Some Software Engineering Research in Our Department

Darko Marinov
CS591PhD, October 26, 2015
Key SE topics: software testing, analytics, security
  - Will present some of our results

Students: not actively looking for new students
  - Will present my recent and current PhD students

Collaborators: always looking!
  - Talk with any of us or attend our CS591SE seminar
Why Software Engineering

Address important, real problems
- Can impact practice
- Our work used at Apache, Google, Eclipse, Microsoft, NASA, Parasoft...
- Joint work or funding from Agitar, Google, IBM, Intel, Microsoft, Samsung...

Do academic research
- Intellectually satisfying
- Both theory and systems

Have fun
- Find bugs, e.g., in friends’ code
- Don’t lose friends
Most Recent PhDs

- **Milos Gligoric**
  - PhD July’15 “Regression Test Selection: Theory and Practice”
  - Assistant Professor at UT Austin
  - Collaborated with Gul Agha, Ralph Johnson, Sam Kamin, Grigore Rosu

- **Qingzhou Luo**
  - PhD May’15 “Testing, Runtime Verification, and Analysis of Concurrent Programs”
  - Software Developer at Google
  - Co-advised by Grigore Rosu
August Shi


- Topics of Interest: Software Engineering, Software Regression Testing

- Past/Ongoing Projects:
  - Test-suite reduction and regression test selection
  - Refactoring test targets in a distributed build system for more efficient testing (with Microsoft)
  - GPU optimizations (with Maria Garzaran)

- Future Work/Interests:
  - Better approaches to evaluate tests
  - Faster testing by splitting integration into unit tests
  - Faster testing by removing tests
Topics of Interest: Software Engineering, Software Testing and Verification, (not research) Photography

Past/Ongoing Projects:
- Test Reliability: expose bugs in the test code itself
- Change Management: change-semantic aware impact analysis (with MSR), software upgrades through refactoring (with Danny Dig)
- Runtime Verification: checking heap data structure invariants at runtime (with Madhu Parthasarathy)

Future Work/Interests:
- Software testing and verification for security and privacy
- Software testing and verification for machine learning

http://mir.cs.Illinois.edu/gyori
Farah Hariri


Topics of Interest: Software Engineering, Regression Testing, Compilers

Past/Ongoing Projects:
- Automatic detection of test order dependencies, study of non-deterministic (flaky) tests
- Bayesian inference of atomic sets (with Gul Agha)
- I/O for HPC applications (with Marc Snir)
- Testing medical software for FDA standards (with Lui Sha)

Future Work/Interests:
- Developing tools for increasing test reliability
- Testing of compiler-related software
- Improving software engineering for medical software
Topics of Interest: Regression Testing, Runtime Verification

Past/Ongoing Projects:
- Comparing manual & automated regression test selection
- Comparing dynamic and static regression test selection
- Detecting flaky tests from test failures
- Combining regression testing & runtime monitoring (co-advised by Grigore Rosu)

Future Work/Interests:
- Study how developers introduce flaky tests and develop techniques to warn them soon as they write such tests
- Leverage regression testing to improve race prediction

http://mir.cs.Illinois.edu/legunsen
Wajih UI Hassan

- First-year student, no web page
- Topics of Interest: Software Engineering, Compilers
- Past/Ongoing Projects:
  - Automated software specialization using LLVM
  - Combining regression testing with runtime monitoring
  - Designing an abstract level protocol to combine symbolic execution tools across languages (with Junaid Siddiqui)
- Future Work/Interests:
  - Using symbolic execution techniques to improve the efficiency of regression testing
Random Research Idea

- Is anyone interested in Machine Learning?

- Can you guess how the students were sorted:
  - August Shi
  - Alex Gyori
  - Farah Hariri
  - Owolabi Legunsen
  - Wajih Ul Hassan

- Do you want to apply ML to ease code (re)formatting? Did you ever use GitHub?
  - Talk to me if interested
Trustworthy Software Everywhere

http://taoxie.cs.illinois.edu/  taoxie@illinois.edu
https://sites.google.com/site/asergrp/
Released as IntelliTest of Visual Studio 2015

Implements Dynamic Symbolic Execution (aka Concolic Testing, invented by Illinois researchers Sen, Marinov, and Agha [ESEC/FSE’05])

Download counts (20 months) (Feb. 2008 - Oct. 2009)
- Academic: 17,366
- Devlabs: 13,022
- Total: 30,388

ASE group has contributed Fitnex search strategy [DSN’09] included in Pex releases since Sept. 2008; contributed many research improvements upon Pex.

http://research.microsoft.com/pex/
ASE group has contributed the main gaming concept in Code Hunt/Pex4Fun [ICSE’13/15-edu]; develop new tool features and conduct data analytics on educational data.
ASE Group has collaborated with Microsoft Research Asia on high practice-impact software analytics research, e.g., **XIAO** [ACSAC’12] clone detection feature released as part of Visual Studio 2012, **SAS** [ASE’13-ex] incident management system deployed for assisting an online service serving hundreds of millions of users, ...

http://research.microsoft.com/en-us/groups/sa/
Reason about user-perceived info: app permissions ↔ app descriptions, e.g., WHYPER [USENIX SEC’13]

Push app security behavior across the boundary to be visible, e.g., AppContext [ICSE’15]
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