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

Samuel W. Flint  Jigyasa Chauhan  Robert Dyer

Department of Computer Science and Engineering
University of Nebraska–Lincoln

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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

- 64% (VCS)
- 31%
- 17% (Forge Metadata)
- 7%
Survey Results

Data Sources

- **GitHub**: 49 (21%)
- **eclipse**: 19 (8%)
- **Anonymized**: 19 (8%)
- **Apache**: 17 (7%)
- **Torrent**: 14 (6%)
- **mozilla**: 13 (5%)
- **stackoverflow**: 9 (4%)
- **Firefox**: 8 (3%)
- **PostgreSQL**: 7 (3%)
- And others...
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%)
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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

- a
  - b
    - c
      - c'
        - ...
          - d'
            - d
              - e
                - f

1970-01-01 → 2020-01-01 → 2020-02-15 → ...

2020-03-01 → 2021-01-02

2020-10-31 → 2021-01-01 → 2022-01-01
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- b: 2020-01-01
- c: 2020-02-15
- c': ...
- d: 2020-10-31
- d': 2021-01-02
- e: ...
- f: 2022-01-01
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