AI-Powered Delay Prediction for Portfolio Management

Gaspar Rocha

Who am I?

- Portugal → Netherlands
- Master's Student @ TU Delft
- AI & Data Analysis
- Thesis @ DevOn
- Guided by Experts

What am I talking about?

AI-Powered Delay Prediction for PPM

Struggles of Predicting Delays

AI for Portfolio Management

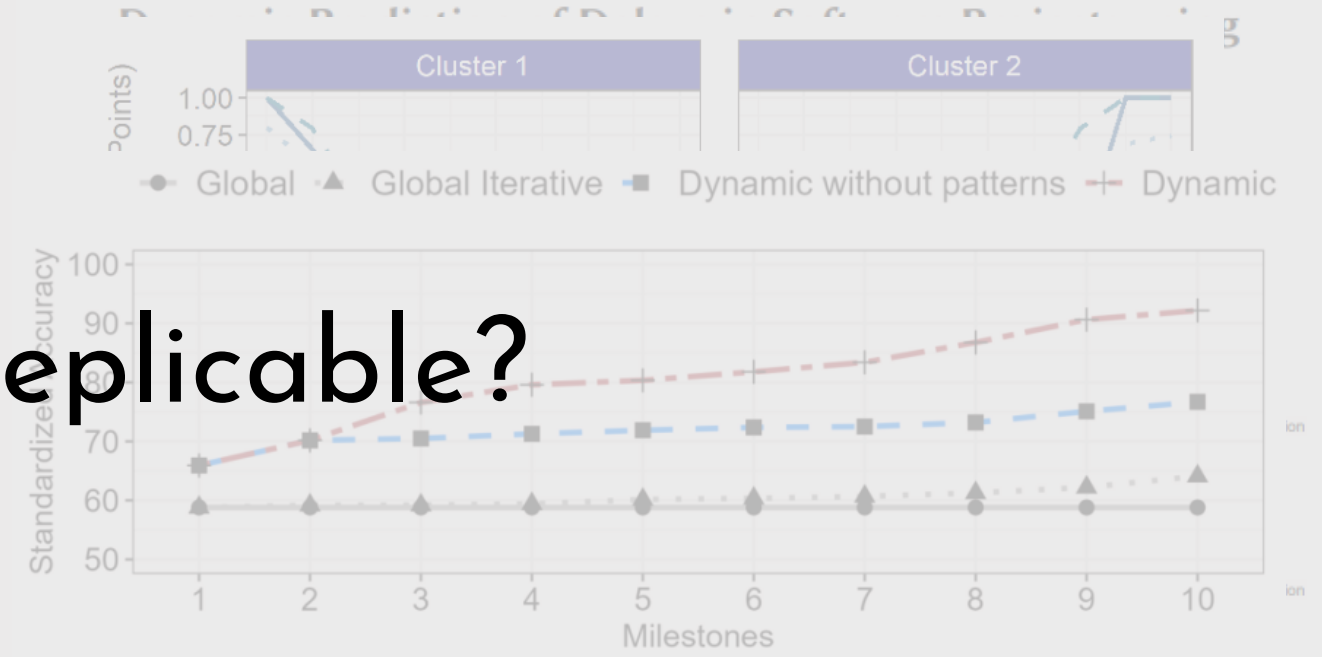
Existing Literature – The work of Dr. Kula

Delay Risk Management

Dynamic AI Model

Delay Patterns

Great Results



(a) Standardized Accuracy over time

ING: 25th percentile: dotted; centroid: solid; and 75th percentile: dashed.

Replicable?

Replication environment

- Different industry
  - Faster moving
  - Less regulated
  - More demand-driven
- Similar investments
  - Agility
  - Data-driven decision-making

How effective is Dr. Kula's solution when applied to CCH's Project Portfolio?

Data Cleaning and Preprocessing

- 7463 epics
- 4040 clean epics
- 54% usability rate

- 2164 epics
  - non-delivered
  - no target dates
  - < 10 planned sprints
  - < 10 actual sprints
- 354 clean epics
- 16% usability rate

devon

Collecting Delay Factors

Risk factor	Predictor variable	Description
Task dependencies	1. out-degree	Number of outgoing dependencies of an epic on other epics
Organizational stability	2. changed-leads	Number of changed tribe leads during the current and previous epic
Team stability	3. stability-ratio	Median of the ratio of team members that did not change during the current and previous epic
Skills and knowledge	4. dev-age-ing	Median of the number of years the developers working on the epic have been working at ING
Team familiarity	5. team-existence	Median of the number of years teams have existed in their current composition of team members
Team commitment	6. hist-performance	Median of the ratio of on-time delivered epics over all teams working on the epic
Work in progress	7. dev-workload	Median of the number of story points assigned to a developer per sprint
Bugs or incidents	8. nr-incidents	Number of incidents that occurred during the development phase of the epic
	9. unplanned-stories	Number of unplanned stories (related to bug fixes or incidents) that have been added to the epic
Project size	10. nr-stories	Number of planned stories assigned to the epic
	11. nr-sprints	Number of sprints assigned to the epic
	12. team-size	Median team size in the epic
Project security	13. security-level	The ratio of user stories in the epic that need to pass a security testing process

Final Datasets

- 4040 epics
- 13 predictor variables

- 354 epics
- 7 predictor variables

Delay Patterns

- Show **when** delays happen throughout an epic
- Large distance between 25th and 75th percentiles
  - Small dataset
  - Unclear or non-existing patterns
- Delay patterns are not indicative of overall delay

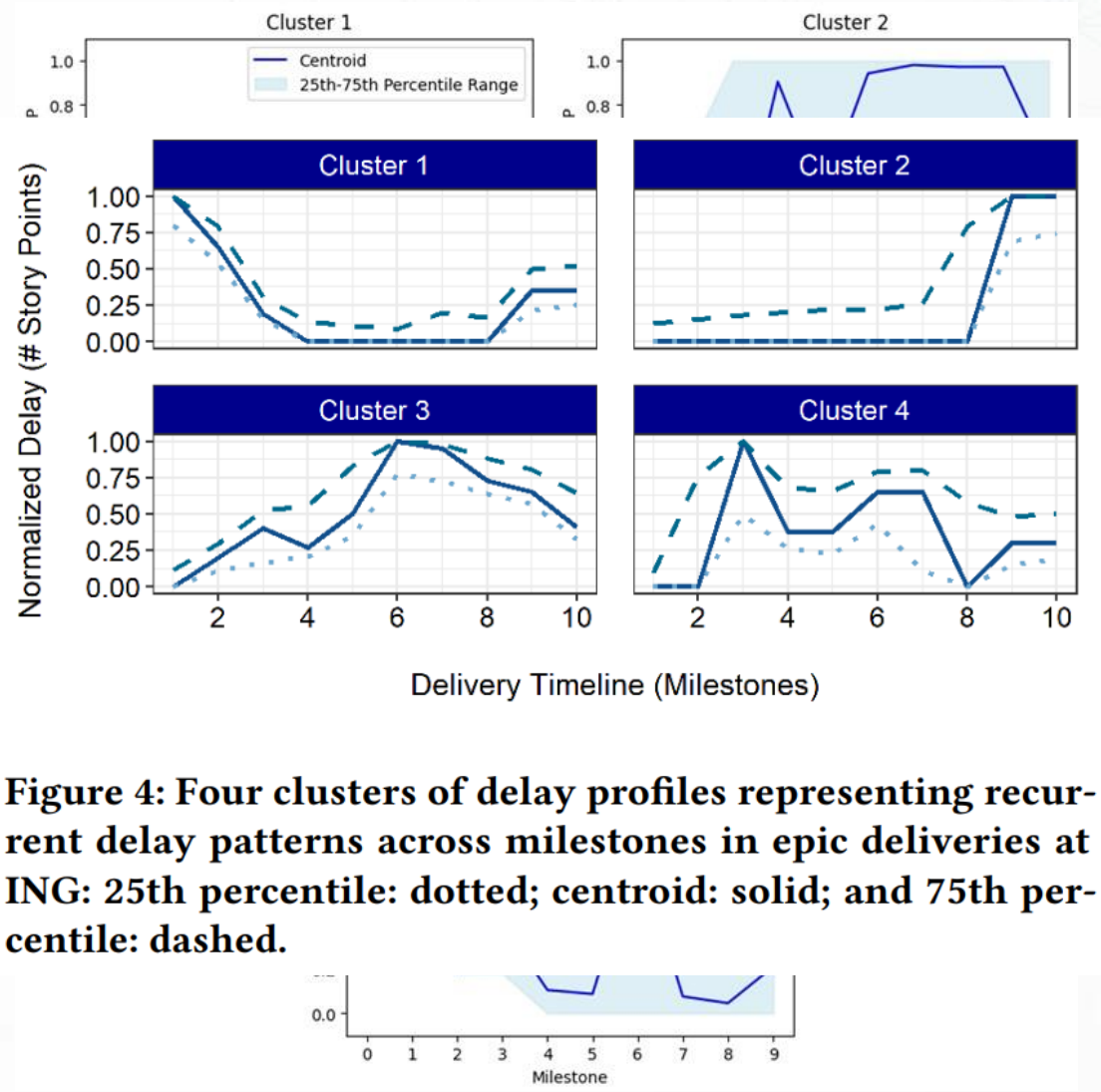


Figure 4: Four clusters of delay profiles representing recurrent delay patterns across milestones in epic deliveries at ING: 25th percentile: dotted; centroid: solid; and 75th percentile: dashed.

Performance Measurements

- Epic delivered
  - on time: BRE = 0
  - 50% longer: BRE = 0.5

Balanced Relative Error (BRE)

$$\text{If Act - Pln } \geq 0, \text{ then BRE } = \frac{\text{Act } - \text{ Pln}}{\text{Planned Duration}}$$

$$\text{If Act - Pln } < 0, \text{ then BRE } = \frac{\text{Act } - \text{ Pln}}{\text{Actual Duration}}$$

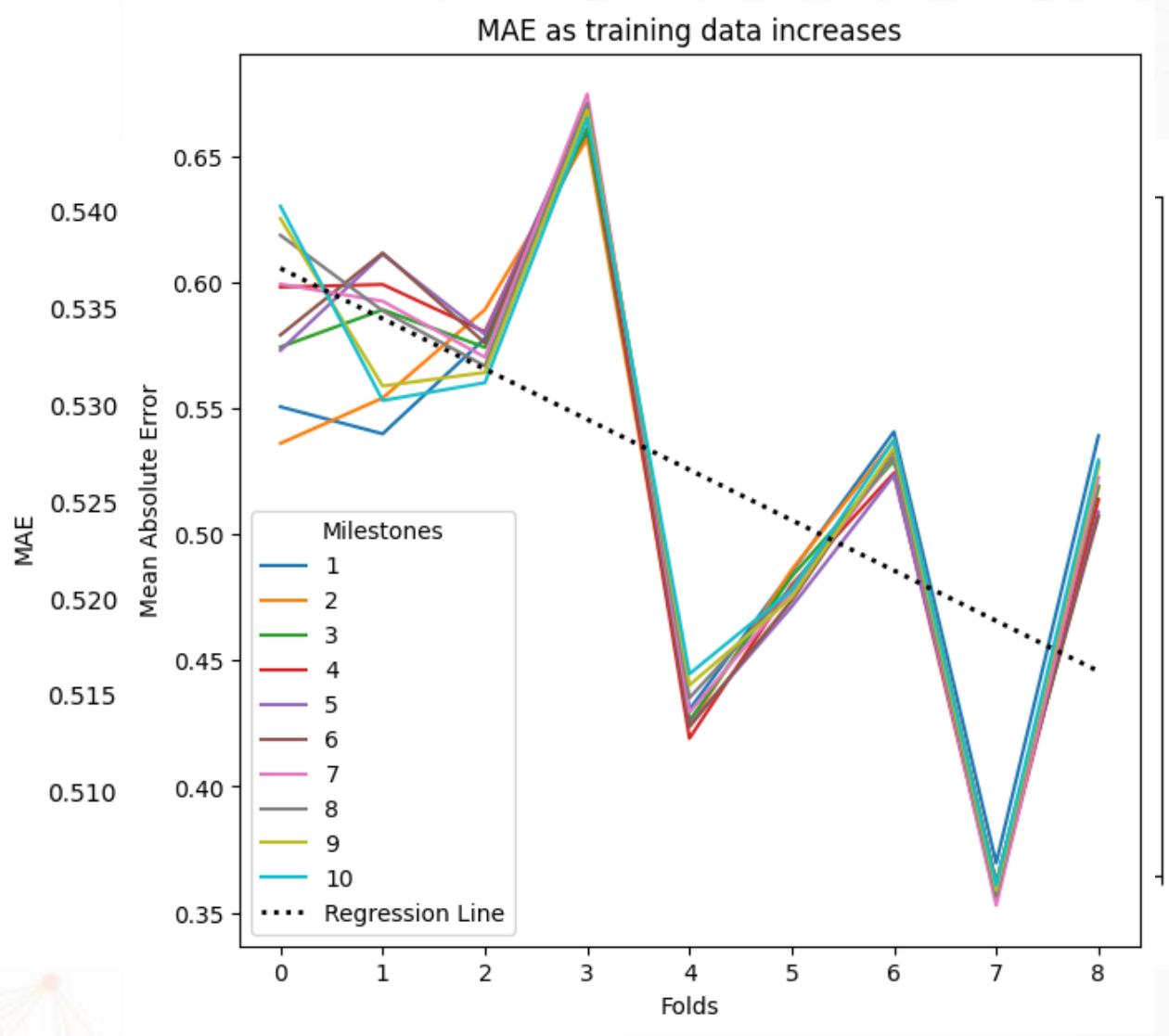
- Average distance between predicted and actual delay
- The lower the MAE, the higher the accuracy

Mean Absolute Error (MAE)

$$MAE = \frac{1}{N} \sum_{i=1}^{N} | \, Actual\ BRE_i - Estimated\ BRE_i \, |$$

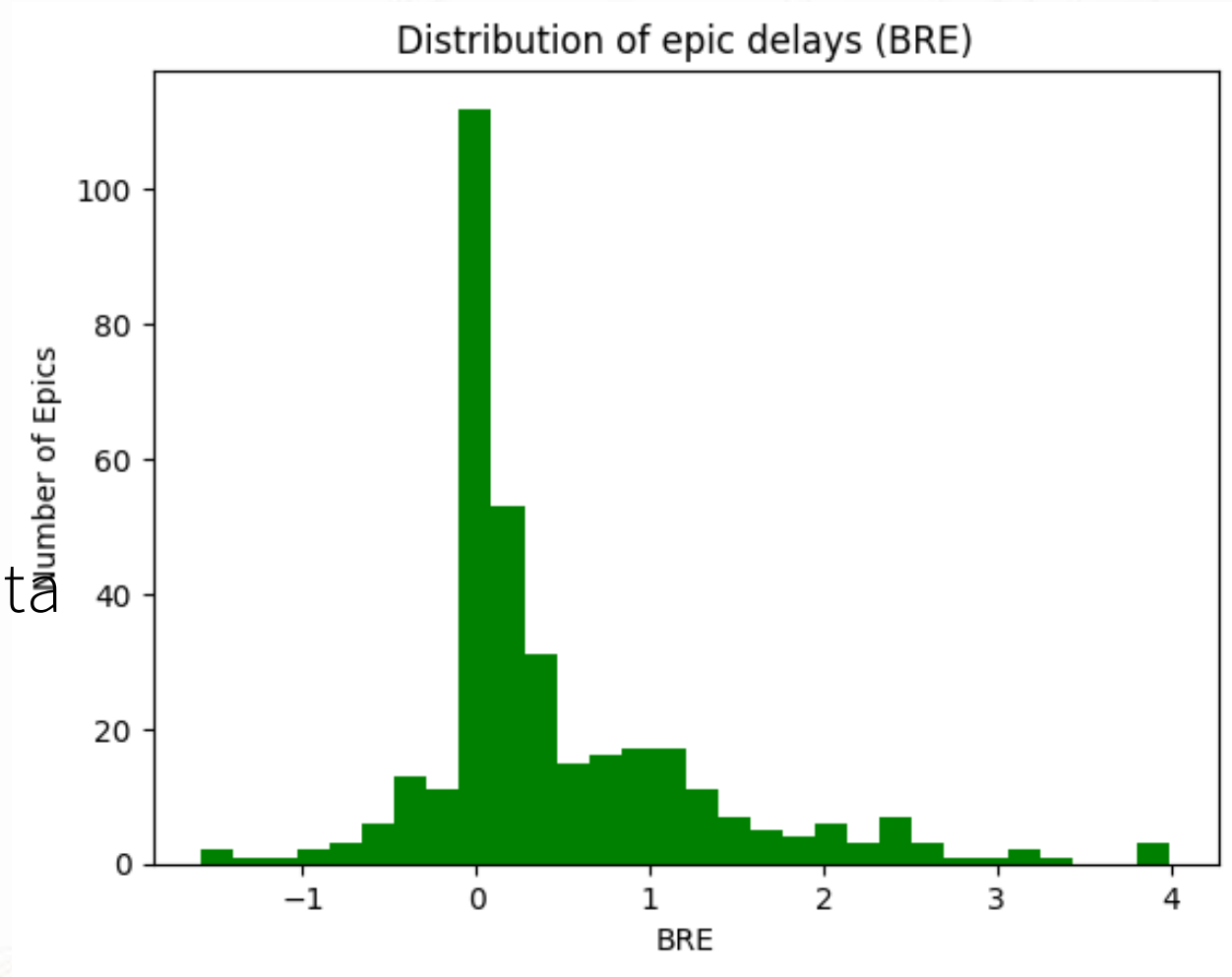
Predictive Results

- MAE ≈ 0.5
  - Off by half the epic's length
- MAE at ING: 0.19 to 0.04
- MAE goes down as amount of training data increases
  - More data, better results!



How effective is Dr. Kula's solution when applied to Coca-Cola Hellenic's Project Portfolio?

- Mean Absolute Error is 0.5
- Effective outlier detector
- Performs better with more data
- Overall, **not effective**.



Data quality is everything.
Data takes time, start today!

Does CCH really need this?
Great solutions are tailored to organizational needs, not wants.
Bottom-up change > Top-down enforcement

devon

Thank you

Gaspar Rocha