

# Umang Mathur

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## EDUCATION

**University of Illinois at Urbana-Champaign**, Urbana-Champaign, IL, USA  
Ph.D., [Department of Computer Science](#)  
Cumulative GPA of 3.96/4.0

Aug 2015 – Present

**Indian Institute of Technology - Bombay**, Mumbai, India  
B.Tech. (Hons.), [Department of Computer Science and Engineering](#)  
Cumulative GPA of 9.18/10.0  
Minor degree in Physics

Jul 2010 – Aug 2014

## PUBLICATIONS

### **Dynamic Race Prediction in Linear Time**

*Dileep Kini, Umang Mathur, Mahesh Viswanathan*

Proceedings of the 38<sup>th</sup> ACM SIGPLAN Conference on Programming Language Design and Implementation, PLDI 2017

### **Look for the Proof to Find the Program: Decorated-Component-Based Program Synthesis**

*Adria Gascon, Ashish Tiwari, Brent Carmer, Umang Mathur*

To appear in Proceedings of the 29<sup>th</sup> International Conference on Computer Aided Verification, CAV 2017

### **Exact Quantitative Model Checking Through Rational Search**

*Matthew S. Bauer, Umang Mathur, Rohit Chadha, A. Prasad Sistla, Mahesh Viswanathan*

To appear in Proceedings of the 17<sup>th</sup> International Conference on Formal Methods in Computer-Aided Design, FMCAD 2017

### **Weak Singular Hybrid Automata**

*Shankara Narayanan Krishna, Umang Mathur, Ashutosh Trivedi*

Proceedings of 12<sup>th</sup> International Conference on Formal Modeling and Analysis of Timed Systems, FORMATS 2014

### **Computing Information Flow Using Symbolic Model-Checking**

*Rohit Chadha, Umang Mathur, Stefan Schwoon*

Proceedings of IARCS Annual Conference on Foundations of Software Technology and Theoretical Computer Science, FSTTCS 2014

## WORK

### **Senior Quantitative Researcher**

Jul 2014 – Jul 2015

## EXPERIENCE

[WorldQuant Research, India](#)

Responsible for conceptualizing and implementing quantitative strategies resulting in excess returns (*alpha*). Responsibilities involved surveying financial literature and analyzing data from various sources to seek out sources of *alpha* following from inefficiencies and persistent causal relations in market behavior, and, aggregating these signals into robust models, with the objective of achieving high Sharpe ratios and significant abnormal returns. Concentrated mainly on seeking low turnover quality *alphas* for trading in the currency market based on canonical and alternative forex evaluation models.

Awarded the **Rookie of the Month** for three months (out of six months), for being the best researcher amongst the newly joined researchers.

## RESEARCH

### **Graduate Research Project, UIUC**

Aug 2016 – Present

## EXPERIENCE

*Natural Proofs for Program Synthesis*

[Prof. Mahesh Viswanathan](#) and [Prof. Madhusudan Parthasarthy](#)

We consider the problem of automatically synthesizing recursive programs, using a component based approach. We formalize the synthesis problem as solving a second order  $\exists\forall$  formula, and reduce it to the problem of finding a natural proof of validity of the inner universally quantified formula.

**Research Internship, SRI International**  
*Efficient Program Synthesis Via Proof Search*

May 2016 – Aug 2016  
Dr. Ashish Tiwari

We propose a novel approach for program synthesis based on search for proofs of bounded length. Such a technique reduces the problem of component-based synthesis to an  $\exists\exists$  first order formula over a decidable theory, as against the conventional approach of solving a  $\exists\forall$  formula.

**Research Internship, SRI International**  
*Verification of Linear Hybrid Systems*

May 2016 – Aug 2016  
Dr. Ashish Tiwari

We propose a class of linear hybrid systems for which reachability questions admit an efficient decision procedure. We further propose an abstraction-refinement based technique to solve the reachability problem for arbitrary hybrid systems with linear dynamics.

**Graduate Research Project, UIUC**  
*Dynamic Race Prediction in Linear Time*

Sep 2015 – Jan 2016  
Prof. Mahesh Viswanathan

We consider the problem of detecting data races from individual executions in a sound manner. The classical approach to solving this problem has been to use Lamport's happens-before (HB) relation. Until now HB remains the only approach that runs in linear time. Previous efforts in improving over HB such as causally-precedes (CP) and maximal causal models fall short due to the fact that they are not implementable efficiently and hence have to compromise on their race detecting ability by limiting their techniques to bounded sized fragments of the execution. We present a new relation weak-causally-precedes (WCP) that is provably better than CP in terms of being able to detect more races, while still remaining sound. Moreover, it admits a linear time algorithm which works on the entire execution without having to fragment it.

**Undergraduate Thesis, IIT Bombay**  
*Weak Singular Hybrid Automata*

Aug 2013 – Apr 2014  
Prof. Krishna S. and Prof. Ashutosh Trivedi

We propose a new subclass of Hybrid Automata called **Weak Singular Hybrid Automata** (WSHA) which are so-far the most expressive subclass for which reachability, schedulability and LTL model checking are decidable even in absence of any known finite bisimulation. We showed that reachability and schedulability are NP-complete, LTL-model checking is PSPACE complete and CTL-model checking is atleast PSPACE-hard for this model.

**Research Internship, LaBRI, France** [[www.labri.fr](http://www.labri.fr)]  
*Non-Zeno strategies for Timed Games*

May 2013 – Jul 2013  
Prof. Igor Walukiewicz and Prof. Frédéric Herbretreau

We consider 2-player concurrent games on timed automata, and devise sound and complete characterization for the existence of a controller that avoids Zeno runs.

**Research Internship, LSV, ENS Cachan France** [[www.lsv.ens-cachan.fr](http://www.lsv.ens-cachan.fr)]  
*Verification of Probabilistic Recursive Programs*

May 2012 – Jul 2013  
Prof. Rohit Chadha and Prof. Stefan Schwoon

We model probabilistic recursive programs as probabilistic pushdown systems and compute program summaries using BDD-based reachability tools like Moped. We show that such summaries can be used to devise efficient algorithms for analysing qualitative and quantitative properties of programs, and can be deployed to calculate information leakage in such programs.

## AWARDS

Secured 28<sup>th</sup> rank amongst more than 450000 students in IIT-JEE 2010

Awarded Silver Medal at the 5<sup>th</sup> **International Junior Science Olympiad** held in Republic of Korea in 2008

Represented India at the 11<sup>th</sup> **Asian Physics Olympiad** held in Taipei, Taiwan in 2010

**Travel grants** for attending CAV conference (2016), Verified Trustworthy Software Systems meetings, organized by The Royal Society of London (2016), and Summer School on Formal Techniques, organized by SRI International (2016).

Awarded Gold Medals in selection camps for the **International Physics and Chemistry Olympiads**, 2010

Awarded the prestigious **KVPY** fellowship and **NTSE** scholarship by the Government of India, **SSTSE** scholarship the Government of Rajasthan in 2008

Received **Mamraj Agarwal Rashtriya Puraskar** for academic excellence by the Governor of Rajasthan, 2008

Selected amongst the Top 1% students across the nation who appeared for the National Standard Examination in Astronomy in the years 2007, 2008, 2009 and 2010

Secured 2<sup>nd</sup> rank in the national Map Quiz conducted by the Indian National Cartographic Association, 2007

Awarded the Narotam Sekhsaria Foundation Scholarship for Undergraduate studies in Engineering in 2010

TEACHING EXPERIENCE	<b>Teaching Assistant - Modern Physics</b> Jan 2012 – May 2013
	Appointed as a Teaching Assistant for the freshmen theory course Modern Physics for 3 consecutive semesters
	<b>Teaching Assistant - CS Labs</b> Jul 2013 – Dec 2013
	Appointed as a Teaching Assistant for 2 lab courses - Computer Architecture Lab and the introductory lab course for freshmen Computer Programming and Utilization Lab
	<b>Teaching Assistant - Theory of Computation</b> Jan 2014
	Appointed as a Teaching Assistant for the core theory course Automata and Theory of Computation
	<b>Grader, APhO 2012</b> May 2012
	Appointed as a grader at the Asian Physics Olympiad 2012, held in New Delhi, India

SERVICE	Reviewed articles for peer-reviewed conferences like CAV, FORTE, FSTTCS, and FORMATS.
	<b>Head, Department Academic Mentorship Program, IIT Bombay</b> Jul 2013 – Present
	Lead a team of 15 academic mentors to guide and motivate students facing academic difficulties. Responsible for suggesting new reforms in the departments undergraduate curriculum, arranging resources for students via a Department CourseWiki and conducting various academic activities such as workshops and help sessions in the department
	<b>Department Academic Mentor</b> Jul 2012 – May 2013
	Responsible for guiding and mentoring academically weak students in the department, and monitoring their overall progress for an academic year
	<b>Student Coordinator, NSS team, IIT Bombay</b> Jul 2011 – May 2012
	Mentoring about 80 students in the Educational Outreach department of the institute NSS (National Service Scheme) Teams. Responsible for organizing meetings, personality development workshops and various other activities

REFERENCES	<b>Mahesh Viswanathan</b> Professor, University of Illinois, Urbana Champaign email: <a href="mailto:vmahesh@illinois.edu">vmahesh@illinois.edu</a>
	<b>Sayan Mitra</b> Associate Professor, University of Illinois, Urbana Champaign email: <a href="mailto:mitras@illinois.edu">mitras@illinois.edu</a>
	<b>Rohit Chadha</b> Assistant Professor, University of Missouri email: <a href="mailto:chadhar@missouri.edu">chadhar@missouri.edu</a>
	<b>Ashutosh Trivedi</b> Assistant Research Professor, University of Colorado Boulder email: <a href="mailto:ashutosh.trivedi@colorado.edu">ashutosh.trivedi@colorado.edu</a>