Rahul Krishna, Yandrapally

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Research Interests

Software Testing, particularly Web and Mobile testing.

Conference Papers and Patents

- **RahulKrishna Yandrapally**, Suresh Thummalapenta, Saurabh Sinha, Satish Chandra. Robust Test Automation Using Contextual Clues. In *Proceedings of 2014 International Symposium on Software Testing and Analysis* ***(ISSTA 2014).***
- **RahulKrishna Yandrapally**, GiriPrasad Sridhara, Saurabh Sinha. Automated Modularization of GUI Test Cases. In *Proceedings of 37th International Conference on Software Engineering, Florence* ***(ICSE 2015).***
- Andrea Stocco, **Rahulkrishna Yandrapally**, and Ali Mesbah. 2018. Visual web test repair. In Proceedings of the 2018 26th ACM Joint Meeting on European Software Engineering Conference and Symposium on the Foundations of Software Engineering **(*ESEC/FSE 2018*)**.
- **RahulKrishna Yandrapally,** Andrea Stocco and Ali Mesbah. An Empirical Study of State Abstraction Functions for Web Testing. Submitted to 12th IEEE International Conference on Software Testing, Verification and Validation (***ICST 2019)*** *[Under Review]****.***
- **RahulKrishna Yandrapally**, Suresh Thummalapenta, Saurabh Sinha, Leigh Williamson. System and Method for Creating Change-Resilient Scripts. ***Patent*** *filed with US Patent office.*
- **RahulKrishna Yandrapally**, Saurabh Sinha, GiriPrasad Sridhara. Automated Modularization Of Graphical User Interface Test Cases. ***Patent*** *filed with US Patent office.*
- William Jacob Cobb, Jr., **RahulKrishna Yandrapally**, Saurabh Sinha, Suresh Thummalapenta, Adaptation of Automated Test Scripts. ***Patent*** *filed with US Patent office.*
- GiriPrasad Sridhara, Saurabh Sinha, **RahulKrishna Yandrapally**, Vijay E, Automatically Detecting Feature Mismatches Between Mobile Application Versions On Different Platforms. ***Patent*** *filed with USPO.*
- S. P. Venkatagiri, A. K. Sinha, **Rahulkrishna Yandrapally**, P. Dey and B. Sengupta. Puppeteer: De-centralized platform for connected-yet-autonomous educational toys. In Proceedings of *2018 10th International Conference on Communication Systems & Networks* ***(COMSNETS)***, Bengaluru.

Education

- Indian Institute of Technology (IIT), Kanpur
  Dual Degree **(Bachelors and Masters)** in Computer Science*, (2007-2012)*
- The University of British Columbia
  PhD in Electrical and Computer Engineering *(2017- Present)*

Key Projects

PhD, Electrical and Computer Engineering, The University of British Columbia (Sept 2017 – Present)

Visual Web Test Repair *(ESEC/FSE 2018)* (Oct 2017 – Mar 2018)

Aim :- Automate repair of regression Selenium web tests using Computer Vision (CV) techniques.
Features:- Online test adaptation; visual web element relocation; workflow repair through local crawling.

- Developed an approach to visually validate test steps and suggest potential repairs in a regression test run.
- Employed a fast image processing pipeline of 3 CV algorithms (FAST, SIFT and Fast Normalized Cross Correlation) that work synergistically to capture and analyze ***relevant visual information***.
- Implemented the approach in the tool, Vista, which is shown to be superior to the state-of-the-art test repair technique that relies on DOM in terms of both effectiveness and performance**.**

Mobile Test Dependency Detection (Jan 2018 – Mar 2018)

Aim :- Show existence of test dependencies in ***Mobile GUI*** test cases and a practical approach to identify them.

- Instrumented android API to capture application state changes caused by GUI test cases.
- Automatically detected data dependencies between GUI test cases that impact the test result.
- Showed that unlike test dependency detection in Unit tests, for GUI test cases, app specific ***domain knowledge*** is required to correctly tag reads and writes in network communication.

An Empirical Study of State Abstraction Functions (SAFs) for Web Testing *(ICST 2019)* (May 2018 – Oct 2018)

Aim :- Study the impact of the choice of SAF on application models produced by web crawlers.

Features:- Visual Crawling; Comparison of crawl models; near-duplicate web page detection.

- Proposed and employed nine visual SAFs to crawl web applications.
- Developed a methodology to objectively compare crawl models using different metrics.
- Showed the prevalence of ***near-duplicate*** web pages in practice and evaluated the effectiveness of 13 SAFs (four DOM and nine Visual) in detecting them in existing crawl models.
- Compared the ***precision*** and ***recall*** of crawl models produced by the best Visual and DOM SAFs to highlight the trade-offs to be considered and challenges in selecting the ***optimal*** SAF for crawling a given web application.

IBM Research India (Software Engineering group; Mobile Innovations group) (Aug 2012 – July 2017)

Role and Responsibilities: - Design and develop solutions aiding efficient Web UI testing and Mobile testing.

Automating Test Automation (ATA) & ATA-QV *(ISSTA 2014)* (Aug 2012 – May 2014)

Aim :- Development of advanced test automation tool.

Features:- Robust Test Script generation; Reduction in manual programming required for automation

- Created a cost effective and easily deployable selenium variant of ATA tool.
- Developed a new method called ATA-QV to address ***script fragility*** in the ATA caused by usage of UI Element locators like ***XPath*** that break with even minor application changes and ***browser differences***.
- ATA-QV infers ***contextual clues*** to identify target elements instead and has been compared with traditional tools relying on Element Locators, Image Matching techniques or Programming to showcase its effectiveness.

Automatic Modularization of GUI Test Cases *(ICSE 2015)* **(**Apr 2014 – July 2014)

Aim :- Minimize *UI* **test maintenance** for Web applications during ***regression test runs***.

- Achieved this by extracting ***reusable subroutines*** which reduce duplication of test steps across test cases minimizing the manual intervention required in fixing element locators that break due to application changes.
- Developed a novel approach to define an ***abstract application state*** based on the test steps that are part of a subroutine and establish ***UI Element equivalence*** across test cases without expensive dynamic trace collection.

Automated Test-Script Adaptation for Mobile Apps (Oct 2014 – June 2015)

Aim:- Develop a *Test Adaptation* tool that enables creation of a robust and ***adaptive test script*** which it can automatically ***repair*** or ***modify*** to test the same *functionality* when run on other variants.

- Employed a combination of heuristics and learning techniques to aid *targeted* ***local crawling*** with ***backtracking*** for state exploration performed while adapting the test script to the new variant.
- Enabled ***flow repair*** of test scripts through addition and removal besides modification of test steps.
- Ensured the ***correctness*** of modified test script by using certain *verification steps* as ***test oracles***.

CLARITest: Cloud-based Automation of Robust Intelligible Tests (Apr 2015 – Mar 2016)

Aim:- Develop a ***cloud-based*** solution that offers web testing as a service.

Features:- ***Platform-agnostic*** test script creation from manual tests; *Cross-Browser/Platform* regression testing.

- Provisioned the features of Automating Test Automation (ATA) such as its algorithm for robust test script creation and playback for individual test cases as part of a ***web testing service***.
- Developed a tool capable of handling challenges of a multi-user ***test management tool***.
- Built a batch execution portal for ***regression testing*** with a grid manager and a ***grid*** with multiple platform and browser combinations which can ***scale*** up on demand.

Test Selection for IOS Mobile Applications through Change Impact Analysis (June 2016 – March 2017)

Aim:- Develop a Test selection tool for IOS Application Test cases **(*XCTest and XCUITest*)** that are written using XCode IDE Test ***recorder*** or Swift/Objective-C ***programming***.

- Surveyed IOS Application Development processes and ***XCode Test framework*** to design a Test Selection approach for XCTests (Test Case Classes written in XCode).
- Evaluated the effectiveness of language tools like *Antlr* for analysis of ***Swift*** and ***Objective-C*** programs.
- Experimented augmenting traditional *Program Analysis* techniques with *Information Retrieval* techniques to derive dependencies between XCTests, the application source code and resources.

Bachelors and Masters, Department of Computer Science, IIT Kanpur (Jul 2007 – June 2012)

Secure ATM (Masters Thesis)

Supervisor: Prof. Rajat Moona and Prof. Veena Bansal (Jan 2011 – June 2012)

Aim:- A ***cost effective*** and ***Trusted*** Money Dispenser that can work with ***intermittent network connectivity***.

- Employed ***Smart Cards*** in place of Magnetic Strip cards which gave protection against ***skimming*** attacks.
- Enabled scope for ***offline authentication*** and elimination of a fake outlet by designing a protocol based on ***Public Key Cryptography*** *(PKI),* which establishes the ***authenticity*** of both ATM and User before a transaction.
- Supported usage of keypad and screen of personal electronic device eliminating the ***keypad overlay attack*** and ***shoulder surfing*** *attack*.

Sign language interpreter for speech handicapped (Jan 2011 – Apr 2011)

- Used the ***OPENCV*** library for image processing in the application development.
- Employed Image processing techniques to isolate the *region of interest* and the machine learning technique of ***decision tree classification*** to classify the symbols and display/output corresponding English alphabets.
- Presented in ***Grace Hopper Conference*** *2011* and ***Intel Cup Embedded System Design Challenge*** (ESDC) 2012.

Institute payment gateway for payment of institute dues (Aug 2010 – Nov 2010)

Aim:- Design and Develop a website which uses information from ***Institute Automation System*** and provides the students with a system to pay all the institute dues including hostel and library dues.

- Developed a ***payment gateway*** to contact individual banks and *credit card companies* to enable payments.

Internship (**VMWARE** Bangalore) (May 2010 – July 2010)

Aim:- Develop a standalone application to ***monitor*** print commands issued from a windows machine independent of the server hosting the *network printer* and the application issuing print command.

- Tailored the ***daemon*** to monitor the *print traffic* and alert the user of excessive usage of print pages or repeated printing of same document etc.
- My work helped support an ***ecological*** *campaign* to reduce paper wastage in the usage of *network printers*.
- Gained experience working with *visual studio* (visual C++) and ***windows print*** internals (*spooler architecture*).

Scholastic Achievements

- Recipient of **Academic Excellence Award** in the Department of Computer Science, IIT Kanpur for the Academic Year *2010-11*.
- Won ***A-Level Accomplishment*** award for my work on *Automating Test Automation* (ATA) tool in IBM Research, India. This is given to very few research projects with significant revenue impact.
- Nominated to represent IIT Kanpur as the sole participant from India in the Intel Cup Embedded System Design Contest (**ESDC**) 2012 held in **Shanghai,** China.