Exploiting the Correspondence between Micro Patterns and Class Names

Jeremy Singer and Chris Kirkham

University of Manchester, UK

Thanks to *Mark Harman* for presenting

What are Micro Patterns?

- Simple single-class properties
- Detect with efficient static analysis
- Invented by Gil and Maman [OOPSLA '05]

Example Micro Pattern

```
public class List {
  Object head;
  List tail;
}
```

exhibits the *recursive* micro pattern, since at least one instance field has the same type as the class itself.

Another Example Micro Pattern

```
public class Point {
  public int getX() {
    return this.x;
  }
  public int getY() {
    return this.y;
  }
}
```

exhibits the *data manager* micro pattern, since all methods are data accessors.

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- our new technique: *correlate MPs with class names*

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- focus on last word in name: *suffix*
- e.g. `Buffer`

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- We show a relationship between class names and micro patterns
    - this allows us to use class names for analysis/optimizations!

Our hypothesis

Class name suffix is often an indicator of micro patterns exhibited by that class.

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- Large corpus of open-source Java applications
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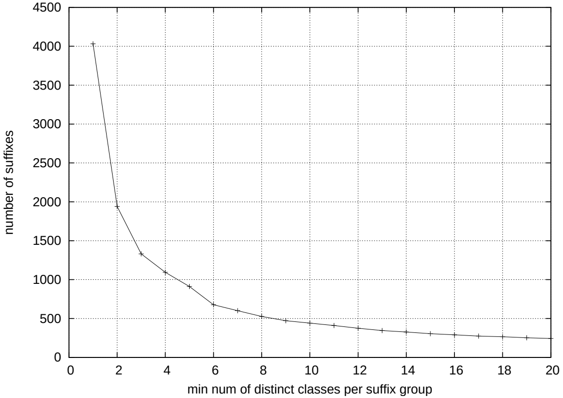
- ⇒ suffix re-use is common practice for Java developers

Suffix statistics



- 50% of suffixes (2000/4000) unique to a single class
- 5% (200/4000) shared between 20+ classes

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- Statistical significance issues
    - Over all the classes, for the most popular micro pattern, there is only a 4% chance that two randomly selected classes will share that micro pattern.

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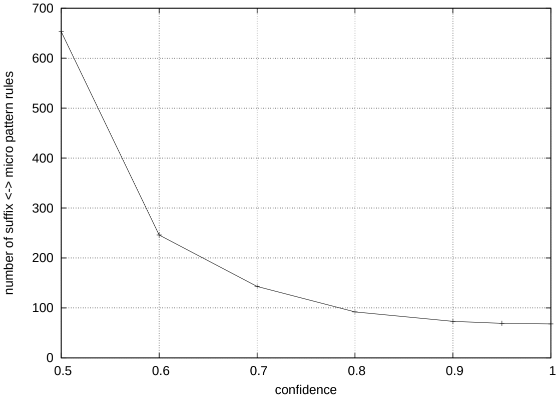

- For suffixes with at least two classes, from at least two programs *(see paper for more graphs with different parameters)*
- Around 70 rules at 100% confidence

Example Rules

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Possible optimizations / bug checks for these rules are presented in paper.

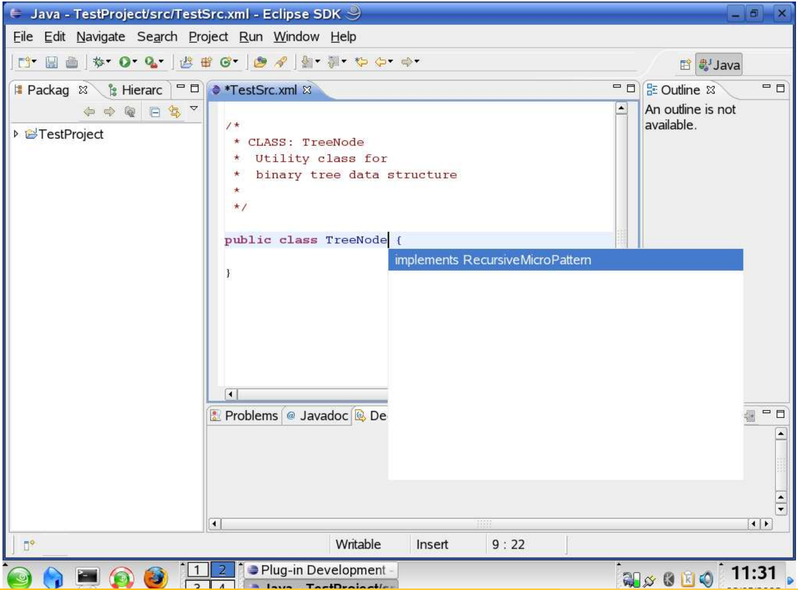
Applications of these rules

- build or download a database of such (suffix,pattern) rules
- apply at code development time
  - to get auto-complete hints
- apply at code review time
  - to identify possible bugs

Auto-complete hints

- developer types class name in IDE
- automatic wizard analyses the suffix
    - suggests possible micro patterns for this class
    - links to documentation
    - fills in skeleton source code

Development time tool: Eclipse wizard



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```
/*
 * CLASS: TreeNode
 *  Utility class for
 *  binary tree data structure
 *
 */

public class TreeNode {

}
```

implements RecursiveMicroPattern

Review time tool: Lint-like checker

Given complete source code for a class, check to see if it violates the micro pattern rules for that suffix. Warn user of potential problems:

Example

```
*Violation* of Recursive micro pattern!
Class TreeNode, declared in
file:TreeNode.xml, line 9, does not contain
any instance fields of type TreeNode.
This rule has confidence 75%
```

Conclusions

- *Class name suffix is often an indicator of micro patterns exhibited by that class.*
- Why is this useful?
  - formalizing the instinctive behaviour of Java programmers
    - suffix/pattern rules
  - exploiting rules for program analysis and optimization
    - prototype tools presented