

Ashutosh Pandey

CONTACT INFORMATION

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RESEARCH INTERESTS

I am broadly interested in improving the design of software systems. My research interest lies in the intersection of software architecture, formal models, model-based software development, model checking and artificial intelligence. Currently, in my Ph.D., I am exploring the application of software architecture principles in the creation of intelligent software systems. In particular, I am exploring the incorporation of artificial intelligence technologies - specifically AI planning and machine learning techniques - to improve run-time decision making in software systems that seek to self-adapt their behavior in response to faults, changing environments and attacks.

EDUCATION

Ph.D. Student, Software Engineering **2012 - Present**

School of Computer Science
Carnegie Mellon University, Pittsburgh, PA, USA

Masters in Software Engineering **2012 - 2015**

School of Computer Science
Carnegie Mellon University, Pittsburgh, PA, USA

Bachelor of Technology, Computer Science **2000 - 2004**

Harcourt Butler Technological Institute (HBTI)
Kanpur, Uttar Pradesh, India

RESEARCH PROJECTS

Hybrid Planning in Self-Adaptive Systems

This project is part of my ongoing thesis work. Due to the fundamental trade-off between quality and timeliness of planning, today designers of self-adaptive software systems often have to compromise between an approach that is quick to find a plan that can (possibly) be low in quality and an approach that is slow but finds a quality plan. To deal with this trade-off, I proposed a hybrid planning approach that combines reactive and deliberative planning to find a balance between quality and timeliness. In this ongoing project, I developed a formal framework to define the problem of hybrid planning. Currently, I am developing a methodology to apply hybrid planning to realistic self-adaptive systems.

Automated Planning for Software Architecture Evolution

This project demonstrated how automated planning techniques can be used to support automatic generation of architectural evolution paths, relieving the architect of this burden. I developed planning specifications showing how an architecture evolution problem can be translated into a planning problem and solved using existing automated planning tools.

Model-Based Adaptation for Robotics Systems

In this project, we are investigating how architecture-based adaptation could be applied to robotics systems; this approach is expected to reduce software maintenance costs in the long-run. I am working on to design scenarios, which could be used for evaluating the proposed approach.

Exploring the Usability of Pronounceable Passwords

Text passwords are prevalent in computer systems, mainly due to their simplicity. However, to remember these passwords, users tend to rely on tricks and patterns that tend to result in easily guessable, and thus insecure, passwords. A promising alternative is the use of pronounceable

passwords. In this project, we conducted a usability study of pronounceable passwords. To investigate the memorability and likability of these passwords, I did coding and analysis of the responses provided by subjects of the user study.

PUBLICATIONS

Ashutosh Pandey, Bradley Schmerl and David Garlan. “Instance-based Learning for Hybrid Planning”. In Proceedings of the 3rd International Workshop on Data-driven Self-regulating Systems (**DSS 2017**), Tucson, AZ, USA, 18-22 September 2017.

Ashutosh Pandey. “Hybrid Planning in Self-Adaptive Systems”. In FAS* Foundations and Applications of Self* Systems (**FAS* 2017**) Doctoral Symposium, Tucson, AZ, USA, 18-22 September 2017.

Ashutosh Pandey, Ivan Ruchkin, Bradley Schmerl and Javier Camara Moreno. “Towards a Formal Framework for Hybrid Planning in Self-Adaptation”. In Proceedings of the 12th International Symposium on Software Engineering for Adaptive and Self-Managing Systems (**SEAMS 2017**), Buenos Aires, Argentina, 22-23 May 2017.

Ashutosh Pandey, Gabriel Moreno, Javier Camara and David Garlan. “Hybrid Planning for Decision Making in Self-adaptive Systems”. In Proceedings of the 10th IEEE International Conference on Self-Adaptive and Self-Organizing Systems (**SASO 2016**), Augsburg, Germany, 12-16 September 2016.

Javier Camara, David Garlan, Bradley Schmerl and Ashutosh Pandey. “Optimal Planning for Architecture-Based Self-Adaptation Via Model Checking of Stochastic Games”. In Proceedings of the 10th DADS Track of the 30th ACM Symposium on Applied Computing (**SAC 2014**), Salamanca, Spain, 13-17 April 2015.

Jeffrey M. Barnes, Ashutosh Pandey and David Garlan. “Automated Planning for Software Architecture Evolution”. Proceedings of the IEEE/ACM International Conference on Automated Software Architecture (**ASE 2013**), Silicon Valley, CA, 11-15 November 2013.

ABSTRACTS AND POSTER

Shing-Hon Lau, Stephen Siena, Ashutosh Pandey, Sroaj Sosothikul, Lorrie Cranor, Blase Ur and Richard Shay. “Exploring the Usability of Pronounceable Passwords”. In Proceedings of the Symposium On Usable Privacy and Security (**SOUPS 2014**), Menlo Park, CA, USA, 9-11 July, 2014.

THESIS

Ashutosh Pandey. “Hybrid Planning in Self-Adaptive Systems”. Doctoral Thesis Proposal, Advisor: Prof. David Garlan, School of Computer Science, Carnegie Mellon University, November 2017.

TEACHING EXPERIENCE

Worked as a teaching assistant for the following courses:

- *Architectures for Software Systems*
Instructor: Prof. Anthony Lattanze
Semester: Spring 2014
Students: Masters in Software Engineering
Responsibilities: Updating assignments and reading questions, grading, recitations, holding office hours
- *Models of Software Systems*
Instructor: Prof. David Garlan
Semesters: Fall 2013
Students: Masters in Software Engineering
Responsibilities: Updating assignments, designing examination questions, grading, recitations, holding office hours

AWARDS

NSF travel scholarship to attend the IEEE SASO conference held at Tuscon (AZ), USA

SERVICES

Paper Reviewing

Reviewer: SEAMS artifact 2016, 2017 & 2018, FGCS 2017

Subreviewer: ICSE 2013 & 2016, WICSA 2015, TAAS 2016

University

Member of the Software Engineering *Ph.D. student admission committee*, Institute for Software Research, Carnegie Mellon University, Pittsburgh, PA. January-2018.

TUTORIALS & TALKS

“Physical Verification Concepts” at Mentor Graphics, Noida, India, 2012.

PROFESSIONAL EXPERIENCE

Synopsys Inc., Mountain View, CA, USA

Research Intern

May, 2016 - August, 2016

Software crashes is one of the serious categories of defects, which is generally dealt with high priority. To debug a software crash, companies collect function stack traces. Often an issue in a code piece causes a crash on different customer sites resulting in the submission of multiple crash reports for that issue. Having multiple traces for the same issue could increase turnaround time. Therefore, efficient management of stack-traces is required. During the internship, I developed an approach to group (cluster) the crash reports that are caused by the same issue based on stack traces. I performed the following tasks:

- Studied existing approaches for stack trace management.
- Implemented a metric to measure similarity between two stack traces.
- Built a training dataset from bug database.
- Performed parameter tuning for clustering stack traces resulting from the same underlying issue.
- Worked on the architectural design of a system to support our clustering solution.

The Auton Lab, Carnegie Mellon University Pittsburgh, USA

Research Intern

May, 2014 - August, 2014

Sex trafficking is a threat to the society that particularly affects women and children. To help law enforcement officials, Autonlab is developing the *TrafficJam* tool that scraps web advertisements and uses machine learning techniques to identify possible cases of sex trafficking. Creating a comprehensive training dataset to train the classifier is key to the success of the tool. *Active learning* is a special case of semi-supervised machine learning in which a learning algorithm is able to interactively query the user (or some other information source) to obtain the desired outputs at new data points. During the internship, I worked on the active learning feature of TrafficJam and performed the following tasks:

- Studied various active learning techniques to identify an appropriate technique to use in TrafficJam.
- Designed and implemented *uncertainty sampling* approach for active learning.
- Evaluated the performance of the active learning module using cross-validation and generating the ROC plots.

The Bosch Research and Technology Center North America Ltd, Pittsburgh, USA

Research Intern

June, 2013 - August, 2013

- Worked on the task assistance functionality of a smart home project, which was supposed to provide a framework to integrate multiple smart devices.
- Explored various task representation techniques that can be used to develop dynamic task assistance plans under uncertainty.
- Developed a ranking heuristic to rank tactics to select the best tactic during plan generation.

Mentor Graphics Limited, Noida, Uttar Pradesh India

Member Consulting Staff

April, 2006 - July 2012

Calibre DRC and Calibre LVS are the flagship products of the Mentor Graphics in the physical verification domain in the electronic design automation (EDA) industry. I completed several important projects related to these products. For the projects handled by me, I was responsible for all aspects of the software life cycle which ranged from discussing requirements with application engineers to the final shipment of the features. The details of the key projects that I undertook are as follows:

- **DRC Waiver Flow:**
 - Worked on the architecture and several functionalities of the DRC waiver flow tool.
 - Integrated the high performance GDSII and OASIS parsers with the waiver flow tool.
 - Refactored existing procedural code to object-oriented.
 - Designed mathematical models of the density waiving functionality.
- **Spice File Viewer for Calibre RVE:**
 - Refactored legacy procedural Tcl/Tk code to object-oriented ITCL code.
 - Developed algorithms for cross highlighting devices and wires in Spice files representing a hierarchical chip design. Since these files are opened in different Spice viewer windows, I developed a light-weight communication protocol to facilitate communication among windows.
 - Designed and implemented a hybrid model for efficiently loading large spice files. This hybrid model adopts a *lazy loading* approach i.e., initially loads only basic information from a file and loads specific information only when required.
 - Integrated the schematic viewer with the text viewer for Spice files.
- **Verilog to Spice converter(V2lvs):**
 - Implemented a fully IEEE-1364-1995 compliant Verilog parser using Lex and Yacc.
 - Designed data structures to store Verilog information and convert them to Spice format.
 - Prepared the user specification document for the tool.
- **Spectre to Spice converter(S2lvs):**
 - Developed BNF for the Spectre language.
 - Implemented the Spectre parser based on Spectre's BNF specification using Lex and Yacc.
 - Designed and implemented the tool single-handedly.
 - Developed functionality for run-time parsing and evaluation of user defined Spectre function calls.

Alcatel India Ltd, Gurgaon, India

Software Engineer

October, 2005 - April, 2006

During my short stint at Alcatel, my team worked for an Australian telecommunication company *Optus* as our client. In particular, I developed PERL scripts for automated testing.

Quark Media House Pvt. Ltd, Mohali, Punjab India

R & D Engineer

July, 2004 - October, 2005

I worked on the QuarkXPress product, which is the flagship product of the company developed for publishing industry. My key responsibilities involved the design and implementation of new features, enhancement of old features. The details of the projects completed by me are as follows:

- **Color Management tool:**
 - Implemented modules in the Color Manager component, which provides color management solutions in QuarkXPress-7.0.
 - Integrated Color Manager with other components of QuarkXPress-7.0.
- **Color Append functionality:**
 - Supported users in importing multi-derivation and single derivation colors from one project to another.
 - Migrated the entire legacy code for the color append functionality from C to C++ that required extensive object-oriented design.

TECHNICAL SKILLS

- Operating Systems: Linux, Mac OS X and Windows
- Languages: C/C++, Tcl/Tk, Java, Python
- Tools: GDB, Lex-Yacc, CVS, SVN, Git, Purifier, Valgrind, L^AT_EX
- IDEs/Frameworks: Eclipse, Visual Studio .NET, CodeWarrior, Robot Operating System (ROS)

REFERENCES

Prof. David Garlan
Ph.D. Adviser
Carnegie Mellon University
E-mail: garlan@cs.cmu.edu

Anant Adke
Director of Engineering, D2S division
Mentor Graphics
E-mail: anant_adke@mentor.com