Compression of Programs and the Similarity Distance

KIREPRO1PE Research Project, MSc. Computer Science, ITU - 10th of June 2025

Jonas Nim Røssum <jglr@itu.dk>

Background

- *Lines of Code Changed* (LoCC)
  - De facto standard for measuring code changes
  - Has it's limitations (e.g. structural changes, formatting changes, etc.)

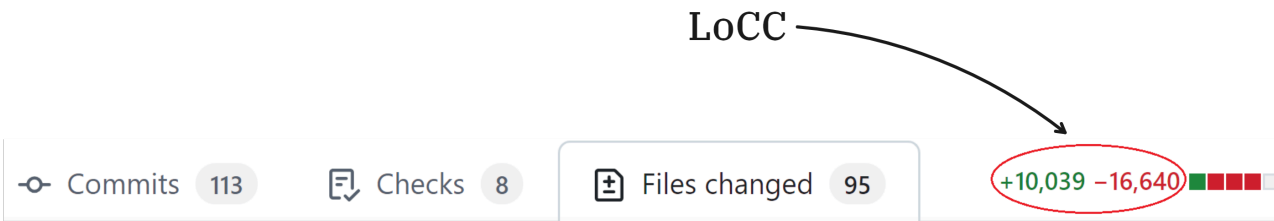


Figure 1: LoCC in a GitHub Pull Request

Project goal and findings

- Find a new metric to address limitations of *Lines of Code Changed* (LoCC)
- *Difference in Compression Distance* (ΔCD)

Research questions

? Is ΔCD correlated with LoCC?

? Can ΔCD discriminate between commit types?

? What are the advantages / limitations of ΔCD?

Findings

⟶ Partial linear correlation, $R^2 = \{0.8, 0.7\}$

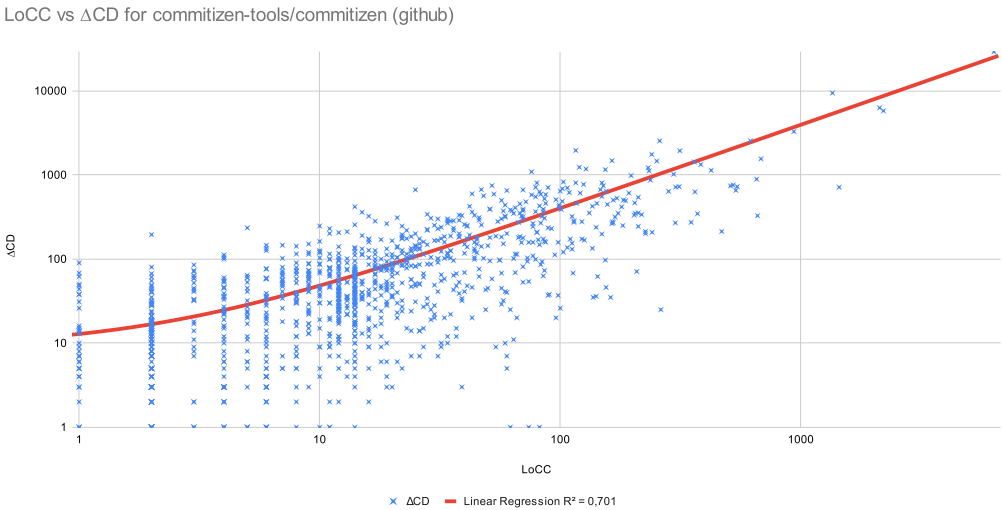
⟶ For Commitizen[1] repo, features and bug fixes stand apart

⟶ Robust to structural changes, survivorship bias / 250× slower than LoCC, scaling challenges

[1] https://github.com/commitizen-tools/commitizen/

RQ1: ΔCD correlation with LoCC

Linear regression R^2 for **commitizen**: 0.7



✅ ΔCD and LoCC correlate, but not perfectly → ΔCD captures more than raw line changes

RQ2: Commit Type Discrimination

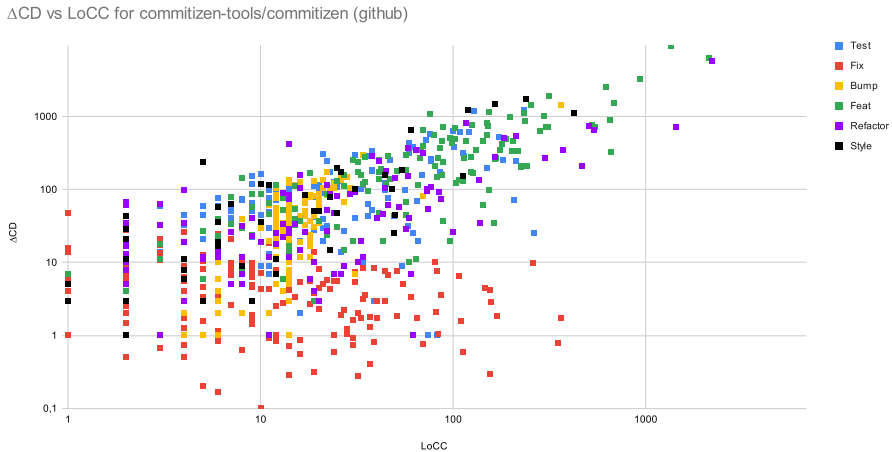
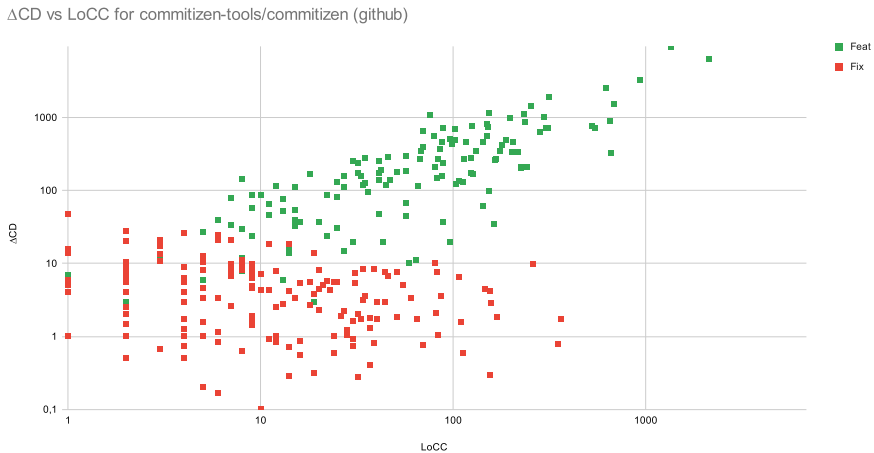


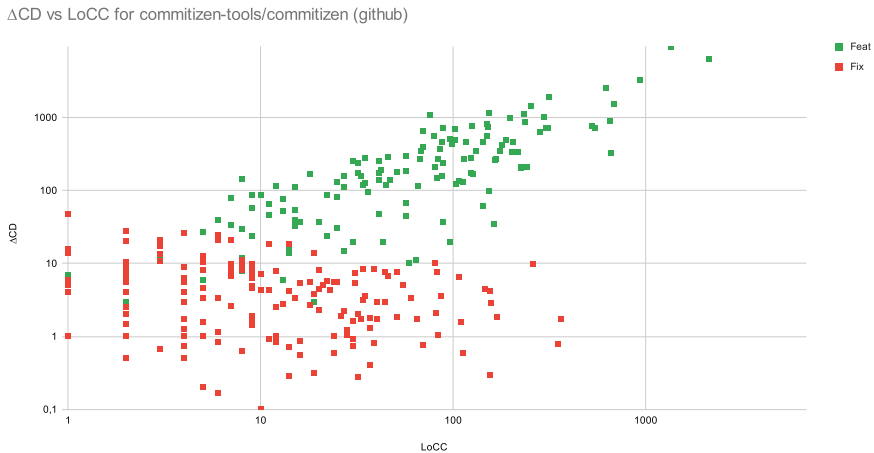
Figure 3: Commits in the Commitizen repository categorized using conventional keywords[2]

[2]https://www.conventionalcommits.org/en/v1.0.0/

RQ2: Commit Type Discrimination



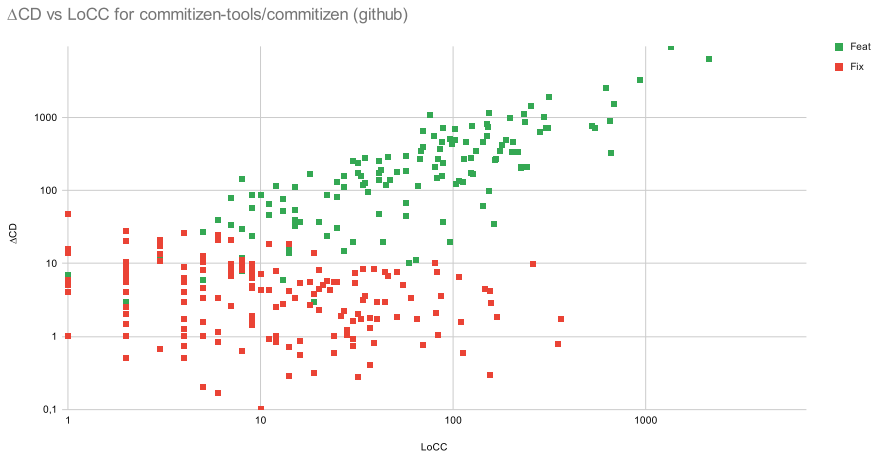
RQ2: Commit Type Discrimination



Bug Fixes: lower ΔCD, changes to existing code

Features: higher ΔCD, typically novel code

RQ2: Commit Type Discrimination



Bug Fixes: lower ΔCD, changes to existing code **Features**: higher ΔCD, typically novel code

✅ ΔCD can partly discriminate between some commit types, at least for this project

RQ3: Advantages - Robust to structural changes

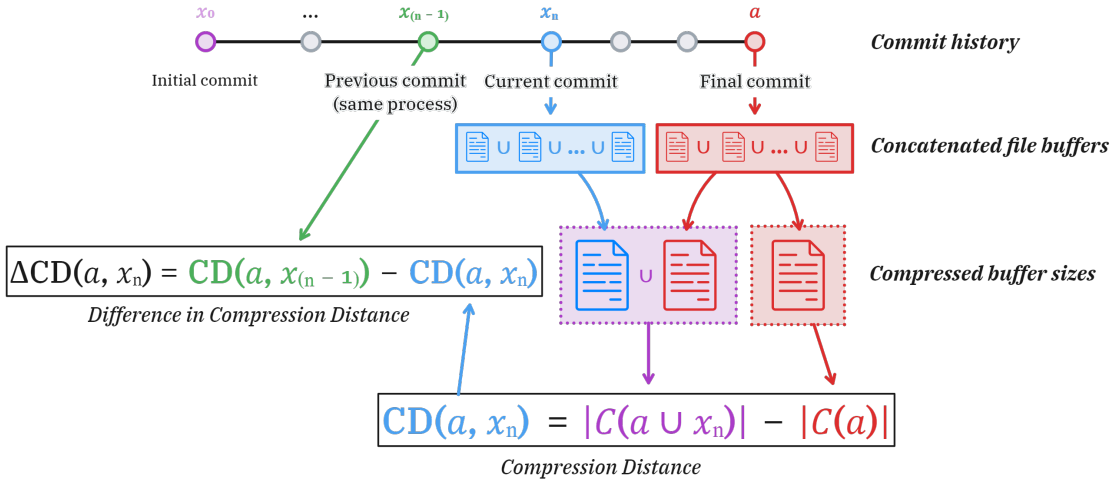
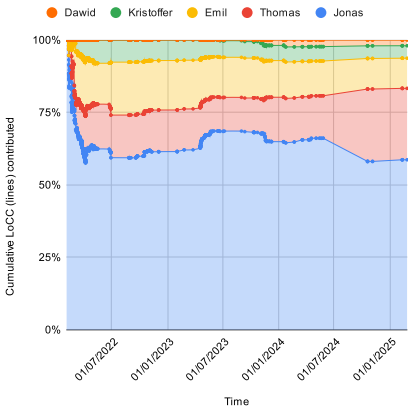


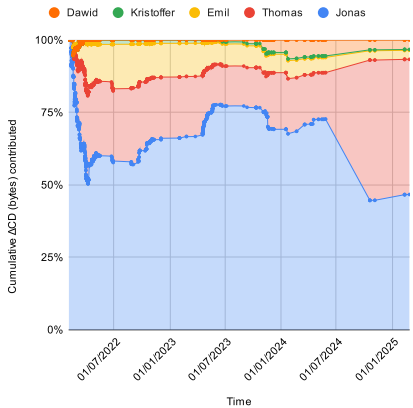
Figure 7: ΔCD (Difference in Compression Distance) Explained

✅ ΔCD is insensitive to project structure

RQ3: Advantages - Survivorship Bias

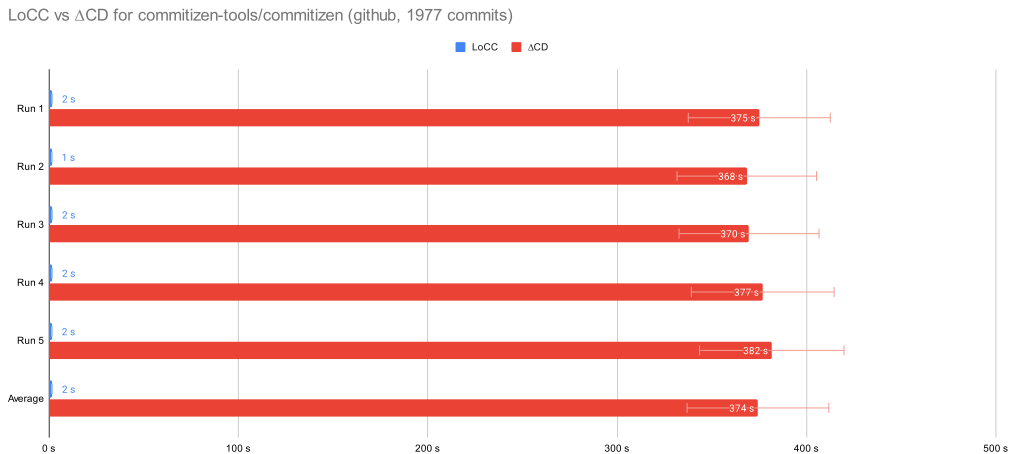
- Example: **Thomas' thesis work in Git Truck**
- According to LoCC (left), Thomas is responsible for 25% of the contributions project
- According to ΔCD (right), Thomas is responsible for 46% of the final revision





✅ ΔCD reflects **lasting impact** on the codebase using survivorship bias

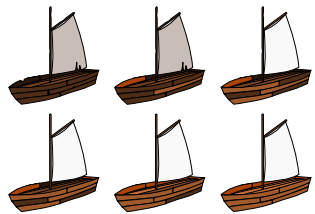
Limitations: Performance and Scalability



Future work

Performance and scalability	Generalize findings
Robustness to formatting changes etc.	Integration
Preprocessing	Use cases

Thank You - Questions?



Project work: Jonas Nim Røssum <jglr@itu.dk>

Original idea: Christian Gram Kalhauge <chrg@dtu.dk>

Source code: github.com/git-truck/git-truck