Data Quality Issues Relating to the NASA Metrics Data Program (MDP) Data Sets

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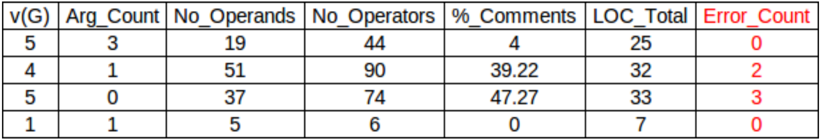
Introduction & Motivation

- M.Sc. project suggestion - Replicate fault prediction study
- Menzies et al - *Data Mining Static Code Attributes to Learn Defect Predictors,* IEEE TSE Journal, January 2007
- Similar results achieved - **but not identical. . .**
- Motivation to take a closer look at the data.

Data

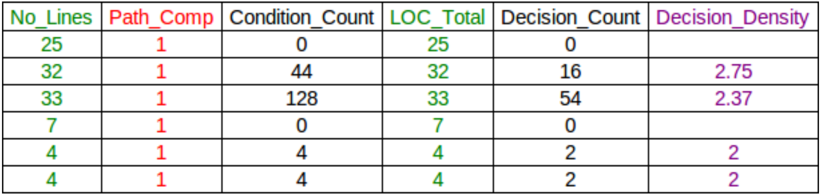
- Data used originated from NASA. . .
- Is available online from the NASA Metrics Data Program (MDP) Repository - http://mdp.ivv.nasa.gov/
- Currently has 13 data sets publicly available. . .



v(G)	Arg_Count	No_Operands	No_Operators	%_Comments	LOC_Total	Error_Count
5	3	19	44	4	25	0
4	1	51	90	39.22	32	2
5	0	37	74	47.27	33	3
1	1	5	6	0	7	0

Issues (1)

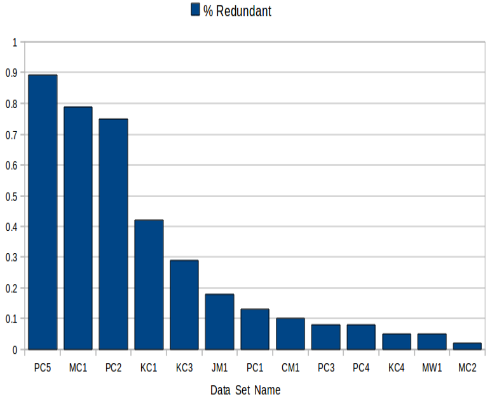
- Constant attributes (no information) - 26 attributes KC4
- Repeated / redundant attributes - KC4
- Missing values - 7 / 13 of the data sets



No_Lines	Path_Comp	Condition_Count	LOC_Total	Decision_Count	Decision_Density
25	1	0	25	0	
32	1	44	32	16	2.75
33	1	128	33	54	2.37
7	1	0	7	0	
4	1	4	4	2	2
4	1	4	4	2	2

Issues (2)

- Repeated / redundant vectors. . .



SERIOUS PROBLEM!

Training and testing sets may contain identical vectors!

Issues (3)

Problem domain expertise can help us validate data integrity…

- No. executable lines < 1: MC1 4841 vectors (51%)
- No. operators / operands < 1: JM1 1332 vectors (12%)
- v(G) $= \mathit{edges} - \mathit{nodes} + 2$ (at the module level…)
  This does not hold for 145 vectors of MC1 (2%)

Conclusion

There are data quality issues with the NASA MDP data sets. . .

Of which the repeated / redundant vector issue is most serious.

Thorough analysis of your data is essential when data mining.

> “it is rather important to explicitly consider the quality
> – meaning the accuracy – of the data sets that form
> the basis of our research.” - Liebchen and Shepperd

The End

Thank you for listening. . .
Questions, comments, feedback?

Appendix

First study believed to mention repeated / redundant data in the NASA data sets (and remove it):

Kaminsky & Boetticher - *Building a Genetically Engineerable Evolvable Program Using Breadth-Based Explicit Knowledge for Predicting Software Defects,* IEEE Annual Meeting of the Fuzzy Information Processing Society, June 2004

First study believed to mention inconsistent data in the NASA data sets:

Seliya, Khoshgoftaar & Zhong - *Analyzing Software Quality with Limited Fault-Proneness Defect Data,* IEEE Int. Symposium on High-Assurance Systems Engineering, October 2005