

# Manish Motwani

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## ACADEMIC DETAILS

Degree	Program	Institute	Year	CGPA
PhD.	Computer Science	CICS, UMass Amherst	2015 onwards	-
MS	Computer Science	CICS, UMass Amherst	2018	3.83/ 4.0
B-Tech(Hons.)	Computer Science & Engineering	IIIT Hyderabad	2011	8.95/10.0

## PUBLICATIONS / PATENTS

- *Manish Motwani, Sandhya Sankaranarayanan, René Just, and Yuriy Brun, Do Automated Program Repair Techniques Repair Hard and Important Bugs?*, in Proceedings of the Journal First Track at the International Conference on Software Engineering (ICSE), 2018
- *Manish Motwani, Sandhya Sankaranarayanan, René Just, and Yuriy Brun, Do Automated Program Repair Techniques Repair Hard and Important Bugs?*, Empirical Software Engineering (EMSE), 2018
- *Smita Ghaisas, Manish Motwani, Balaji Balasubramaniam, Anjali Gajendragadkar, Rahul Kelkar, and Harrick Vin, Towards automating the security compliance value chain*, in proceedings of the Industrial Track at the Joint Meeting on Foundations of Software Engineering (FSE), 2015
- *Smita Ghaisas, Manish Motwani, and Preethu Rose, Detecting System Use Cases and Validations from Documents*, in proceedings of the New Ideas Track at the IEEE/ACM International Conference on Automated Software Engineering (ASE), 2013
- *Preethu R. Anish, SK. Sharma, Manish Motwani, and Smita Ghaisas, Knowledge-assisted Product Requirements Configurator*, in proceedings of the International workshop on Product Line Approaches in Software Engineering (PLEASE), 2013
- *Smita Ghaisas, Manish Motwani, Preethu R. Anish, Balaji Balasubramaniam, and Aarthy Krishnamurthy, Systems and Methods for an Automated Interpretation of Legal Regulations*, US Patent granted – US9972016B2, May 2018.
- *Smita Ghaisas, Manish Motwani, Preethu Rose Anish, and Shashi Kant Sharma, Automated Classification of Business Rules from Text*, US Patent Filed – US13/778850, Feb 2013.

## TECHNICAL SKILLS

**Languages:** Working knowledge of Java, C, C++, Python, Shell, R, Ruby, and PHP.

**Databases:** MySQL, Oracle, **Tools:** Eclipse, L<sup>A</sup>T<sub>E</sub>X, **Cloud platforms:** Amazon Web Services, SLURM clusters

## WORK EXPERIENCE

- Teaching Assistant for the course *Theory and Practice of Software Engineering* at College of Information and Computer Sciences, UMass Amherst. (Sept 2018 - Dec 2018)
- Research Assistant, College of Information and Computer Sciences, UMass Amherst. (Sept 2015 - Aug 2018)
- Researcher at Tata Research Development and Design Centre (division of Tata Consultancy Services), Pune, India. (July 2011 - July 2015)
- Internship at Cisco Systems India Pvt. Ltd., Bangalore, India. (May 2010 – July 2010). I implemented Perl scripts to create new (and enhance existing) features in Cisco's IOS XR operating system used in routers.
- Teaching Assistant for the course *Building Energy Simulation* at IIIT Hyderabad, India. (Spring 2011)
- Teaching Assistant for the course *Compilers* at IIIT Hyderabad, India. (Monsoon 2010)
- Teaching Assistant for the course *Discrete Mathematics* at IIIT Hyderabad, India. (Monsoon 2009)

## RESEARCH EXPERIENCE

Currently ongoing research projects at CICS, UMass Amherst (Sept 2015 - till date)

- **High-Quality Automatic Program Repair using Software Concerns**  
(Guide: Prof. Yuriy Brun, Prof. James Allan, Prof. Brendan O'Connor, Jan'18 - till date) (Java, Python)  
Existing repair techniques are able to repair large number of defects however, most of the patches produced by these techniques are not acceptable to developers. One of the potential causes of this is that repair techniques use test cases as the proxy for software specification and ignore all other software artifacts (software

concerns) while generating a patch. This project aims to develop an automatic program repair technique that produces high-quality (acceptable by the developers) patches by considering additional information (other than tests cases) available for the software while repairing defects.

- **Evaluating the applicability of Automatic Program Repair techniques using large real-world defects**

(Guide: Prof. Yuriy Brun, Prof. René Just, Jan'16 - Dec'17) (Python, R)

Existing evaluations of automated repair techniques have not focused on the applicability of repair techniques and the characteristics of the defects that these techniques can repair. This project aims to find answers for questions such as "can automated repair techniques repair bugs that are hard for humans to repair?" and "which techniques are more likely to repair a memory leak defect?".

- **Quality of Automated Program Repair on Real World Defects**

(Guide: Prof. Yuriy Brun, Prof. René Just, Prof. Claire Le Goues (CMU) Jan'16 - till date) (Java, R)

This aim of this project is to address a deficit of earlier evaluations of automated repair techniques caused by repairing programs and evaluating generated patches' correctness using the same set of tests. Since tests are an imperfect metric of program correctness, evaluations of this type do not discriminate between correct patches and patches that *overfit* the available tests and break untested but desired functionality. We attempt to evaluate well-studied repair tools, on a publicly available benchmark using independently constructed evaluation test suites.

- **Expressive Semantic Search for Real-World Program Repair**

(Guide: Prof. Yuriy Brun, Prof. Claire Le Goues (CMU), Prof. Kathryn T. Stolee (NCSU) Jan'17 - till date) (C)

Develop a technique that fundamentally redesigns the use of semantic search for automated repair of real-world defects in real-world systems. The technique should handle large, real-world programs that employ realistic programming constructs and idioms (e.g., structs, console output, and library calls) as well as defects with no passing test cases executing the buggy region.

Past research projects pursued at TRDDC-TCS Innovation Labs (July 2011 - July 2015)

- **Towards automating the security compliance value chain**

(Guide: Dr. Smita Ghaisas, 2014 – 2015) (Ruby on Rails)

Developed a generic approach towards automating different activities of the Security Compliance Value Chain (SCVC) in organizations. We discuss the approach in the context of the Payment Card Industry Data Security Standard (PCI-DSS) regulations. Specifically, we present automation of (1) interpretation of PCI-DSS regulations to infer system requirements, (2) traceability of the inferred system requirements to CIS security controls (3) implementation of appropriate security controls, and finally, (4) verification and reporting of compliance.

- **Automating the Interpretation of Regulations and Tracing of their Implications to Requirements**

(Guide: Dr. Smita Ghaisas, 2013 – 2014) (Python)

Devised a Regulatory Rule Model (RRM) to represent regulations and demonstrate its use to automate the interpretation of regulations to ensure ease of compliance. NLP-based techniques were applied around RRM to detect intended constraints in regulatory statements and to interpret them in terms of the implementation specifics they necessitated for software systems to be compliant. We demonstrated the use of RRM for tracing the implementation-specific implications of regulations to software requirements.

- **Detecting System Use Cases and Validations from Documents**

(Guide: Dr. Smita Ghaisas, 2012 – 2013) (Python)

Developed an approach to automate the detection of system use cases and corresponding validations from documents. Devised a representation which captures the essence of rule statements as a composition of atomic 'Rule intents' and key phrases associated with the intents. Syntactic and semantic NL analyses are employed around the model to identify and classify rules and annotate them with 'Rule acts' (frequently co-occurring Rule intents clusters). Rule acts are mapped to business process steps and combinations are highlighted as potential system use cases and validations for supervision.

- **Knowledge assisted product requirements configuration**

(Guide: Dr. Smita Ghaisas, 2012 – 2013) (Ruby on Rails)

Time to market is a key determinant for the success of any product-based business. This depends to a great extent on how efficiently the existing product knowledge is utilized for customization needs. The knowledge is often not represented in a form that allows an easy reuse. In this project, we developed an ontological representation of product primitives for a knowledge-assisted requirements configurator and deployed it in an organizational unit for a financial product suite.

## ACADEMIC PROJECTS

- RFID deployment at IIIT Hyderabad (QT4, C++, MySql)
- Implementing Bloom Filters to trace the malicious packet from victim to its source (C++, Wireshark)
- "Network Pooling" in Linux (QT4, C++, MySql)
- Compiler for Decaf Programming Language (Java, Eclipse)
- Google's PageRank Implementation (Java, Map-Reduce, Eclipse, Hadoop, Amazon EC2 and S3 bucket)
- Implementing primary indexing on B+ Tree
- Implementing and comparing Classification Algorithms (ID3 and SLIQ)
- Simulation of Linux Shell using basic system calls
- Transformed Based Learning for POS Tagging
- Designing of a 2D game "Asteroid Shooter"
- "Online leave application portal" for faculty of IIIT Hyderabad to automate the existing manual process

## ACADEMIC ACHIEVEMENTS

- Earned B-Tech (Hons.) with academic distinction (2011)
- Featured in the Dean's List I award for academic excellence for three consecutive semesters (2010 and 2011)
- Placed in top 0.2% out of 500,000 students in All India Engineering Entrance Examination (AIEEE) (2007)

## EXTRACURRICULAR ACTIVITIES / LEADERSHIP SKILLS

- Elected as graduate student representative for PhD students at CICS, UMass Amherst
- Elected as a member of Indian Students Association (ISA) committee at CICS, UMass Amherst
- Elected as a member of recreational activities organization committee at TRDDC
- Assigned as Fire Evacuation Warden at TRDDC
- Member of Association for Computing Machinery (ACM)
- Member of organization committee of Felicity'10, annual cultural and technical fest of IIIT Hyderabad.