Anagha Athavale

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Research Interest

I am passionate about making machine learning trustworthy. My research interest lies at the intersection of formal methods and machine learning. As a part of my PhD, I am currently working on verifying 2-safety properties in feed-forward deep neural networks. During my Masters, I developed a bounded model checking based verification technique for model-based design frameworks used in the nuclear research domain.

Education

Technische Universität Wien — Vienna, Austria
PhD in Computer Science — 2022–present

- Topic: "Verification and Testing in Machine Learning".
  Currently working on specifying and verifying hyper-properties in deep neural networks
- Supervisors: Prof. Matteo Maffei and Prof. Georg Weissenbacher
- Jointly funded by Technische Universität Wien and Austrian Institute of Technology

Homi Bhabha National Institute — Mumbai, India
M.Tech. in Computer Science Engineering — 2018–2021
(with specialization in Nuclear Engineering)

- Thesis: "Scalable Formal Verification Techniques for Model-Based Design Frameworks".
- Supervisors: Dr. Ajith K.J. and Dr. Amol Wakankar
- CGPA: 8.09/10, Rank 1

University Institute of Technology(RGPV) — Bhopal, India
B.E. with honours in Computer Science Engineering — 2014–2018

- CGPA: 8.68/10, Rank 2

Experience

Bhabha Atomic Research Centre — Mumbai, India
Scientific Officer — 2019-2021

- Development of Automatic Test Case Generator by generating SMT formulas for model-based safety system application development framework
- Development of Integrated Design Verifier using CBMC for model-based safety system application development framework
- Formal verification of application logic of a Reactor Protection System
- Porting of Real Time OS (ESOS) on PPC P1013 board for Safe and Secure PLC.

Bhabha Atomic Research Centre — Mumbai, India
Trainee Scientific Officer — 2018-2019

- Academic training in computer science and nuclear engineering

Publications

A. Athavale, E. Bartocci, M. Christakis, M. Maffei, D. Nickovic, G. Weissenbacher. "Verifying Global Two-Safety Properties in Neural Networks with Confidence", *Submitted to 36th International Conference on Computer Aided Verification(CAV 2024).*

Teaching

Teaching Assistant and lecturer along with Prof Matteo Maffei, 192.059 Formal Methods for Security and Privacy 2023S, TU Wien.

Scholarships and Awards

- Homi Bhabha gold medal and scholarship 2019
  for securing first rank in Computer Science of one year orientation course at BARC
- Chancellor's Scholarship 2018–2019
  for meritorius performace in fourth year of Bachelors
- Chancellor's Scholarship 2015–2016
  for meritorius performace in first year of Bachelors

Projects

- **Scalable Formal Verification Techniques for Model-Based Design Frameworks** (August 2019 - Dec 2020)
  Bounded model checking was performed by obtaining transition relations derived by translating an enhanced Lustre language with support for state-machines to equivalent symbolic expressions. The symbolic expressions are expressed in SMT-LIBv2 format, which can be given to any SMT solver. This was my M.Tech. project.
- **Development of Algorithms for Automatic Synthesis of State Machines to Software Programs** (Apr - Jun 2019)
  Extended the existing causality algorithm for data-flow to accept state-machines with no causal cycles. This was done for an in-house project of BARC on developing Integrated Model-Based Design Framework for critical embedded software. Ensuring the absence of causal cycles is an important phase when automatically generating qualified code from graphical models. This was my minor project during M.Tech.
- **Analyzing Twitter Data Related to Demonetization** (Jan - May 2018)
  Employed an open source approach for sentiment analysis and text mining using Hive to mine the Twitter data and to carry out sentiment analysis for Demonetization in India.This was my bachelor's final year project.
- **Android Based Quiz Application for Enhancing Anytime Anywhere Learning** (Feb - Apr 2017)
  Developed an interactive mobile application based on android framework to conduct quiz sessions for various technical topics. This was my bachelor's minor project.

Skills

Tensorflow, C++, C, Marabou (NN verification), Python, Latex, PyTorch, OCaml, Z3, CBMC

References

Prof. Matteo Maffei
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TU Wien
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Prof. Georg Weissenbacher
Institute of Logic and Computation
TU Wien
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