.

IEEE RAS CET Chapter   *Thiruvananthapuram, India*
SECRETARY   *June 2015 - December 2016*
- Organized RoboExtreme: a two day event, hosted by IEEE RAS CET Chapter, to equip 150 undergraduates with technical know how required for constructing bots.

Programming Languages and Technologies

C, C++, Python, Z3, SMT, Java, SQLite, Shell scripting, Linux.