Automation in the Bug Flow

- MACHINE LEARNING FOR TRIAGING AND TRACING

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The Challenge
The Solution
The Evaluation
1. Issue Assignment
2. Change Impact Analysis
The Challenge
The Solution
The Evaluation
Bug tracker

Machine Learning
Automated Issue Assignment

• Goal:
  Useful tool deployable with minimum configuration effort

• Approach:
  Bugs = textual data + basic metadata
  Train classifiers on historical bug reports
  Combine them using state-of-the-art ensemble learning
Automated Change Impact Analysis

• Goal:
  Intuitive tool to jump start analyses based on historical data
  Faster + more accurate analyses compared to fully manual work
• Approach part 1: Mine the history
• Approach part 2: Recommend impact
by Steve McConnell - (Author) Paperback – June 19, 2004

Widely considered one of the best practical guides to programming, Steve McConnell's original CODE COMPLETE has been helping developers write better software for more than a decade. Now this classic book has been fully updated and revised with leading-edge practices—and hundreds of new code samples—illustrating the art and science of software construction. Capturing the body of knowledge available from research, academia, and everyday commercial practice, McConnell
Construct network of previously reported impact

Index textual data with Lucene
Calculate centrality measures
Automated Impact Analysis

• Approach part 2: Recommend impact
  Find similar bugs using Apache Lucene
  Follow links to identify candidate impact set
Automated Impact Analysis

• Approach part 2: Recommend impact
  Find similar bugs using Apache Lucene
  Follow links to identify candidate impact set
  Use centrality measures to rank candidate impact

<table>
<thead>
<tr>
<th>1. Requirement X.Y</th>
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<tbody>
<tr>
<td>2. Design Document X.Y</td>
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<td>3. Test case UTC56</td>
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<td>4. Design Document X.Y</td>
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<td>5. Requirement Z.Y</td>
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Input Tracker Case

bug in memory reporting tool

Enter Tracker Case ID:

# 34533

Search

Workflow
1. Enter tracker case # to investigate
2. Type or paste textual description.
3. Click ‘Search’
4. Analyze recommendations, give feedback.
5. Conclude feedback by pressing ‘Done’

Most Similar Tracker Cases in the Knowledge Base

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<td>Memory leakage during LEG session</td>
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<td>Minor bug in CVarAccessItem::Find</td>
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Tracker Case Details

Reference handling bug in Shared Blob implementation can cause crash in AC800

"We introduced a concept in SV4.0 called Shared Blob, which the aspect system developer can use to reduce the amount of memory needed when a lot of identical inherited aspects are activated at the same time. The unpacked blob is here only unpacked once and placed on the owning aspect. The inherited ASOs only have a reference to it. So far only AC800Connect (and our own Relative Name) has used it. We have now found a critical reference handling problem in this code. In some circumstances the DLL can be unloaded while there are still active shared blob objects. When the

Reported Impact in Similar Tracker Cases

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The Challenge
The Solution
The Evaluation
Experiment: Issue Assignment

• Five large datasets from two companies
  – Telecom and Automation
  – 50,000+ issue reports
• 10-fold cross-validation and ”replaying history”
Experiment: Issue Assignment

- Prediction accuracy in line with human activity
  - But instantaneous!
- At least 2,000 bug reports in the training set
Experiment: Issue Assignment

• Warning! Some systems need fresh training data
Experiment: Change Impact Analysis

• Experiment with historical impact
  – Training set: 8 years, Test set: 2 years
Case Study: Change Impact Analysis

- Industrial case study
  - Two units of analysis: Team Sweden & Team India
  - Tool deployed in March 2014 & August 2014
  - Interviews and user log files

Click Distribution, top-20 hits
Conclusion
Embrace your bugs!

Machine learning can:
- Guide maintenance
- Recommend impact

Potential more:
- Severity prediction
- Resolution times
- Noise filtering
Thank you!

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@_Troddel_

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