The Confounding Effect of Class Size on the Validity of Object-Oriented Metrics

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Terminology

- Confounding
- Empirical
- Binary classification
- univariate
- Type I error
- Type II error
- Odds ratio

Odds Ratio

The ratio of the odds that the faulty class has High Coupling to the odds that the non-faulty class has High Coupling is the odds ratio [47]:

\[ \psi = \frac{a/c}{d/b} = \frac{ad}{bc}. \] (7)

If coupling is not related to fault-proneness, then the odds ratio is equal to one. If there is a positive association, then the odds ratio will be greater than one, and if there is a negative association, then the odds ratio will be a fraction.

Unmatched case-control study

Table 2 and 3

Size Confounding – fig 2

Table 2

<table>
<thead>
<tr>
<th>Coupling</th>
<th>Fault Proneness</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>MC</td>
<td>Faulty</td>
<td>50</td>
<td>0</td>
</tr>
<tr>
<td>LC</td>
<td>Not Faulty</td>
<td>50</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 3

<table>
<thead>
<tr>
<th>Coupling</th>
<th>Fault Proneness</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>LC</td>
<td>Faulty</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>MC</td>
<td>Not Faulty</td>
<td>15</td>
<td>15</td>
</tr>
</tbody>
</table>
Testing for confounding

- Do logistic regression

- If the regression coefficient change dramatically with and without, then strong indication of confounding

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Figure 3

If association is not significant, assume no confounding – wrong

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Figure 4

Do logistic regression

If the regression coefficient change dramatically with and without, then strong indication of confounding

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Table 4

<table>
<thead>
<tr>
<th>GO Term</th>
<th>Estimate</th>
<th>SE</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1GC</td>
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<td>0.10</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td>DTF</td>
<td>0.89</td>
<td>0.10</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td>RFC</td>
<td>0.34</td>
<td>0.10</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td>LECN</td>
<td>0.60</td>
<td>0.10</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td>NIMA</td>
<td>0.27</td>
<td>0.10</td>
<td>&lt; 0.0001</td>
</tr>
</tbody>
</table>

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Table 5
Discussion

“The results that we obtained are remarkably consistent. They indicate that, for some of the product metrics that we studied, the univariate analyses demonstrate that they are indeed associated with fault-proneness (namely, WMC, CBO, RFC, and NMA). After controlling for the size confounder, all of these associations disappear, and the differences in the product metrics' odds ratios indicates a strong and classic confounding effect. The remaining product metrics were not associated with fault-proneness from a univariate analysis, but this was predictable from previous work.” p642

Conclusion

- Table 5
- What is the conclusion of the article?

Class Discussion

- What kind of experiment should be used for these studies?