Duplicate bug report detection through machine learning techniques

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Duplicate bug reports

- Duplicate bug reports describe the same bug
- Very common in Bug Tracking Systems (BTSs)
  - For instance: 12% of all reports in [1]
- Undetected duplicate bug reports
  - Waste of developer time
- Manually filtered by triage team
  - Beyond team capacity
- **Machine learning technique to help triage team**

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Bug report deduplication

- Automatic detection of duplicate bug reports
- Challenges
  - Noise
  - Lack of information
  - Techniques do not achieve satisfactory results
- Treat as a ranking problem
  - ML system returns a list with the k-most likely duplicate reports
  - Recall Rate@k: percentage of duplicate bug reports whose their correct candidates are within the top k positions in the list
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Our Research

- Deep learning
  - State-of-art in many problems in NLP
  - Combine easily different data types
- Address the problem using distinct data types
  - Categorical data and Textual data
  - Stack trace

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Our Work - Categorical and Textual data

Bug 247988 - Deleting OPEN project takes very long

Status: CLOSED WORKSFORME
Reported: 2008-09-19 11:35 EDT by Alex Bernstein — ECA
Modified: 2016-05-05 10:29 EDT (History)
Alias: None
CC List: 1 user (show)
Product: z_Archived
See Also:
Component: TPTP (show other bugs)
Version: unspecified
Hardware: PC Windows XP
Importance: P1 normal (vote)
Target Milestone: ---
Assignee: Bozier jerome — ECA

Alex Bernstein — ECA 2008-09-19 11:35:53 EDT Description

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Build ID: 4.5.1

Steps To Reproduce:
1. Have a project with one or more large datapool files (6Mb);
2. Make sure it is the only project in the workspace (optional?)
3. Right click on the project in Test Navigator and select "Delete";
4. Do not check the "Also delete..." check box (optional);
5. debugging reveals that Datapool Proxy nodes are recreated, causing Datapools to be
loaded into memory ;


More information:
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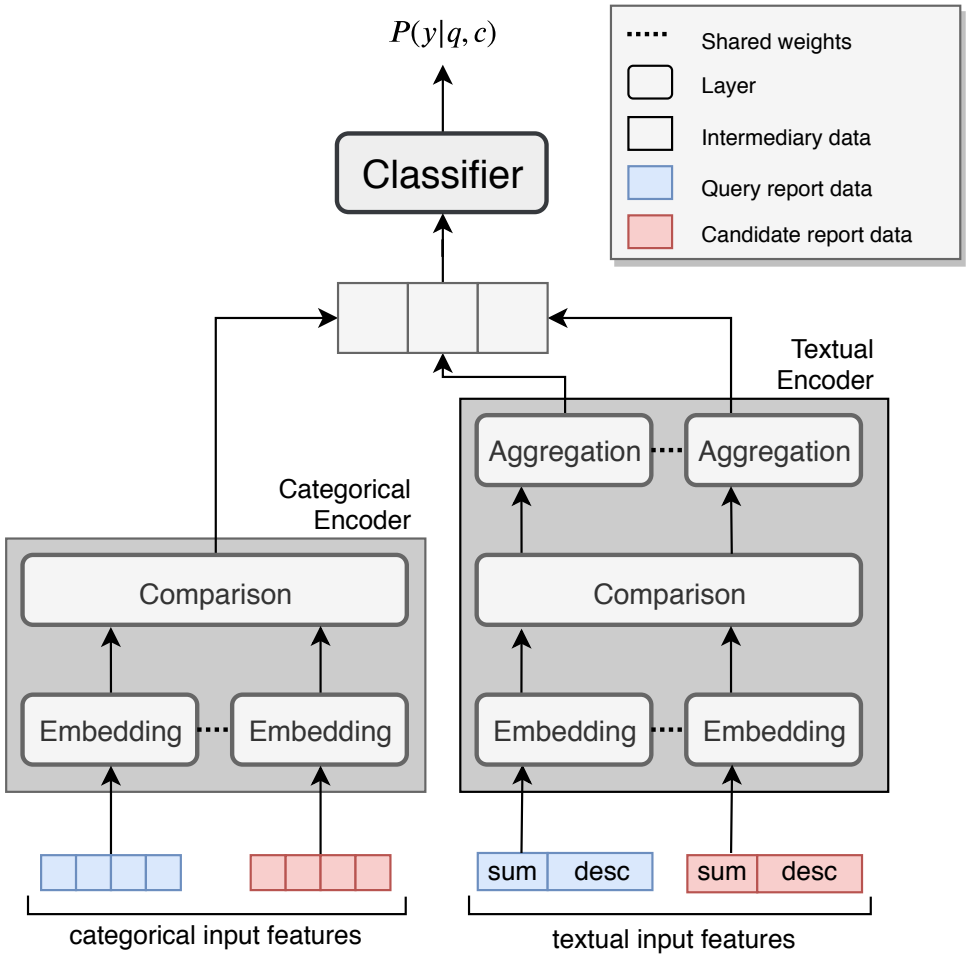

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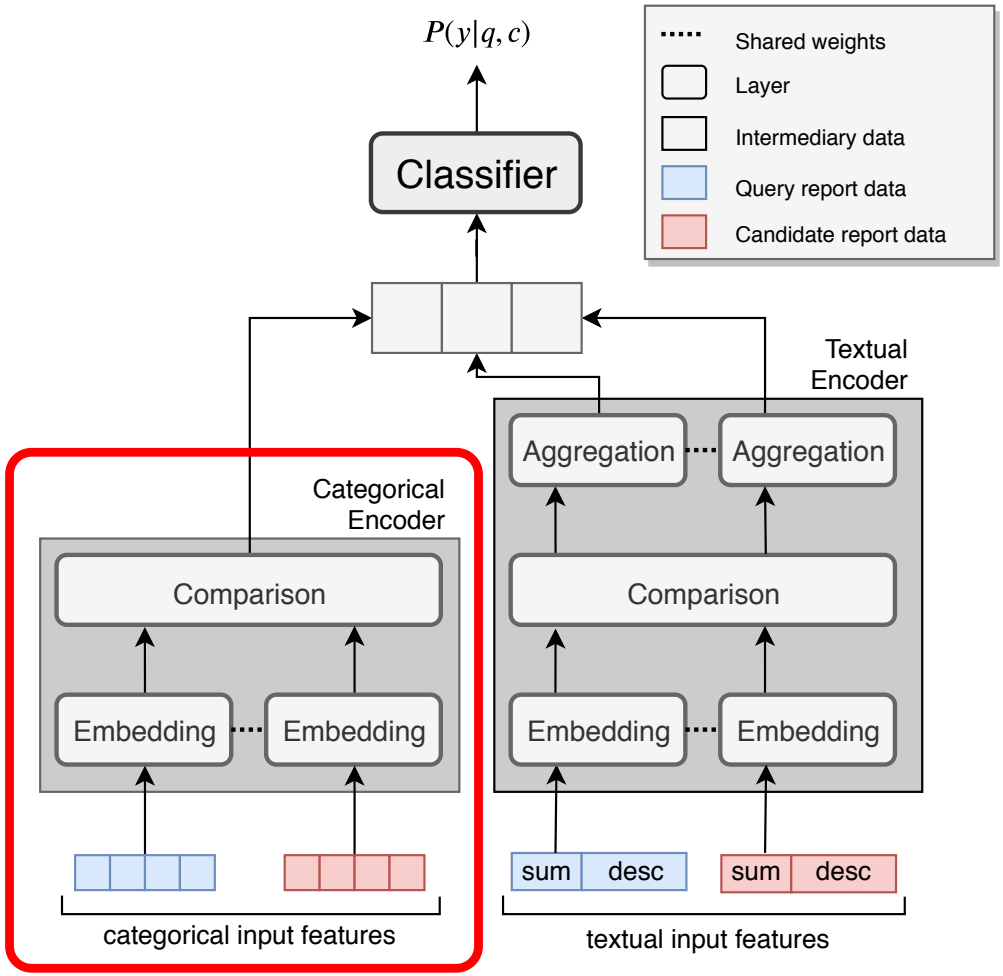

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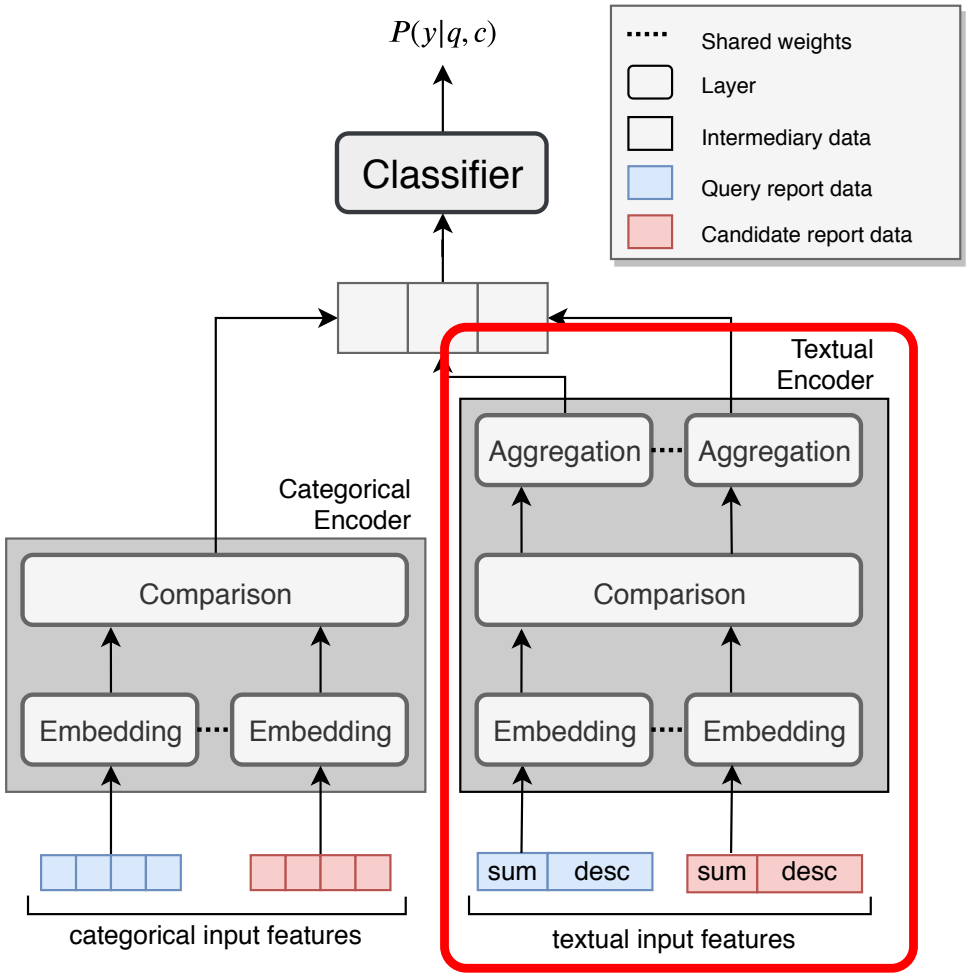

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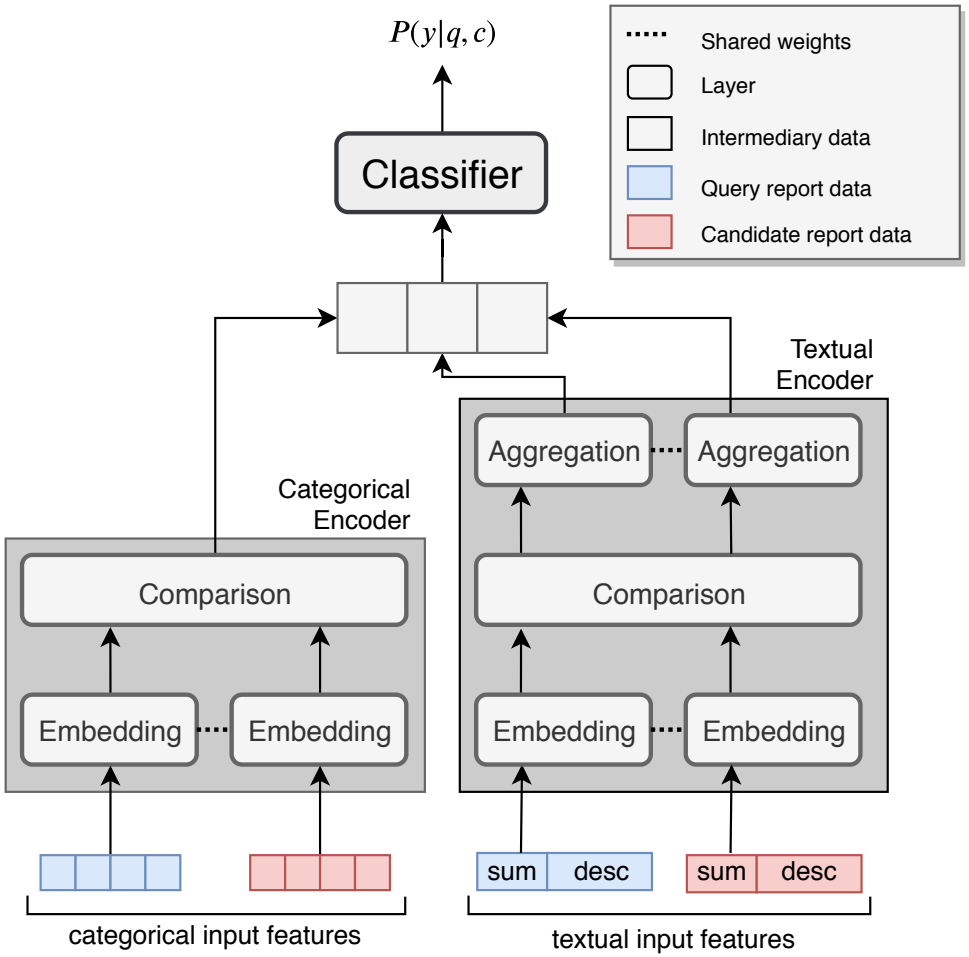

Experiments

- Four BTSs
  - Eclipse, Firefox, OpenOffice and Netbeans
- Our method (CADD) is compared to:
  - BM25F [2]
  - REP [2]
  - DWEN [3]
  - Siamese Pairs [4]
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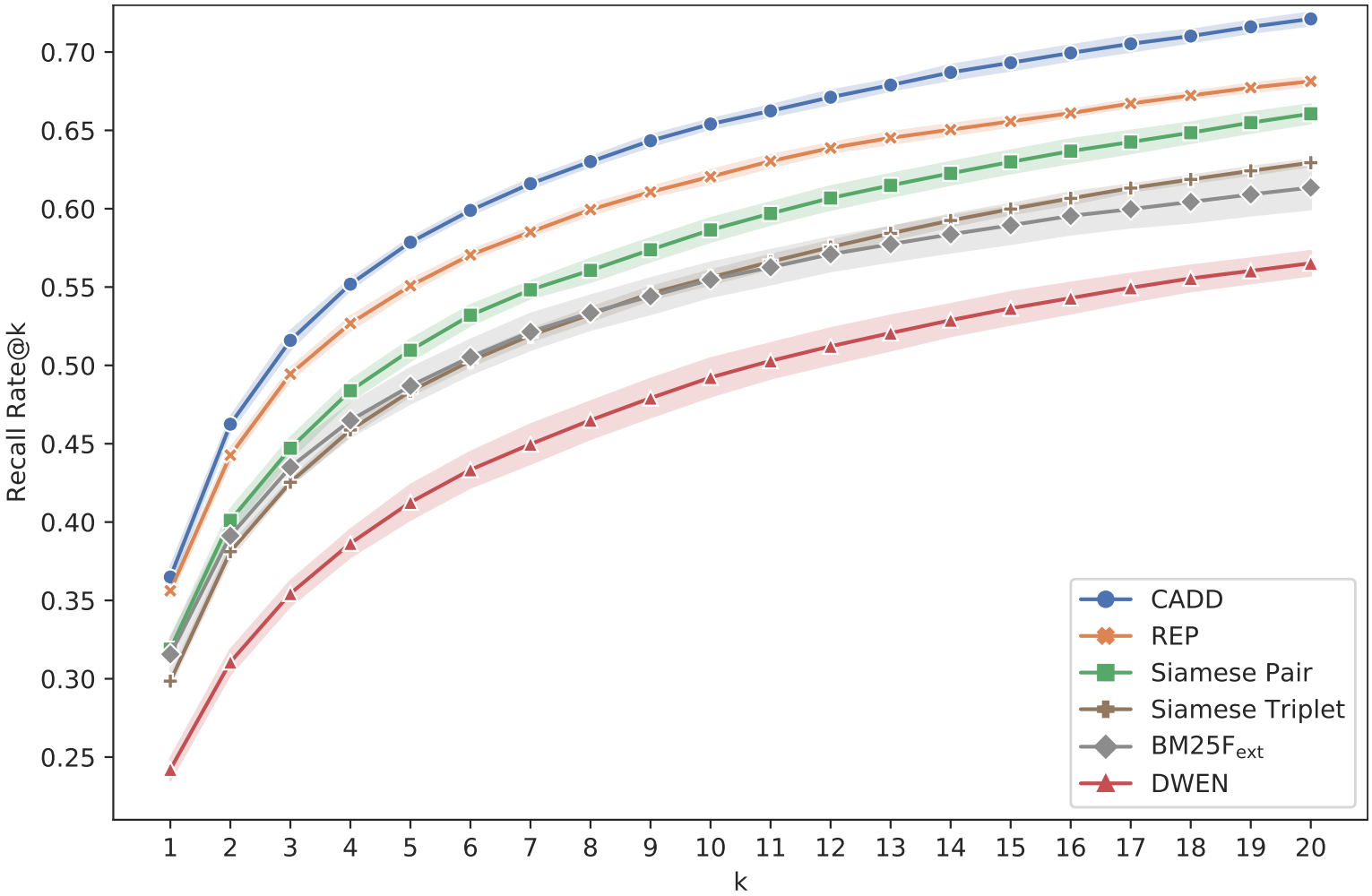
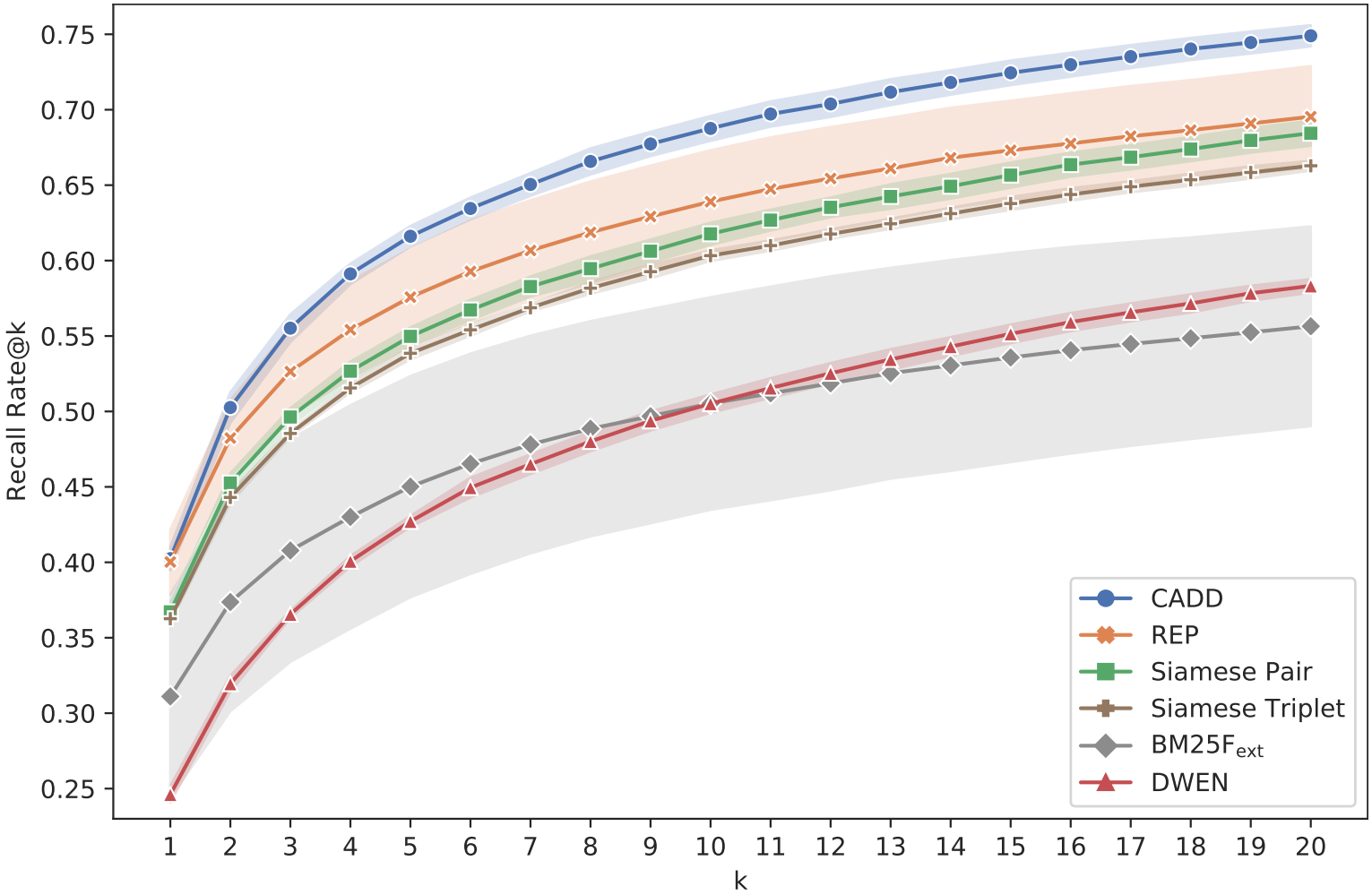


Recall Rate @k in test datasets of **Eclipse**

Experimental Results - Netbeans



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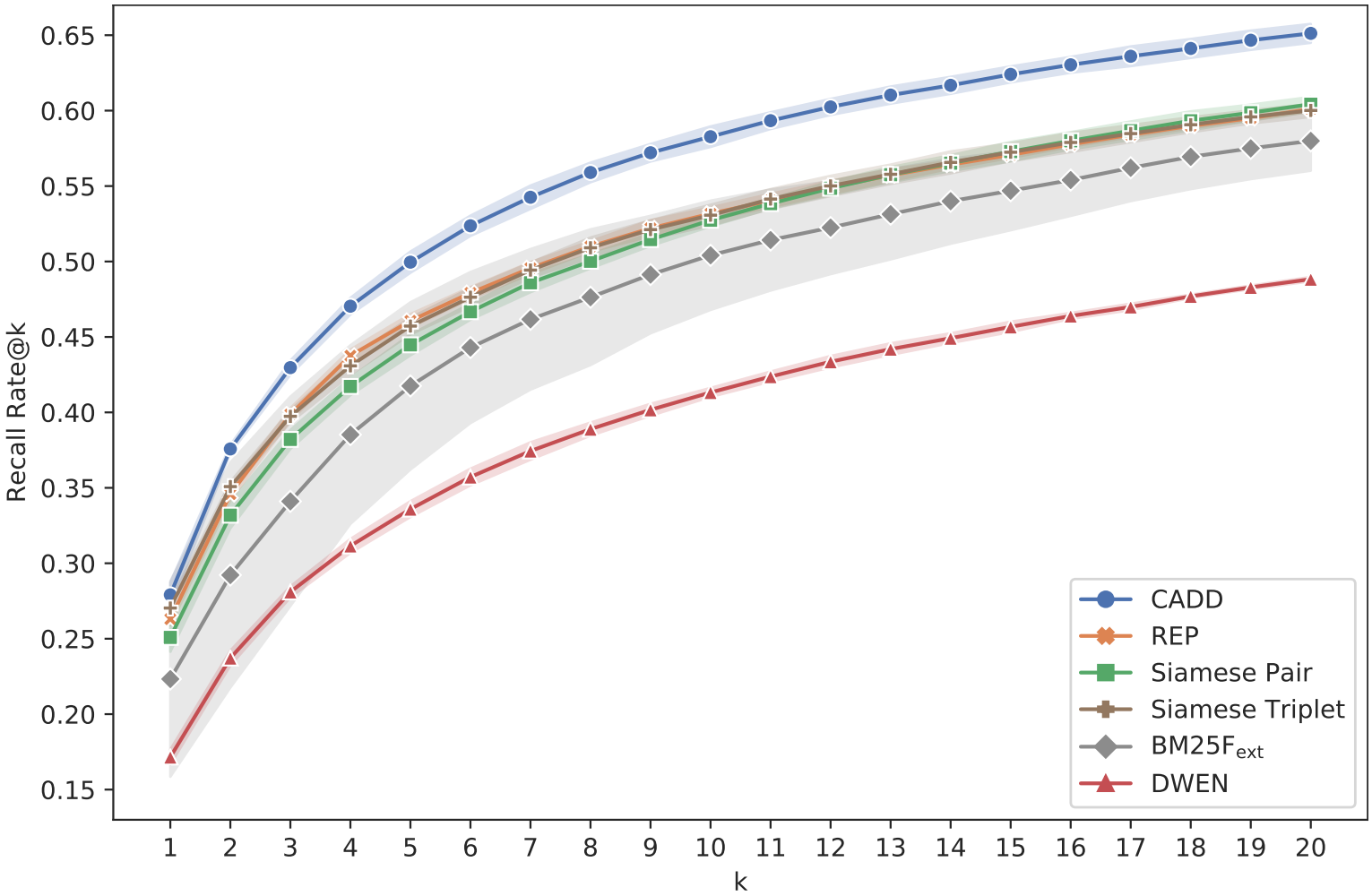
Experimental Results - Open Office



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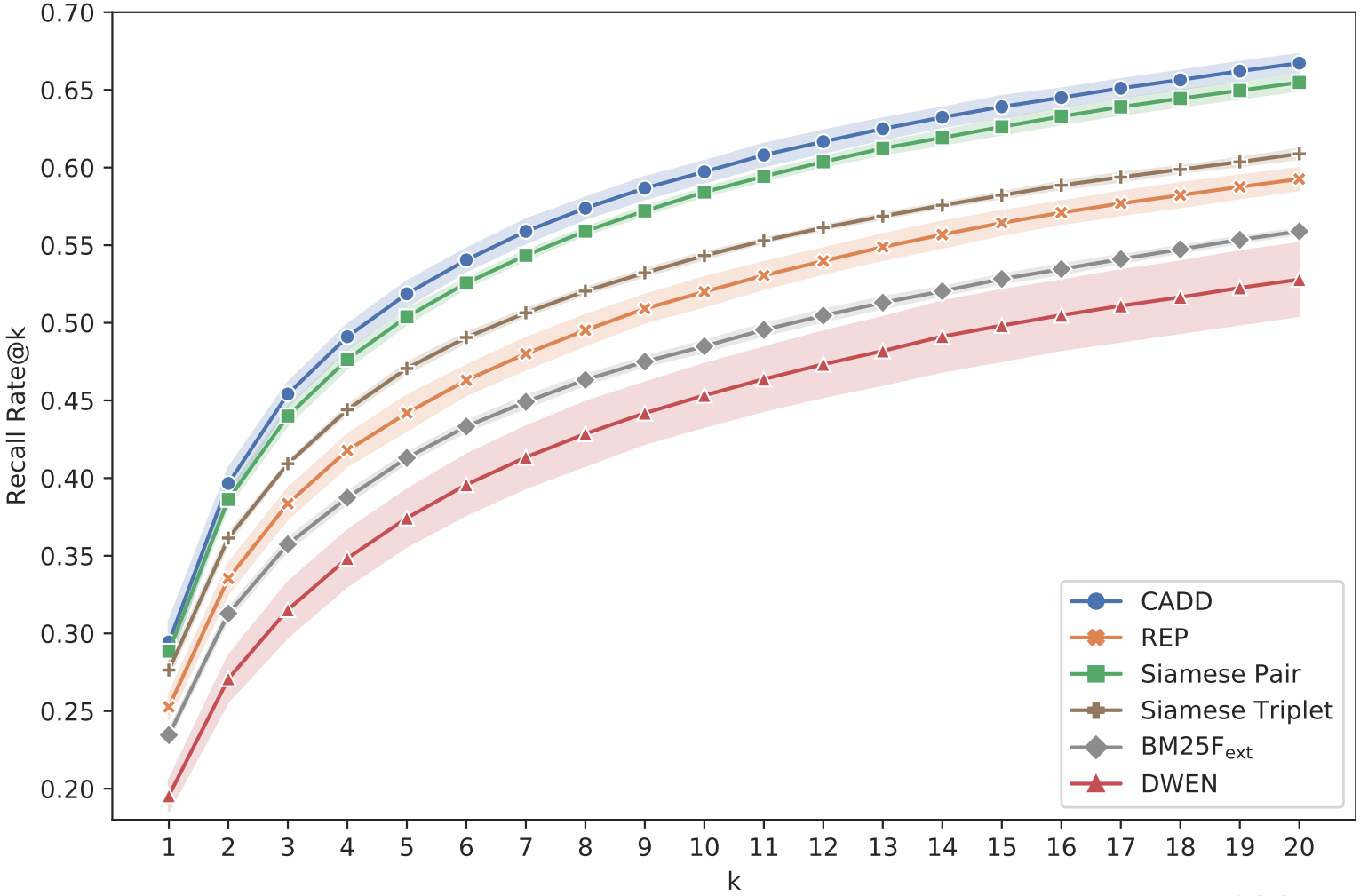
Experimental Results - Mozilla



Recall Rate @k in test datasets of **Mozilla**

CADD

- Superior performance compared to previous methods
  - Reduce triage team overload
  - Help with more difficult instances
- Scalable
  - GPUs
- Easily applied to other BTSs
  - No need for feature engineering
- CADD is limited by report qualities

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Textual Data Disadvantage

- Heavily dependent on users expertise
  - Vague and Ambiguous
  - Different technical background $\rightarrow$ different terminologies
- Limited information about the system execution
  - User can only describe exterior system behaviors
- Alternatives
  - Stack Traces
  - Tracing data

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Bug 15247

Position	Function call
1	localstore.FileSystemResourceManager.read
2	resources.File.getContents
3	resources.File.getContents
4	core.util.SyncFileWriter.readLines
5	core.util.SyncFileWriter.readAllResourceSync
6	EclipseSynchronizer.cacheResourceSyncForChildren
7	EclipseSynchronizer.getResourceSync
8	EclipsePhantomSynchronizer.getResourceSync

Bug 51547

Position	Function call
1	localstore.FileSystemResourceManager.read
2	internal.resources.File.getContents
3	internal.resources.File.getContents
4	core.util.SyncFileWriter.readFirstLine
5	core.util.SyncFileWriter.readFolderSync
6	EclipseSynchronizer.cacheFolderSync
7	EclipseSynchronizer.getFolderSync
8	EclipseFolder.getFolderSyncInfo

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Bug deduplication - Stack Trace

Bug 493220

Position	Function call
1	java.util.ArrayList.rangeCheck
2	java.util.ArrayList.get
3	formatter.TokenManager.get
4	formatter.TokenManager.findFirstTokenInLine
5	formatter.TokenManager.findFirstTokenInLine
6	formatter.TextEditsBuilder.bufferIndent
7	formatter.TextEditsBuilder.bufferLineSeparator
8	formatter.TextEditsBuilder.bufferWhitespaceBefore

Bug 488642

Position	Function call
1	formatter.TextEditsBuilder.appendIndentationString
2	formatter.TextEditsBuilder.bufferIndent
3	formatter.TextEditsBuilder.bufferWhitespaceBefore
4	formatter.TextEditsBuilder.token
5	formatter.TokenTraverser.traverse
6	formatter.TokenManager.traverse
7	formatter.DefaultCodeFormatter.format

Bug deduplication - Stack Trace

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Bug deduplication - Stack Trace

- Studies[5, 6, 7, 8] compare frame positions and do not consider textual similarity
  - Use Package+Function as signature
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- Deep learning method
  - Leverage the data structure
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    - Assumption: the signature similarity is related to the function behavior
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Future Work

- Implement and test our solution for bug deduplication using stack traces
  - Compare with previous methods
  - How can we integrate stack traces and other data types (categorical data)?
- Study how to address the problem with tracing data
  - Generate data
  - Can we use the same method developed by stack traces?

Thank You for your attention!

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