



Software Engineering & Project (COMP SCI 7015)

Snapshot Week 07 of Group RAIL PG-2

Rail Break Prediction ML

Tao Xu a1937511

Sheng Wang a1903948

Jinchao Yuan a1936476

Zi Lun Ma a1915860

Di Zhu a1919727

Xin Wei a1912958

Yifan Gu a1909803

Tianhua Zhang a1915934

Zihan Luo a1916700

Supervisor: Murtaza Bootwala

1. Product Backlog and Task Board

1.1. The product backlog

ID	Priority	User Story/Task/Spike	Description
PB1	1	Feature Engineering	Create new features based on domain knowledge and data patterns to improve model performance.
PB2	1	Feature Selection	Identify and retain the most relevant features to reduce noise and improve efficiency.
PB3	1	Model Research & Selection	Investigate suitable machine learning techniques for imbalance temporal datasets
PB4	2	Data Ingestion into InsightFactory.ai	Import the provided real-world production dataset into the InsightFactory platform.
PB5	2	Data Cleaning & Preprocessing	Handle missing values, outliers, and inconsistencies in the dataset.
PB6	2	Exploratory Data Analysis (EDA)	Analyze data distributions, trends, and anomalies to understand key characteristics.
PB7	3	Model Training	Train predictive models using the processed and engineered dataset.
PB8	3	Model Evaluation	Assess models using Accuracy, F1 Score, and AUCPR metrics.
PB9	3	Benchmark Comparison	Compare the model's performance against the InsightFactory bench mark model for potential bonus marks.
PB10	4	Model Optimization & Finalization	Fine-tune model parameters, optimize features, and prepare the final deliverable.
PB11	1	Implement Feature Engineering Methods	exploring and testing different feature transformation and construction approaches to enhance the predictive power of the dataset.
PB12	1	Implement Feature Selection Methods	applying statistical and algorithmic techniques to identify the most relevant features and reduce dimensionality for improved model efficiency.
PB13	2	Implement Machine Learning Techniques for Datasets	investigating specialized algorithms and resampling strategies to handle class imbalance effectively.
PB14	2	Training Table Preparation Implementation	Implement Training table preparation scripts, these scripts provide the fundamental data integration for the overall project pipeline.
PB15	1	Implement additional feature engineering techniques	Try out at least 2 more feature engineering techniques.

PB16	1	Implement additional feature selection techniques	Try out at least 2 more feature selection techniques.
PB17	1	Implement ML techniques for addressing imbalanced datasets	Try out at least 2 more techniques for handling imbalanced datasets.
PB18	2	Implement different ML models with hyperparameters tuning	Tuning hyperparameter of <ul style="list-style-type: none"> at least 3 different ML models feature selection, feature engineering, and imbalanced dataset handling techniques, if they have hyperparameters to tune

1.2. The task board

The task board displays the following items:

- Sprint Backlog (User Stories):**
 - RAIL-PG-2 #1: US1: As a software engineer, I want to research modelling on an imbalanced temporal dataset (user story)
 - RAIL-PG-2 #7: US2: As a software engineer, I want to try out, 1) feature engineering methods, 2) feature selection methods and 3) Machine Learning (ML) techniques (user story)
 - RAIL-PG-2 #11: US3: As a software engineer, I want to try out, 1) different models with hyperparameters tuning, 2) additional feature engineering, feature selection, and addressing imbalanced datasets techniques (user story)
- To Do (Tasks or Spikes):**
 - RAIL-PG-2 #1: This item hasn't been started
 - RAIL-PG-2 #1: US1: As a software engineer, I want to research modelling on an imbalanced temporal dataset (user story)
 - RAIL-PG-2 #1: US2: As a software engineer, I want to try out, 1) feature engineering methods, 2) feature selection methods and 3) Machine Learning (ML) techniques (user story)
 - RAIL-PG-2 #11: US3: As a software engineer, I want to try out, 1) different models with hyperparameters tuning, 2) additional feature engineering, feature selection, and addressing imbalanced datasets techniques (user story)
- In progress (Tasks or Spikes):**
 - RAIL-PG-2 #13: Implement additional feature selection techniques (task)
 - RAIL-PG-2 #14: Implement ML techniques for addressing imbalanced datasets (task)
 - RAIL-PG-2 #15: Implement different ML models with hyperparameters tuning (task)
 - RAIL-PG-2 #12: Implement additional feature engineering techniques (task)
- Done (Tasks or Spikes):**
 - RAIL-PG-2 #16: Training Table Preparation Implementation (US2) (task)
 - RAIL-PG-2 #10: Implement Machine Learning Techniques for Datasets (US2) (task)
 - RAIL-PG-2 #6: Conduct Exploratory Data Analysis (EDA) (US1) (spike)
 - RAIL-PG-2 #8: Implement Feature Engineering Methods (US2) (task)

2. Sprint Backlog and User Stories

2.1. The Sprint backlog

- **Implement different ML models with hyperparameters tuning** task
#15 opened last week by a1919727
- **Implement ML techniques for addressing imbalanced datasets** task
#14 opened last week by a1919727
- **Implement additional feature selection techniques** task
#13 opened last week by a1919727
- **Implement additional feature engineering techniques** task
#12 opened last week by a1919727
- **US3: As a software engineer, I want to try out, 1) different models with hyperparameters tuning, 2) additional feature engineering, feature selection, and addressing imbalanced datasets techniques** user story
#11 opened last week by a1919727

2.2. User stories

User story 3:

As a software engineer, I want to 1) try out different models while fine-tuning their hyperparameters, and 2) tryout additional techniques for feature engineering, feature selection, and methods for addressing imbalanced datasets, so that I can improve the test set predictions to achieve an F1 score exceeding 55%.

Related tasks:

1. Implement additional feature engineering Methods
2. Implement additional feature selection Methods
3. Implement machine learning techniques for addressing imbalanced datasets
4. Implement different machine learning models with hyperparameters tuning

3. Definition of Done

A backlog item is considered “Done” when:

Task:

- Create different branches for different tasks
- Code (including database scripts) is implemented according to acceptance criteria.
- Code has been peer-reviewed and approved if a new table is created in the final schema.
- All relevant tests (unit, integration) have been passed.
- Documentation (code comments, user guides) is updated.
- No major open defects remain.

4. Summary of Changes

This week, the feature engineering team applied resampling and four handling imbalanced datasets techniques for the total training table. The feature selection team applied RFE with LightGBM and a Transformer-GroupLasso model to assess the impact of feature selection on prediction results, submitting both to the leaderboard. For GroupLasso, they further extended

the Sprint 2 baseline by testing different feature extraction time windows for training and prediction to evaluate performance effects. The ML model training team started to tune hyperparameters for the SVM, DNN, and Transformer model. Also, they connected to datasets that were handled by different feature selection and feature engineering techniques and recorded the F1 score for every model.