

Mining Version Histories to Guide Software Changes

- Thomas Zimmermann, Peter Weibgerber,
Stephan Diehl, and Andreas Zeller
Tao Xia

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Motivation

- When programmer changes something, what else would he like to change also?
- From the software history, can we find any useful information to guide programmers?

ROSE

- Support Count
 - Existing instances of a rule
- Confidence
 - The strength of a rule
- Use ROSE to analyze 8 open source projects

Computing Rules

- Apriori Algorithm
 - Calculate all rules before hand, straight forward but slow
- Optimization
 - Constrained antecedents
 - Single consequents

Results

- Navigation
- Error Prevention
- Closure

Results for Fine Granularity (R = recall; P = precision; Fb = feedback; L = likelihood)

	Navigation				Prevention			Closure	
Support Count Confidence	1 0.1				3 0.9			3 0.9	
Project	Fb	R_M	P_M	L_3	Fb	R_M	P_M	Fb	$1 - Fb$
ECLIPSE	0.64	0.34	0.30	0.57	0.03	0.83	0.70	0.019	0.981
GCC	0.63	0.45	0.31	0.91	0.08	0.96	0.95	0.015	0.985
GIMP	0.60	0.35	0.30	0.92	0.03	0.92	0.89	0.018	0.982
JBOSS	0.59	0.36	0.31	0.62	0.02	0.73	0.65	0.021	0.979
JEDIT	0.74	0.21	0.31	0.86	0.01	0.42	0.38	0.043	0.957
KOFFICE	0.65	0.24	0.23	0.54	0.01	0.50	0.46	0.008	0.992
POSTGRES	0.76	0.29	0.29	0.65	0.02	0.89	0.82	0.012	0.988
PYTHON	0.66	0.37	0.27	0.54	0.02	0.72	0.67	0.013	0.987
Average	0.66	0.33	0.29	0.70	0.03	0.75	0.69	0.019	0.981

Granularity

- Moved focus from functions, variables to files

Results for Coarse Granularity (R = recall; P = precision; Fb = feedback; L = likelihood)

	Navigation				Prevention			Closure	
Support Count	1				3			3	
Confidence	0.1				0.9			0.9	
Project	Fb	R_M	P_M	L_3	Fb	R_M	P_M	Fb	$1 - Fb$
ECLIPSE	0.80	0.36	0.29	0.57	0.04	0.83	0.68	0.019	0.981
GCC	0.76	0.59	0.35	0.88	0.21	0.97	0.95	0.040	0.960
GIMP	0.77	0.48	0.28	0.92	0.10	0.94	0.88	0.045	0.955
JBOSS	0.74	0.36	0.19	0.51	0.03	0.56	0.50	0.017	0.983
JEDIT	0.95	0.41	0.31	0.88	0.03	0.41	0.37	0.064	0.936
KOFFICE	0.87	0.45	0.30	0.70	0.04	0.77	0.76	0.021	0.979
POSTGRES	0.95	0.37	0.29	0.72	0.05	0.72	0.63	0.026	0.974
PYTHON	0.73	0.46	0.34	0.61	0.04	0.87	0.82	0.005	0.995
Average	0.82	0.44	0.29	0.72	0.07	0.76	0.70	0.030	0.970

Maintenance

- Concentrate on modifications only.

Results for Maintenance (R = recall; P = precision; Fb = feedback; L = likelihood)

Navigation: Support Count=1, Confidence=0.1, Granularity=Fine												
Project	All				Non-maintenance				Maintenance			
	Fb	R_M	P_M	L_{10}	Fb	R_M	P_M	L_{10}	Fb	R_M	P_M	L_{10}
ECLIPSE	0.64	0.34	0.30	0.70	0.55	0.23	0.23	0.66	0.72	0.41	0.36	0.74
GCC	0.63	0.45	0.31	0.91	0.63	0.31	0.35	0.94	0.63	0.60	0.29	0.87
GIMP	0.60	0.35	0.30	0.95	0.58	0.23	0.32	0.99	0.64	0.52	0.28	0.89
JBOSS	0.59	0.36	0.31	0.76	0.55	0.28	0.31	0.76	0.67	0.51	0.37	0.79
JEDIT	0.74	0.21	0.31	0.91	0.73	0.18	0.32	0.93	0.80	0.30	0.29	0.84
KOFFICE	0.65	0.24	0.23	0.69	0.62	0.21	0.23	0.62	0.71	0.29	0.24	0.64
POSTGRES	0.76	0.29	0.29	0.75	0.72	0.22	0.30	0.72	0.83	0.42	0.27	0.71
PYTHON	0.66	0.37	0.27	0.68	0.65	0.30	0.26	0.65	0.67	0.47	0.30	0.68
Average	0.66	0.33	0.29	0.79	0.63	0.25	0.29	0.78	0.71	0.44	0.30	0.77

More Results

- Multiple Dimensions
 - Add and remove entity improves recall
- History
 - ROSE gives useful suggestions in a short period of time (few weeks)
- Recent Changes
 - Higher weight to recent changes improves precision and recall for frequently restructured projects

Good Things

- Focus at class entity level (variables, functions)
- Lots of data to support conclusions
- Great analyze of the conclusions