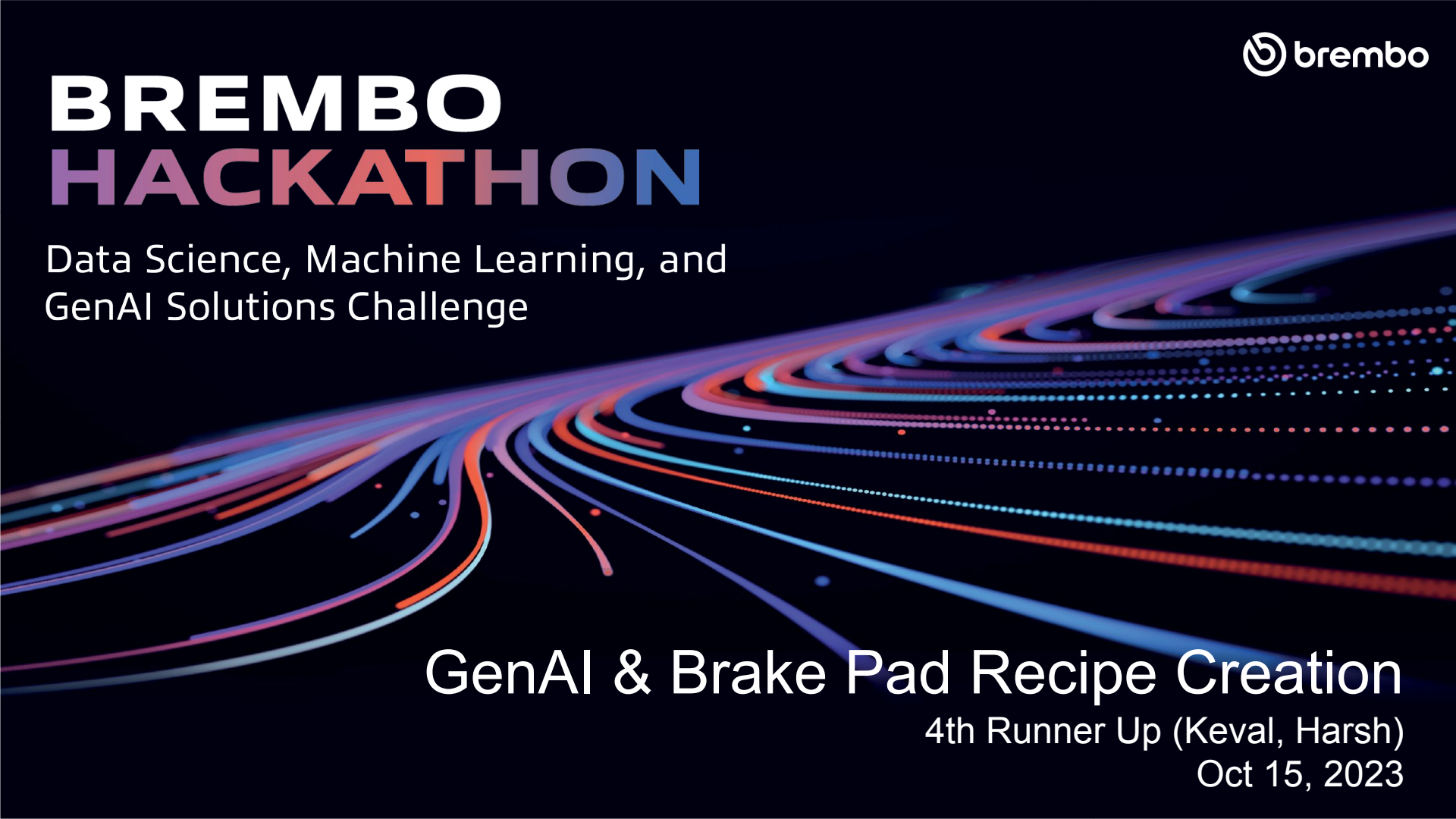
BREMBO HACKATHON

Data Science, Machine Learning, and GenAI Solutions Challenge

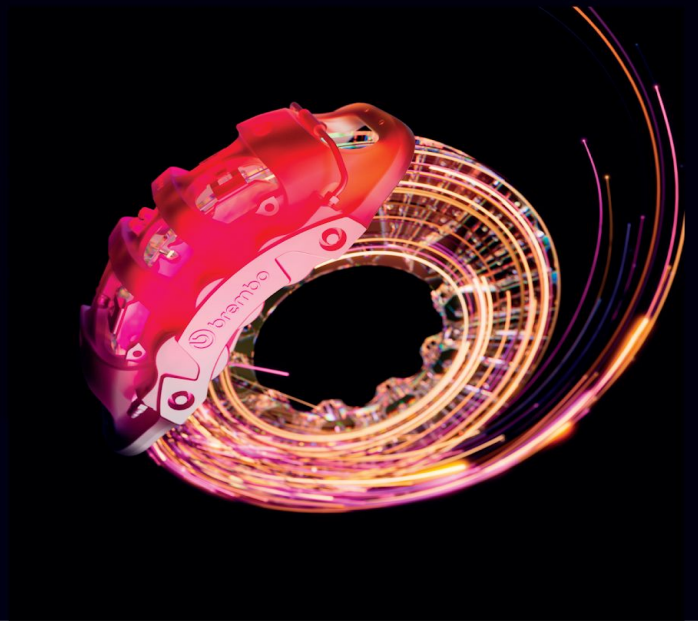


GenAI & Brake Pad Recipe Creation

4th Runner Up (Keval, Harsh)

Oct 15, 2023

OVERVIEW & METHODOLOGY



Motivation

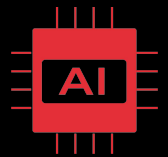
brembo

Why this challenge?

- Novelty of the challenge, opening possibilities to discover completely new compounds

What piqued our curiosity?

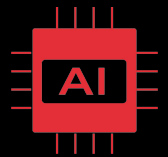
- Complexity and variation in type of dataset
- Exponential impact of the outcome, significantly reducing the amount of real-life tests needed



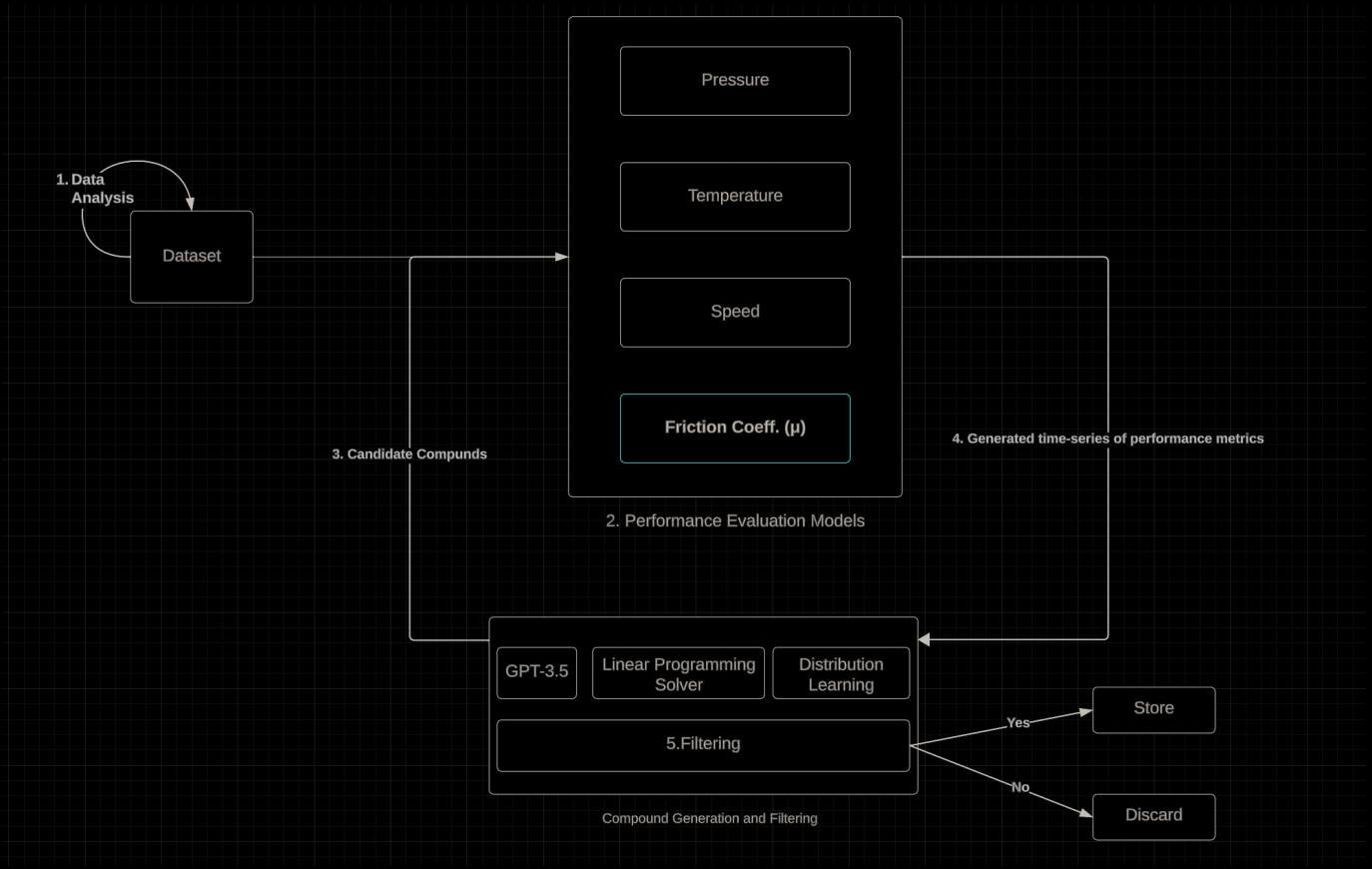
Objective

- Come up with novel and diverse compounds with $\mu = 0.6 \pm 0.1$
- Train an AI model to generate the time series values for Speed, Pressure, Temperature, and μ

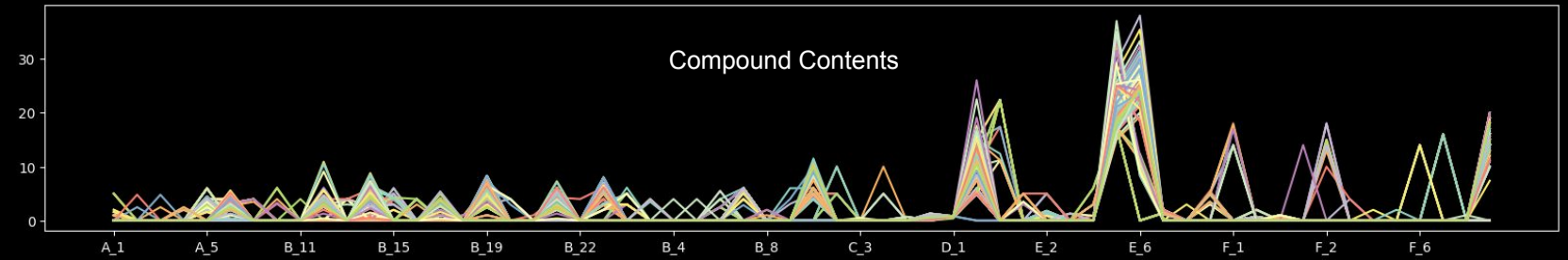
Material class code	min %	max %
A	0	12
B	1	30
C	0	18
D	0.4	1
E	45	92
F	3	27

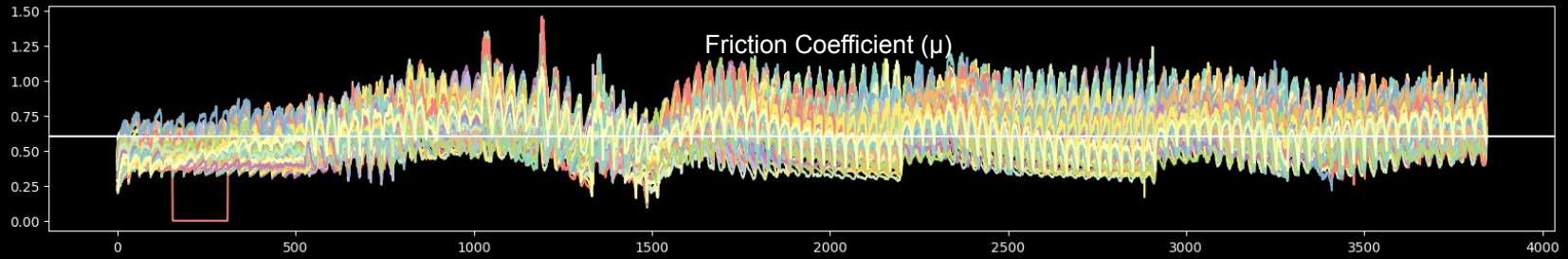


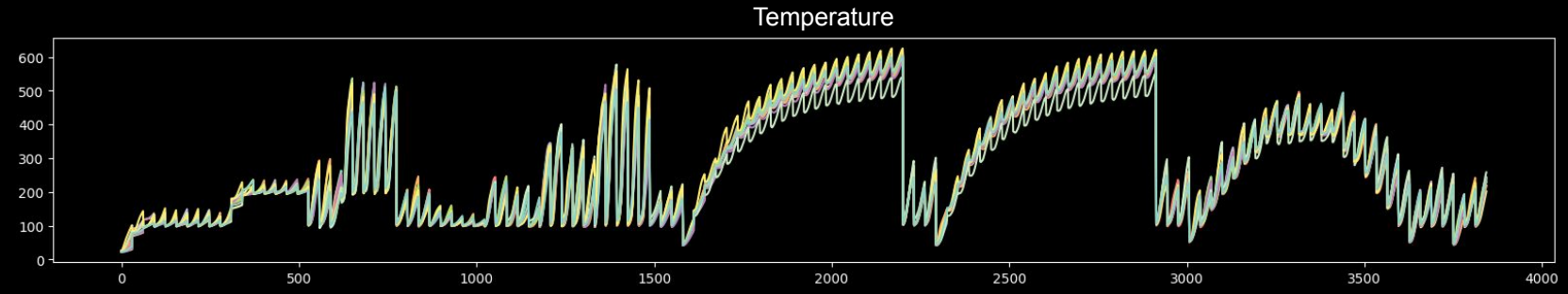
AI Approach - Overview



Data Analysis



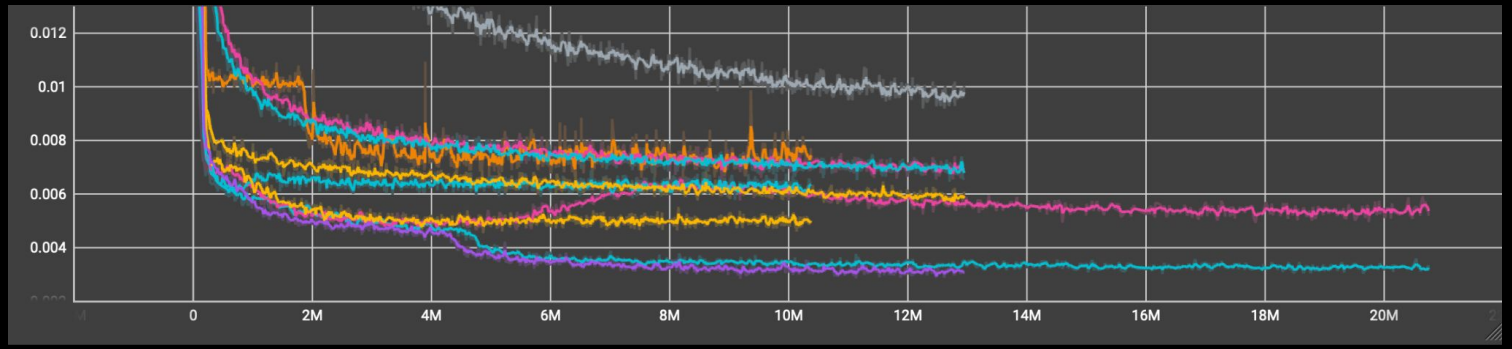




AI Approach for Performance Models

- TRIAL 1: Predict Time-series from compound composition
  - ❌ Unable to follow the expected trend
  - ❌ Not enough data to train the AI

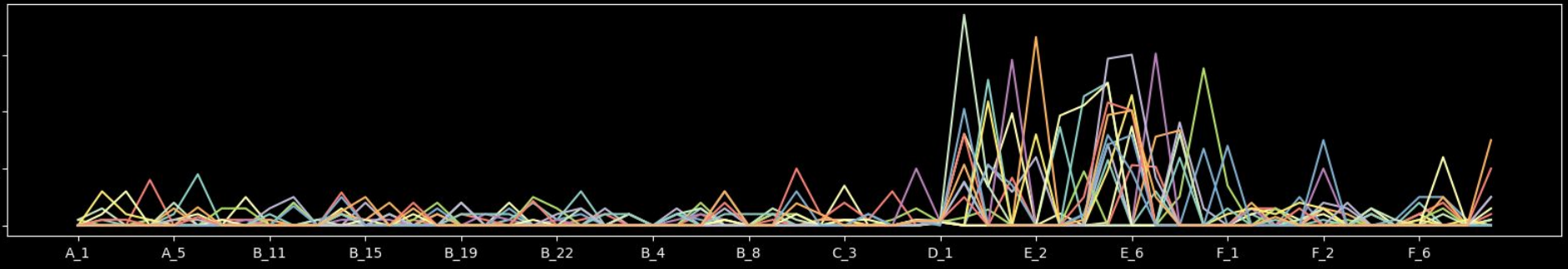
- TRIAL 2: Predict delta from average trend line
  - ✅ Easier task for the model to learn
  - ✅ Predictions can roughly follow the desired trend



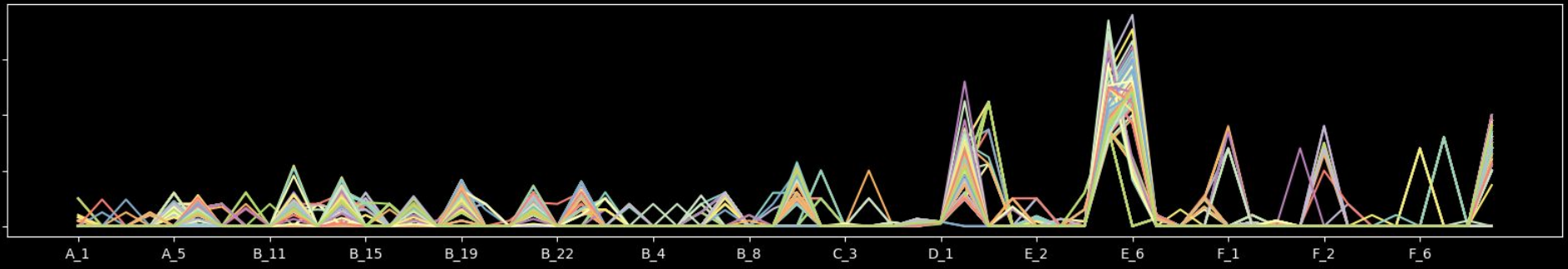
EVALUATION & RESULTS

Generated Compounds

Ours

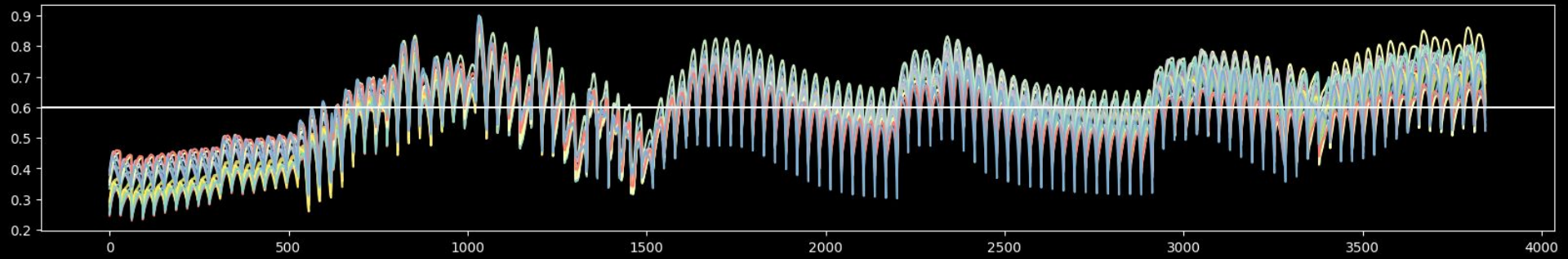


Given



Friction Coeff. (μ)

Ours



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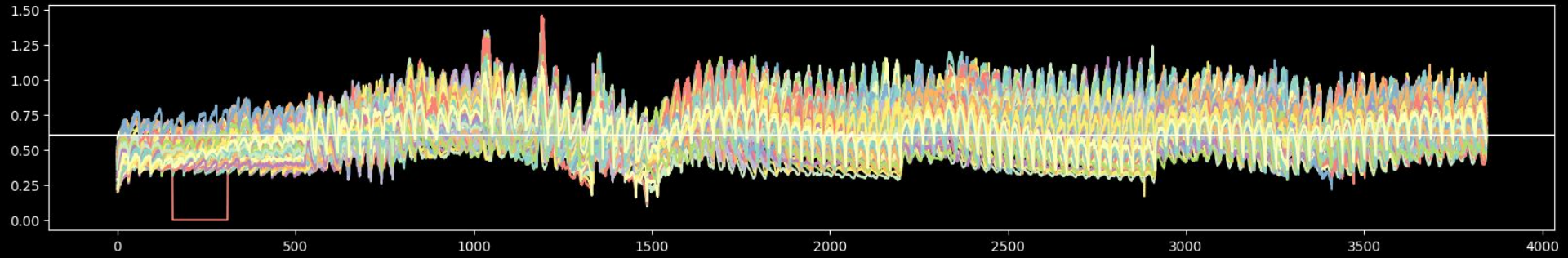
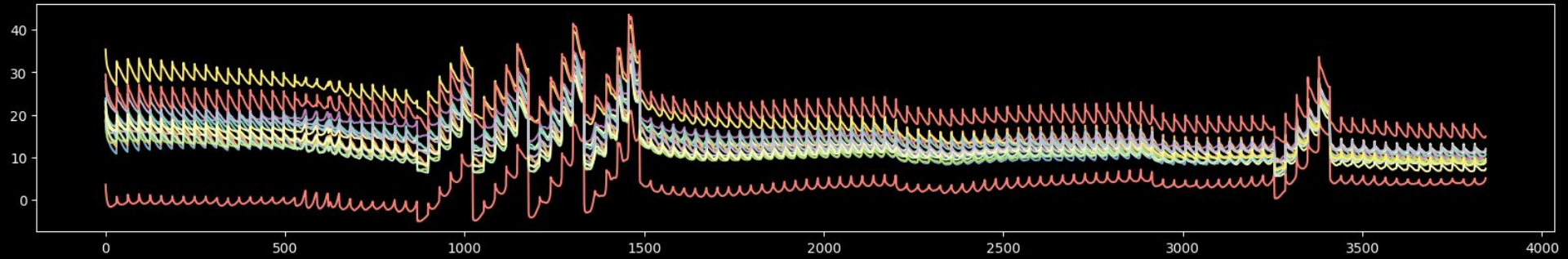


Pressure

Ours



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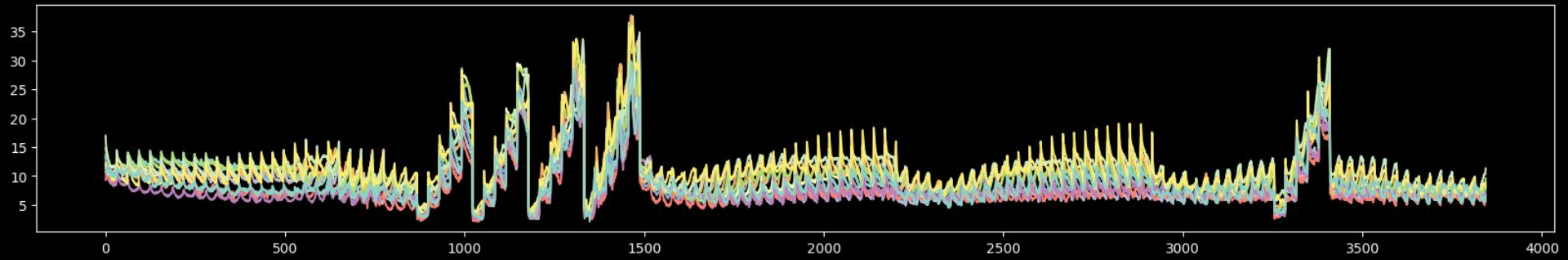
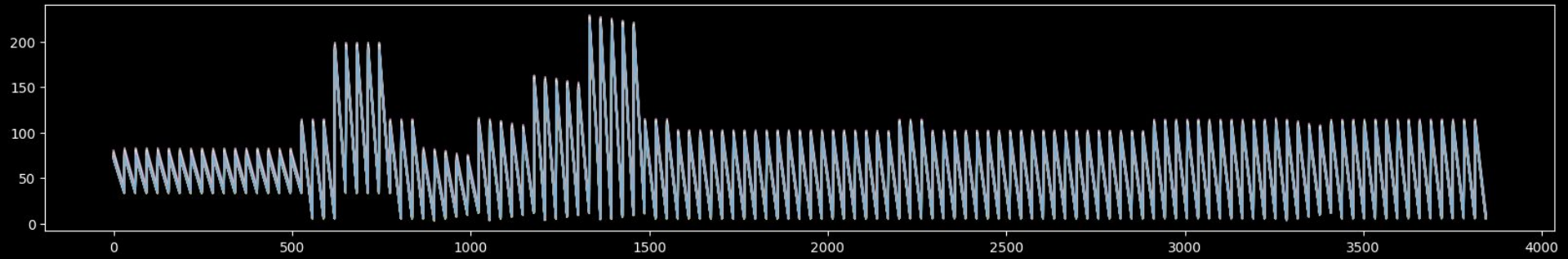


Speed

Ours



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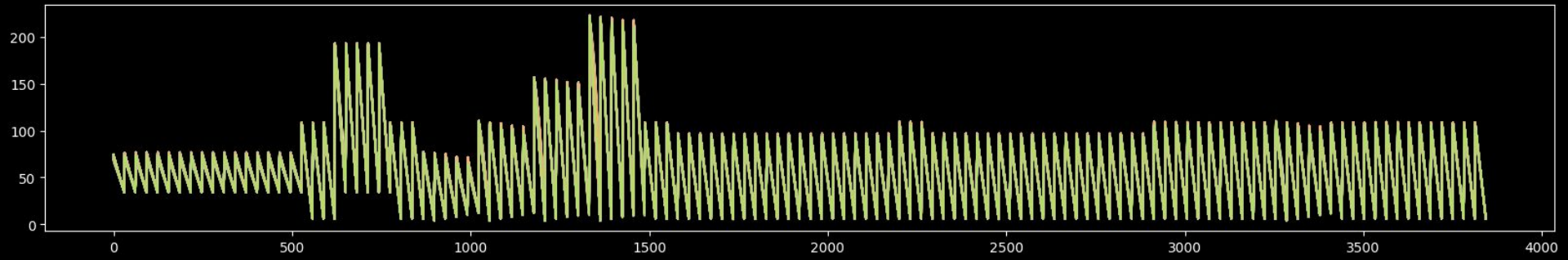
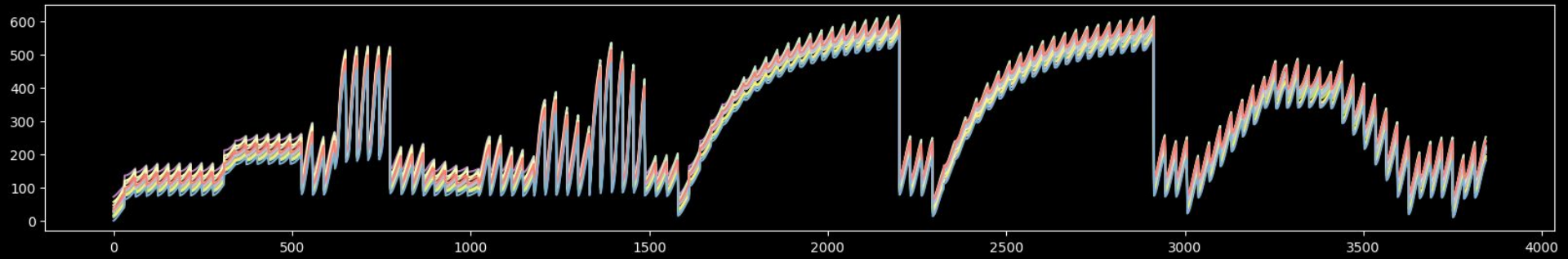


Temperature

Ours



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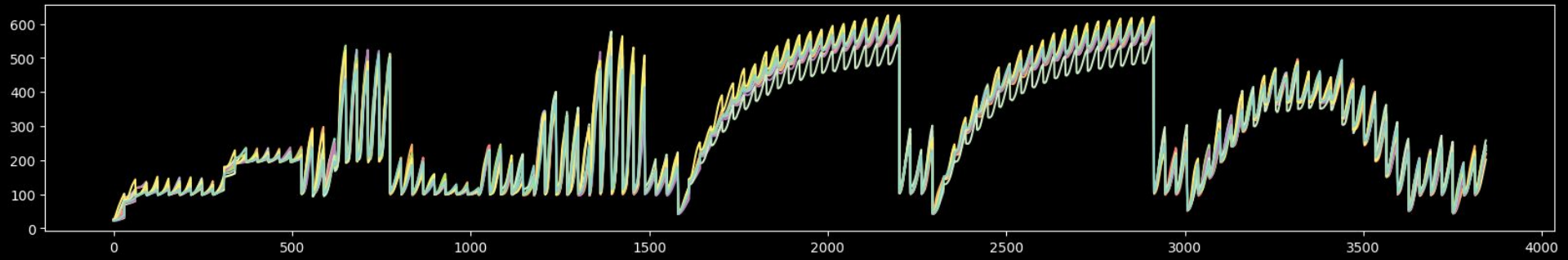


Results - 1st on Leaderboard!

- Generated 15 new compounds
- Achieved excellent score for most metrics
- Still room for improvement

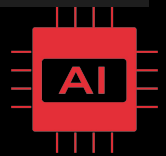
SUBMISSION RESULTS

SUBMISSION 1 ---> N/A

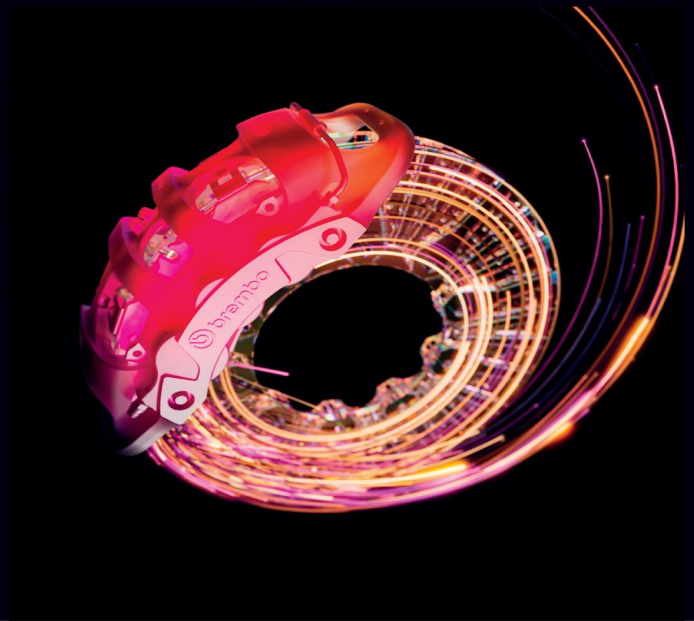
SUBMISSION 2 ---> N/A

SUBMISSION 3 ---> 100.0/100

	score_type	value
0	technical_constraints	100
1	technical_relevance	41.4946
2	technical_performance	100
3	variability	99.9995



CONCLUSIONS

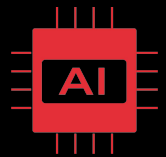


Conclusions

- Trained an excellent AI model to predict performance numbers for a new compound without actually producing and testing it
- Generated new and feasible compounds expected to perform well!

Next Steps:

- Use correlation between speed, pressure, temperature and μ
- Better algorithms for finding compounds
  - Evolutionary algorithms



QUESTIONS?