Escaping the Time Pit: Pitfalls and Guidelines for Using Time-based Git Data

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Time Data is Everywhere!

Almost any repository data we touch has a time component:

- Commits
- Issues
- Pull Requests
- Forge metadata
- Logs
- *Etc*.

But like any data, we need to be careful handling it.

(https://latestaesthetics.com/products/melting-dali-clock)

Research Questions

1. How many MSR papers rely on time-based data?
2. What kinds of data include time?
3. What filtering or cleaning techniques are used?
4. Is bad time-based Git data common?

Selection Criteria

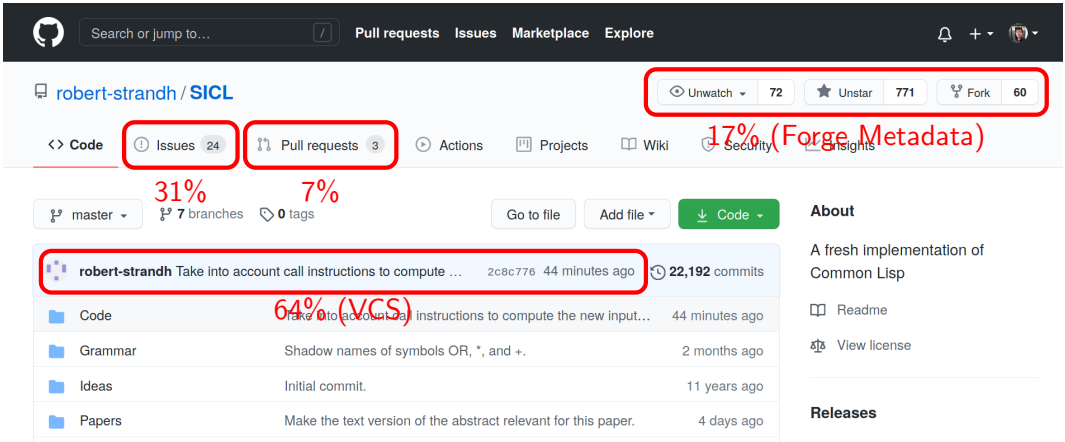
- **Mining Software Repositories (MSR)** conference
- Technical track & Data Showcase papers
- 2004–2020
- 580 technical + 110 data showcase = **690 papers**
- Filtered by time-related keywords, *e.g.*, `minute`, `hour`, `epoch`, `interval`

Selection Criteria

- 282 matched the keyword search
- 43 papers were removed after manual inspection
- **RQ1 result: 239 papers (35% of 690)** were retained

Survey Results

RQ2 result: Kinds of Data



Survey Results

Data Sources

49 (21%)

19 (8%)

19 (8%)

17 (7%)

Torrent
14 (6%)

13 (5%)

9 (4%)

8 (3%)
And others. . .

7 (3%)

7 (3%)

Survey Results

RQ3 result: Filtering and Cleaning Techniques

- None explicitly mentioned (146, 62%)
- Selecting within a time window (24, 10%)
- Describing a cut-off date (15, 6%)
- Using a Custom Condition (7, 3%)
- Coalescing Changesets (5, 2%)
- Using an Analysis Tool (4, 2%)
- Correcting Date Formats (3, 1%)

Survey Results

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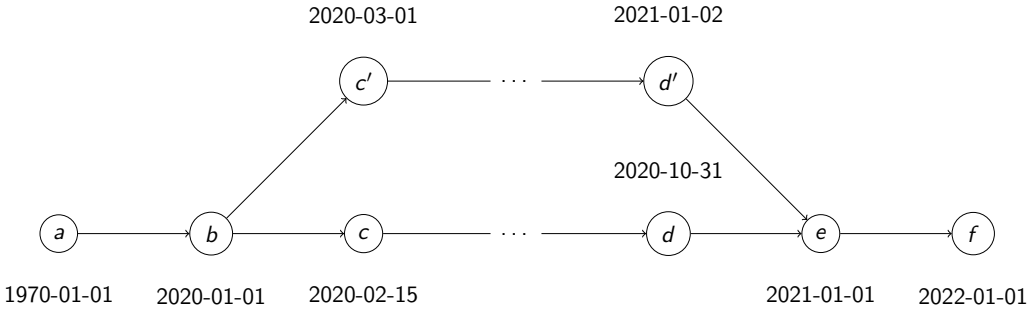
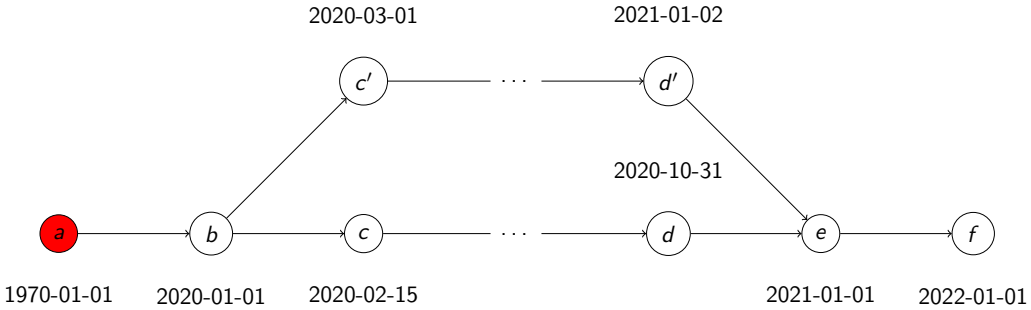
Studying Git

- GitHub is the most common data source
- VCS data is the most studied kind of data
- What would a time problem look like? How frequently are they found?

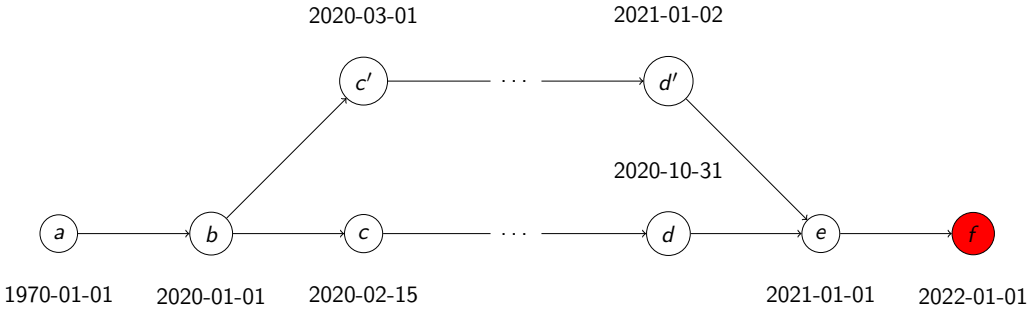
Kinds of Time Problems



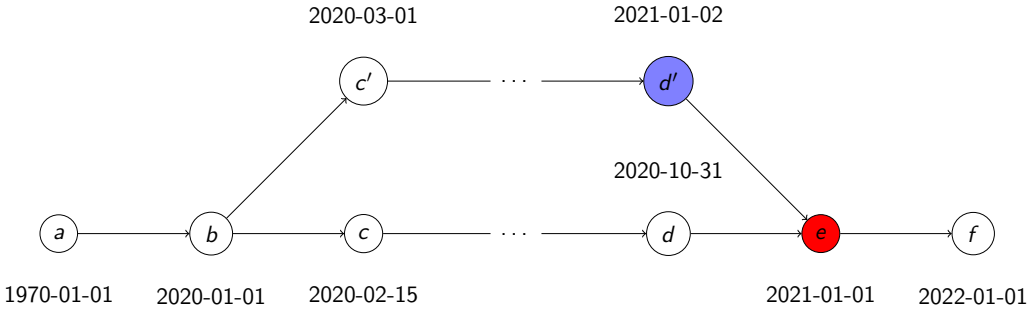
Kinds of Time Problems



Kinds of Time Problems



Kinds of Time Problems



Observed Dataset Problems

- From Boa's 2019 GitHub Large Dataset
- 26,252 suspicious due to being out of order, from 4,744 projects
- 4,735 suspicious due to being too old, from 82 projects
- 11 suspicious due to being in the "future", from 3 projects

Proposed Mitigation

- Filter by Project
- Filter by Date
- Remove projects modified by `git-svn`

Conclusion

Literature

- **RQ1:** At least 35% of MSR studies consider time-based data
- **RQ2:** VCS is the most common, most often from GitHub
- **RQ3:** Filtering & cleaning of time-based data isn't commonly described

RQ4: Mining GitHub

- Out-of-order commits most common error, 26,252 from 4,744 projects
- For "too old" commits, `git-svn` seems connected
- Causes likely due to tools, misconfiguration or user error

Replication Package: https://doi.org/10.5281/zenodo.4625288