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Bridging knowledge to economy

Detection and Correction of Design Defects

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- Technological answer fitting in the US market of \$60B of software defects
- Looking for partners to bring the technology to the market

- Software industry: Worldwide market of \$380B
- Quality assurance: Worldwide market of \$1.4B
- Software errors
 - Misunderstanding of the specifications
 - Bad implementation of the specifications
- **Lead to major difficulties** to understand the design, debug the code, and change the software
- **Are costly!**
 - In 2005, 10 millions canadian bank accounts were affected by the deployment of untested code. Cost exceeded \$100M in only two weeks
 - In 2005, several problems were discovered with the \$170M Trilogy project to modernize FBI's IT. Software testing was one of the major problem according to a report of the commission reviewing the project

- Reviews: Architecture, design, code reviews
- Tests: Unit, regression, integration...
- Automated checking
 - Conformance to standards, locking and threading issues, idioms and libraries “good practices”
 - Checkstyle, FindBugs, FX Cop, PMD, JWiz...
 - AppPerfect, Assent, CodePro Studio, JStyle...
- Current tools are like **spell-checkers**...
what about the **grammar**?
Ptidej detect errors of design

- Technology to evaluate and improve the quality of object-oriented programs by promoting the use of patterns
- Three competitive advantages:
Fast, generic, and... **it works!**



Detection of Design Defects

The screenshot displays the Ptidej v2.0 interface with a UML class diagram for JHotDraw v5.1. The diagram shows various classes and interfaces, including Painter, Point Constrainer, Drawing Editor, Palette Listener, Command, Handle, Tool, Figure Enumeration, DrawingView, Locator, Pattern Painter, Buffered Update Strategy, Simple Update Strategy, Gnd Constrainer, Java Draw, Arrow Tip, Abstract Connector, Chop Box Connector, Chop Polygon Connector, Chop Ellipse Connector, Poly Line Connector, Elbow Text Locator, Poly Line Locator, Offset Locator, Relative Locator, Image Figure, Round Rectangle Figure, and Node Figure. A red circle highlights a specific area of the diagram, and a yellow tooltip box provides details about a detected micro-architecture.

Micro-architecture 1 similar at 100% with Blob
DataClass-0 = CH.ifa.draw.framework.DrawingChangeEvent
DataClass-2 = CH.ifa.draw.framework.FigureSelection
LargeClass-1 = CH.ifa.draw.standard.StandardDrawingView
Name = Blob
NMD+NAD-0 = 5.0
NMD+NAD-0 = 4.0
NMD+NAD_MaxBound-0 = {}
NMD+NAD_MaxBound-0 = {}
NMD_NAD-0 = 74.0
NMD_NAD_MaxBound-0 = {NMD_NAD_MaxBound=26.5}

Buttons: Drawing Change Event, Figure Selection, Standard Drawing View

Right sidebar options:

- Choice: SpaghettiCode, Blob, FunctionalDecomposition, SwissArmyKnife
- Action: New RuleCard, Delete RuleCard, Detect Anti Patterns
- Anti Patterns: ControllerClassDetection, DataClass, LargeClassDetection, LowCohesionDetection, ClassOneMethod, FieldPrivate, FunctionClassDetection, NoInheritanceDetection, NoPolymorphism, StaticFunctionMethodDetection, ClassGlobalVariable, LongMethodDetection, MethodNoParameter, NoInheritanceDetection, DefaultProtectedMethodDetection, MultipleInterfaceDetection, StaticMethodDetection

Bottom status bar:

- Loading from: F:/Software/Ptidej/PADL/bn/padl/eme/dmp/Relationship.class
- Loading from: F:/Software/Ptidej/PADL/bn/padl/eme/dmp/Setter.class
- Loading from: F:/Software/Ptidej/PADL/bn/padl/eme/dmp/Specialisation.class
- Loading from: F:/Software/Ptidej/PADL/bn/padl/eme/dmp/UseRelationship.class

Benchmarks

- Precision and recall

Design Defects	Number of Classes in XERCES v2.7.0	Numbers of Known True Positives		Numbers of Detected Defects		Precision	Recall	Time
Blob	513	39	(7.60%)	44	(8.58%)	88.64%	100.00%	2.45s
Functional Decomposition		15	(2.92%)	29	(5.65%)	51.72%	100.00%	0.91s
Spaghetti Code		46	(8.97%)	76	(14.81%)	60.53%	100.00%	0.23s
Swiss Army Knife		23	(4.48%)	56	(10.91%)	41.07%	100.00%	0.08s

	ARGO UML	AZUREUS	GANTT PROJECT	LOG4J	LUCENE	NUTCH	PMD	QUICK UML	XERCES v1.0.1	XERCES v2.7.0
Blob	29 (2.36%) 25 (2.03%) 86.21% 3.01s	41 (2.83%) 38 (2.62%) 92.68% 6.41s	10 (5.32%) 9 (4.79%) 90.00% 2.44	3 (1.59%) 3 (1.59%) 100% 1.34s	3 (1.95%) 2 (1.29%) 66.67% 1.84s	6 (2.90%) 4 (1.93%) 66.67% 3.56s	4 (0.95%) 4 (0.95%) 100% 3.87s	0 (0%) 0 (0%) 100% 0.45s	10 (5.29%) 10 (5.29%) 100% 2.75s	44 (8.58%) 39 (7.60%) 88.64% 2.45s
F.D.	37 (3.01%) 22 (1.79%) 59.46% 0.42s	44 (3.04%) 17 (1.17%) 38.64% 0.47s	15 (7.98%) 4 (2.12%) 26.67% 0.80s	11 (5.82%) 6 (3.17%) 54.55% 0.05s	1 (0.65%) 0 (0.00%) 0% 0.03s	15 (7.25%) 3 (1.45%) 20.00% 0.05s	13 (3.07%) 4 (0.95%) 30.77% 0.06s	10 (7.04%) 3 (2.11%) 30.00% 0.02s	4 (2.12%) 4 (2.12%) 100.00% 0.03s	29 (5.65%) 15 (2.92%) 51.72% 0.16s
S.C.	44 (3.58%) 38 (3.09%) 86.36% 0.26	153 (15.56%) 125 (8.62%) 81.70% 2.86s	14 (7.45%) 10 (5.32%) 71.43% 0.20	3 (1.59%) 2 (1.06%) 66.67% 0.08s	8 (5.19%) 6 (3.89%) 75.00% 0.09s	26 (12.56%) 22 (10.63%) 84.61% 0.11s	9 (2.13%) 5 (1.18%) 55.56% 0.06s	5 (3.52%) 0 (0.00%) 0% 0.03s	25 (13.23%) 23 (12.17%) 92.00% 0.11s	76 (14.81%) 46 (8.97%) 60.53% 0.22s
S.A.K.	108 (8.78%) 18 (1.46%) 16.67% 0.28s	145 (10.00%) 33 (2.27%) 22.76% 0.13s	8 (4.25%) 3 (1.59%) 37.50% 0.05s	51 (26.98%) 33 (17.46%) 64.70% 0.02s	9 (5.84%) 1 (0.65%) 11.11% 0.02s	33 (15.94%) 13 (6.28%) 39.39% 0.02s	13 (3.07%) 6 (1.42%) 46.15% 0.02s	6 (4.22%) 1 (0.70%) 16.67% 0.02s	12 (6.35%) 5 (2.65%) 41.67% 0.03s	56 (10.91%) 23 (4.48%) 41.07% 0.05s

- **Developers**
 - Reduced development cycle
 - Improved software quality
 - Quicker time-to-market
- **Managers**
 - Improved software quality
 - Developers
 - **Sub-contractors!**
 - Better confidence before deployment
- **Training**
 - Better understanding of design quality
 - Better understanding of design choices

- Research and development
 - Yann-Gaël Guéhéneuc, Ph.D., jr. eng.
 - Naouel Moha (Ph.D. candidate)
 - Foutse Khomh (Ph.D. candidate)
 - Stéphane Vaucher (Ph.D. candidate)

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 - Pierre Patenaude, eng., MBA

- Please, come visit our booth at 33
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