

# Manish Motwani

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## ACADEMIC DETAILS

Degree	Program	Institute	Year	CGPA
Ph.D.	Computer Science	CICS, UMass Amherst	2021 (expected)	-
MS	Computer Science	CICS, UMass Amherst	2018	3.83/ 4.0
B-Tech (Hons.)	Computer Science & Engineering	IIIT Hyderabad	2011	8.95/10.0

## AREAS OF INTEREST

I am interested in improving software engineers' productivity by automating software engineering practices. My research involves analyzing large software repositories to learn interesting phenomena in software development and maintenance, and to use that knowledge to design novel automation techniques, such as testing and program repair.

## PUBLICATIONS / PATENTS

- *Manish Motwani, High-Quality Automated Program Repair*, in proceedings of the Doctoral Symposium Track at the International Conference on Software Engineering (ICSE), 2021
- *Manish Motwani, Mauricio Soto, Yuriy Brun, René Just, and Claire Le Goues, Quality of Automated Program Repair on Real-World Defects*, IEEE Transactions on Software Engineering (TSE), 2020
- *Afsoon Afzal, Manish Motwani, Kathryn T. Stolee, Yuriy Brun, and Claire Le Goues, SOSRepair: Expressive Semantic Search for Real-World Program Repair*, IEEE Transactions on Software Engineering (TSE), 2019
- *Manish Motwani and Yuriy Brun, Automatically Generating Precise Oracles from Structured Natural Language Specifications*, in proceedings of the technical track at the International Conference on Software Engineering (ICSE), 2019
- *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 granted – US10146762B2, Dec 2018.

## WORK EXPERIENCE

- Graduate Research Assistant, CICS, UMass Amherst. (2015–Present)
- Research Intern, Microsoft. (May 2020–Aug 2020)  
Identified factors that affect developers' behavior to write good quality (expressed in terms of static analysis results) code and developed a model to predict developers' behavior under given influencing factors.
- Researcher, Tata Research Development and Design Centre, Pune, India. (July 2011–July 2015)
- Software Developer Intern, Cisco Systems India Pvt. Ltd., Bangalore, India. (May 2010–July 2010)  
Implemented scripts to create new and enhance existing features in Cisco's IOS XR OS used in routers.

## TEACHING EXPERIENCE

- Guest Lecturer, *Theory and Practice of Software Engineering*, CICS, UMass Amherst. (Spring 2020)
- Teaching Assistant, *Theory and Practice of Software Engineering*, CICS, UMass Amherst. (Fall 2018)
- Teaching Assistant, *Building Energy Simulation*, IIIT Hyderabad, India. (Spring 2011)
- Teaching Assistant, *Compilers*, IIIT Hyderabad, India. (Fall 2010)
- Teaching Assistant, *Discrete Mathematics*, IIIT Hyderabad, India. (Fall 2009)

## TECHNICAL SKILLS

**Research & Planning:** Identifying Problems, Gathering Information, Developing Evaluations, Calculating Results

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

**Machine Learning:** PyTorch, Keras/Tensorflow

**Databases:** MySQL, Oracle, Kusto

**Tools:** Eclipse, NetBeans, MS Visual Studio, Vim, Git

**Cloud platforms:** Amazon Web Services, SLURM clusters

## PROPOSED DISSERTATION

### High-Quality Automatic Program Repair

(Committee: Prof. Yuriy Brun, Prof. Claire Le Goues (CMU), Prof. Arjun Guha, Prof. George S. Avrunin)

A significant fraction of developers' time and effort is spent on fixing defects in the software. Automatic Program Repair is a research area that has recently gained attention because it proposes techniques to fix software defects without any human intervention. While existing repair techniques can fix a large number of defects in real-world software, most of the repairs produced are not "correct" or acceptable to developers.

Whether manual or automated, software repair is essentially a three step process. The first step involves identifying program elements that cause the defect (fault localization). The second step involves identifying modifications to the defective program elements which would fix the defect (patch generation). Finally, the third step involves verifying that the modified program actually fixes the defect (patch validation). Recent studies have shown that using information about the defect from various sources including natural-language software artifacts such as bug reports can significantly improve automated fault localization. Similarly, using artifacts such as software specifications and developer-written code comments can improve developer-written tests which are typically used to constraint the search space of the candidate patches (during patch generation) and to verify the correctness of the produced repair (during patch validation) by automated program repair techniques.

In this dissertation, I first describe how to objectively evaluate repair techniques along the dimensions of repair quality and repair applicability, and present the evaluation of these techniques for each dimension on real-world defects. I then propose multiple methods to improve fault localization and patch validation steps of the program repair process to improve the quality of the repairs produced. The proposed methods use machine learning techniques to transform relevant information extracted from different information sources into machine-processable form, and equip program repair techniques with this additional information during the repair process. With improved fault localization and patch validation, the search space of candidate fixes could be more constrained which would likely improve the quality of repairs produced.

## ACADEMIC ACHIEVEMENTS

- Earned MS degree, passed portfolio, and became a PhD candidate at CICS, UMass Amherst (2018)
- Earned B-Tech (Hons.) with academic distinction from IIIT Hyderabad (2011)
- Featured in the Dean's List awards for academic excellence at IIIT Hyderabad (2010 and 2011)
- Placed in top 2% of 350,000 students in IIT Joint Entrance Examination (2007)
- Placed in top 0.2% out of 500,000 students in All India Engineering Entrance Examination (AIEEE) (2007)

## SERVICES

- Sub-reviewer: ASE 2020, TSE 2019, FSE (2018, 2019), ICSE (2018, 2019), RE 2015
- Member of the Association for Computing Machinery (ACM)
- Member of the Institute of Electrical and Electronics Engineers (IEEE)
- Graduate student representative for PhD students at CICS, UMass Amherst
- Event-coordinator in Indian Students Association (ISA) committee, UMass Amherst
- Event-coordinator in Recreational Activities Organization committee at TRDDC
- Fire Evacuation Warden at TRDDC
- Member of the organization committee for Felicity'10, annual cultural and technical fest of IIIT Hyderabad