MotherBoard Failure Prediction

Hemanth V

Hemanth.v1016@gmail.com

Overview

- MotherBoard (MB) is a critical component of a computer system
- Failure of MB will lead to system not booting
- MB replacement is a costly affair for the companies
- Hence it is important to predict if MB will fail and take preventive steps

Data Set Available

- Data from systems and MB are collected by companies
- Various events generated for a specific system are pushed to cloud database
- Events include Battery, SPI Flash, FAN, thermal, processor etc
- These events are available for systems where MB had to be replaced
- Similar set of events are available where MB was not replaced

Goal of MB Model

- Determine the hidden relation between events which could cause MB failure which might not be obvious

- Determine if any additional events are required

- Create a model to predict with high accuracy the likelihood of MB failure

Challenges : Are the events available sufficient to accurately predict MB failure

Data Analysis

- **Data columns (total 61 columns):**
- # Column   Non-Null Count   Dtype
- --- ------   -------------- -----
- 0   Audio   691 non-null   float64
- 1   Cables   12374 non-null   float64
- 2   Charger   10638 non-null   float64
- 3   CPU Fan   484 non-null   float64
- 4   Dell_Monitor_IR   2 non-null   float64
- 5   Disk 1   12646 non-null   float64
- 6   Disk 2   2212 non-null   float64
- 7   Disk 3   30 non-null   float64
- 8   Disk 4   6 non-null   float64
- 9   FailSafeEC_1   2772 non-null   float64
- 10   FailSafeEC_2   5 non-null   float64

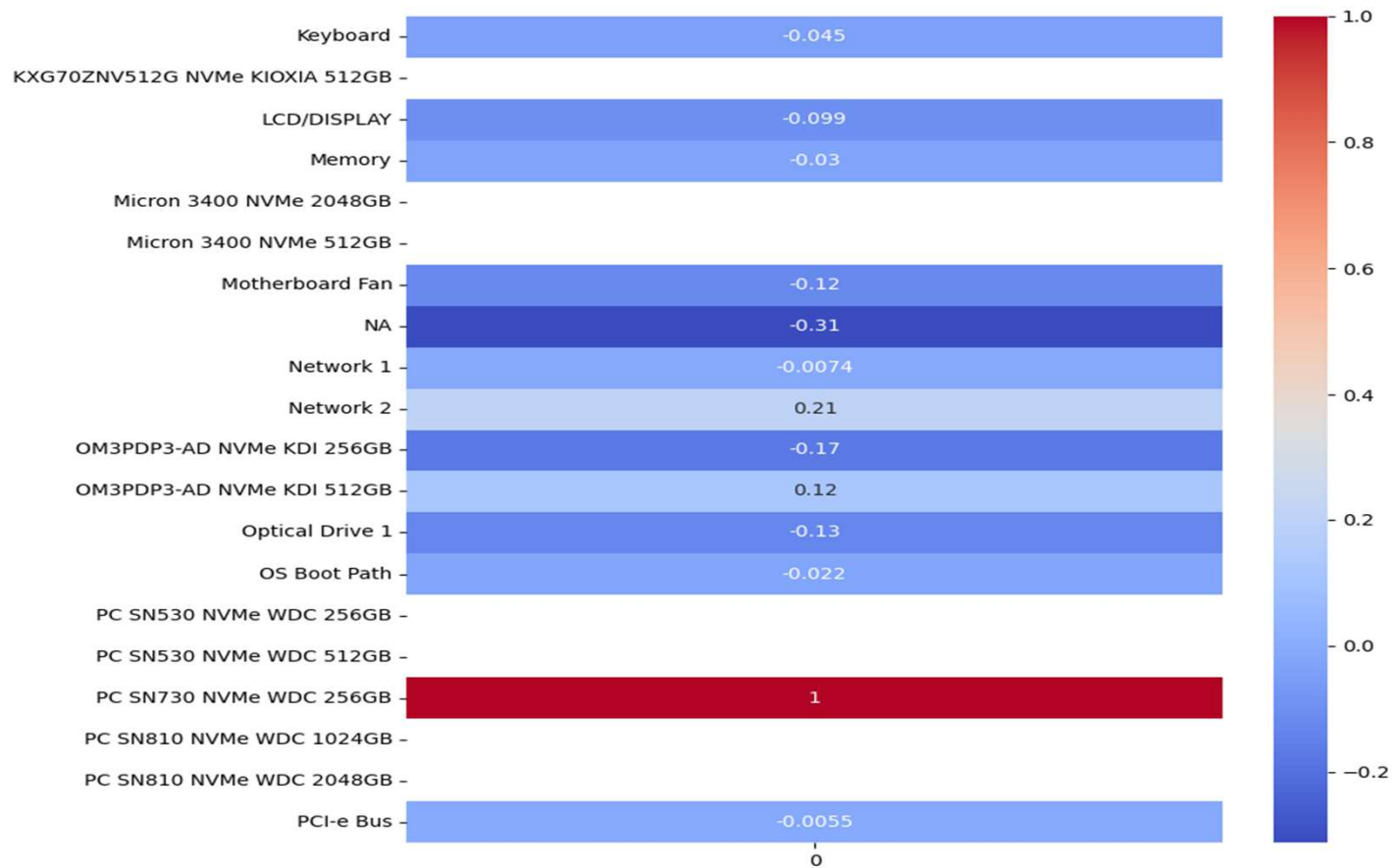**DataFrame Shape (25358, 61)**

Output Variable in Column 60
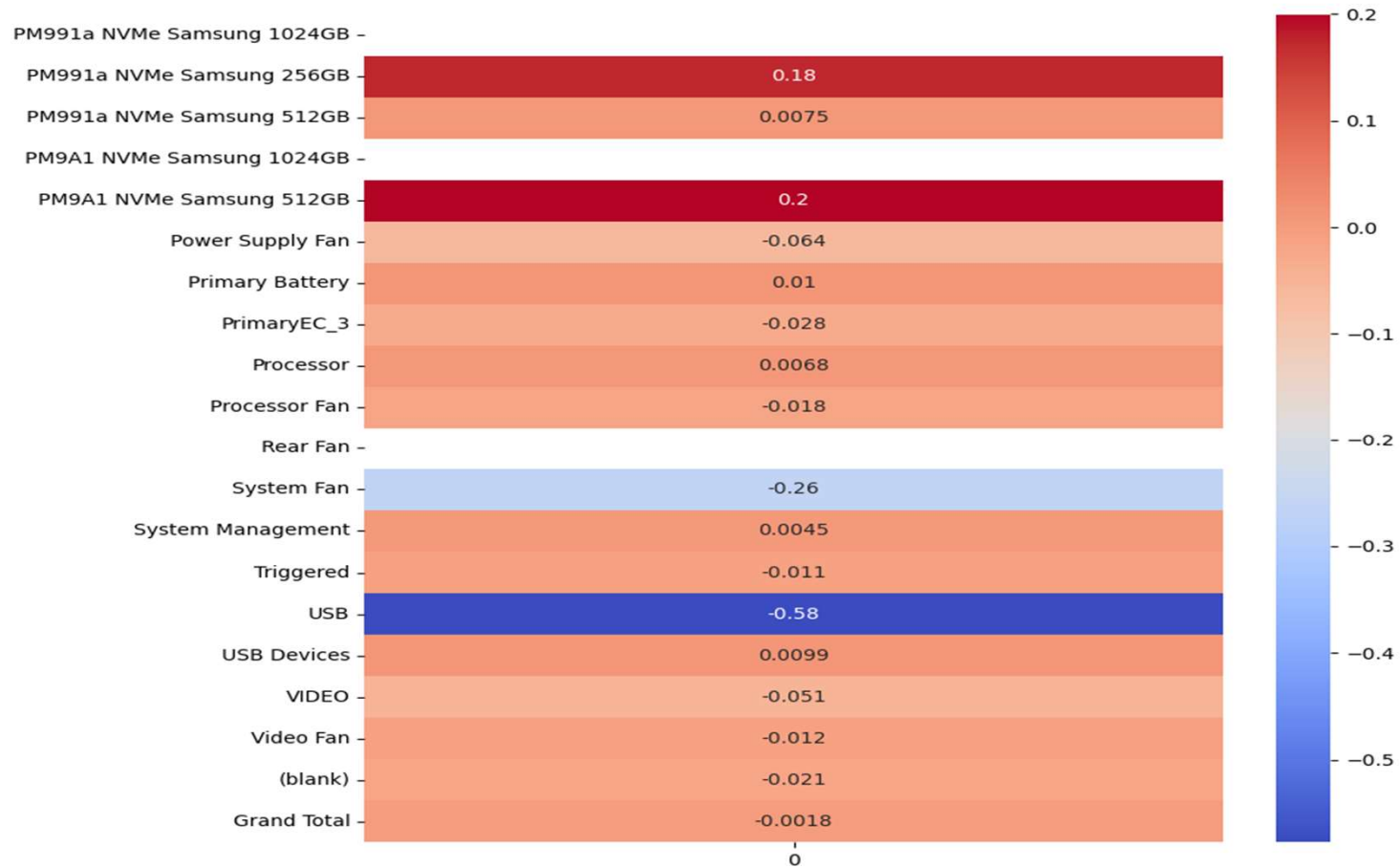
60   Dispatch   25358 non-null   int64

Heatmap Analysis for features
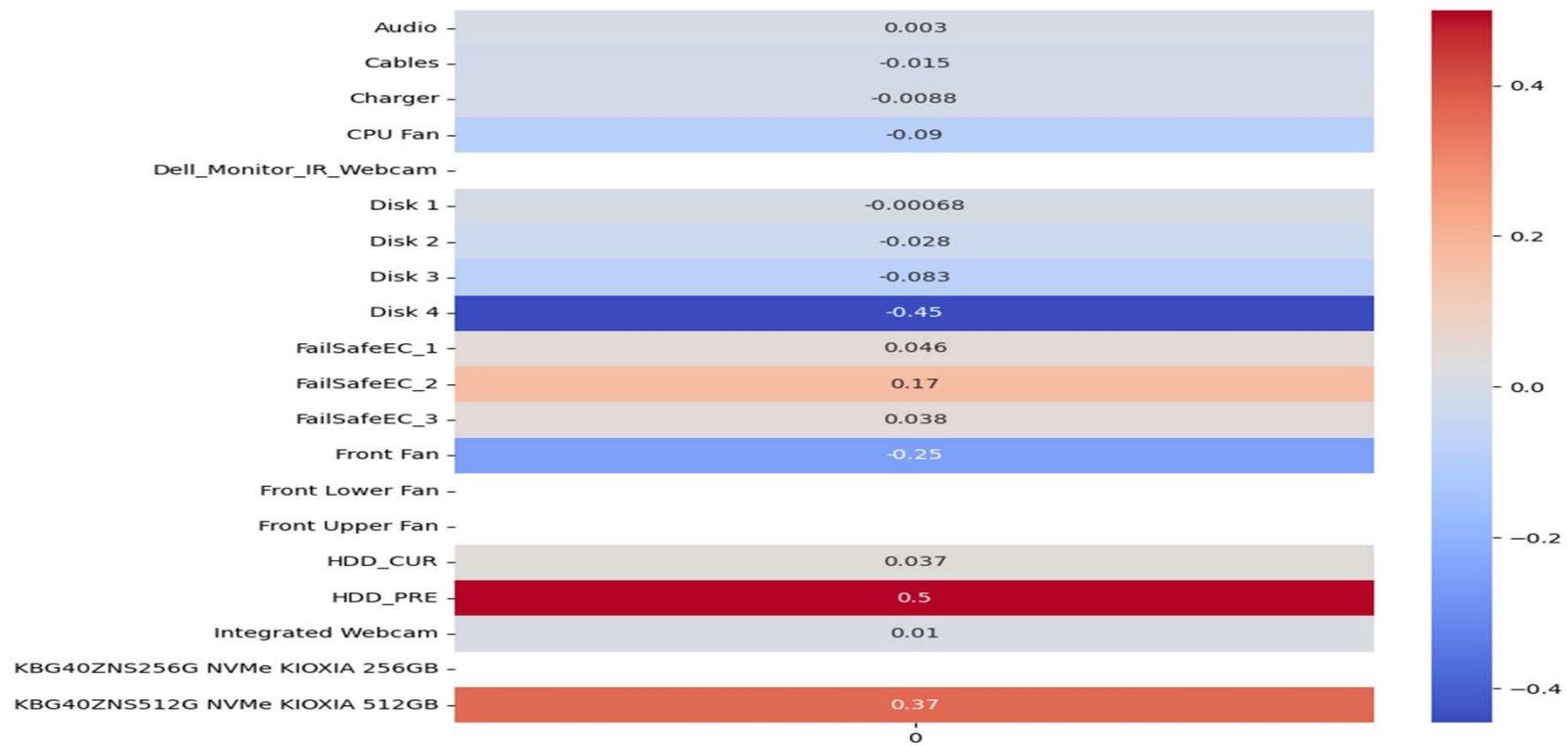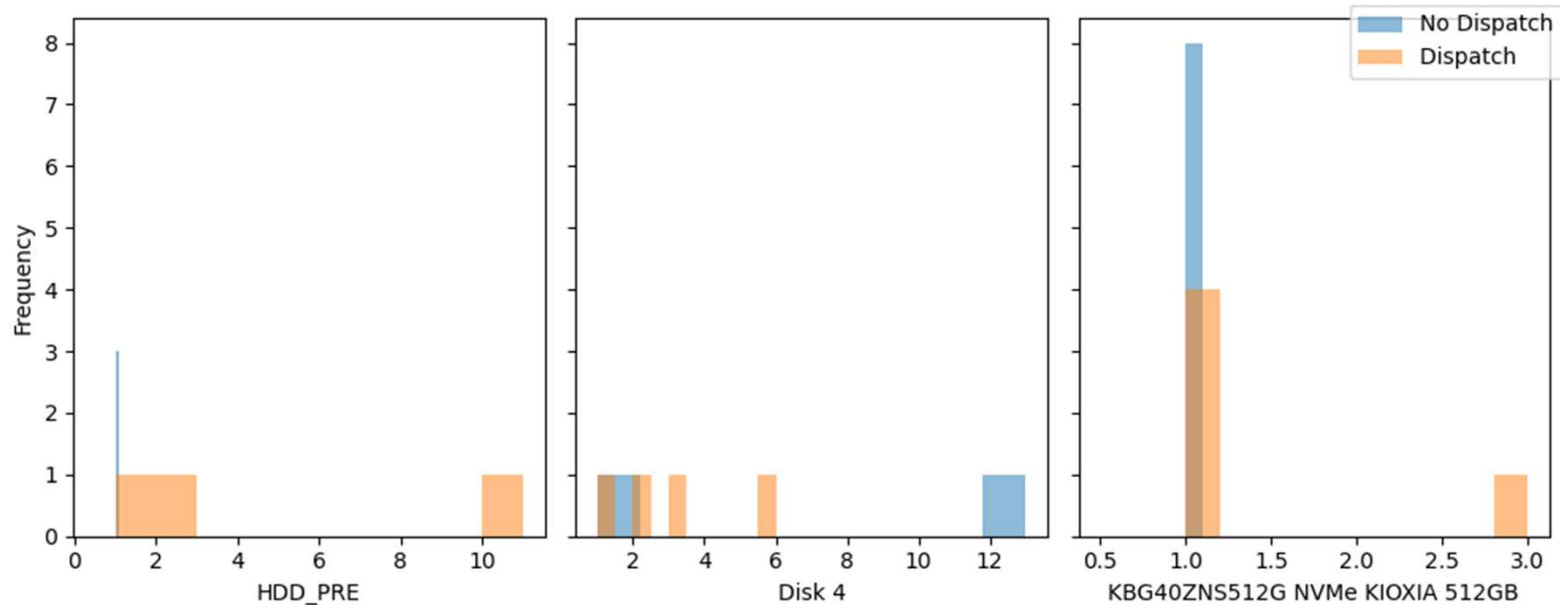
Heatmap Analysis for features
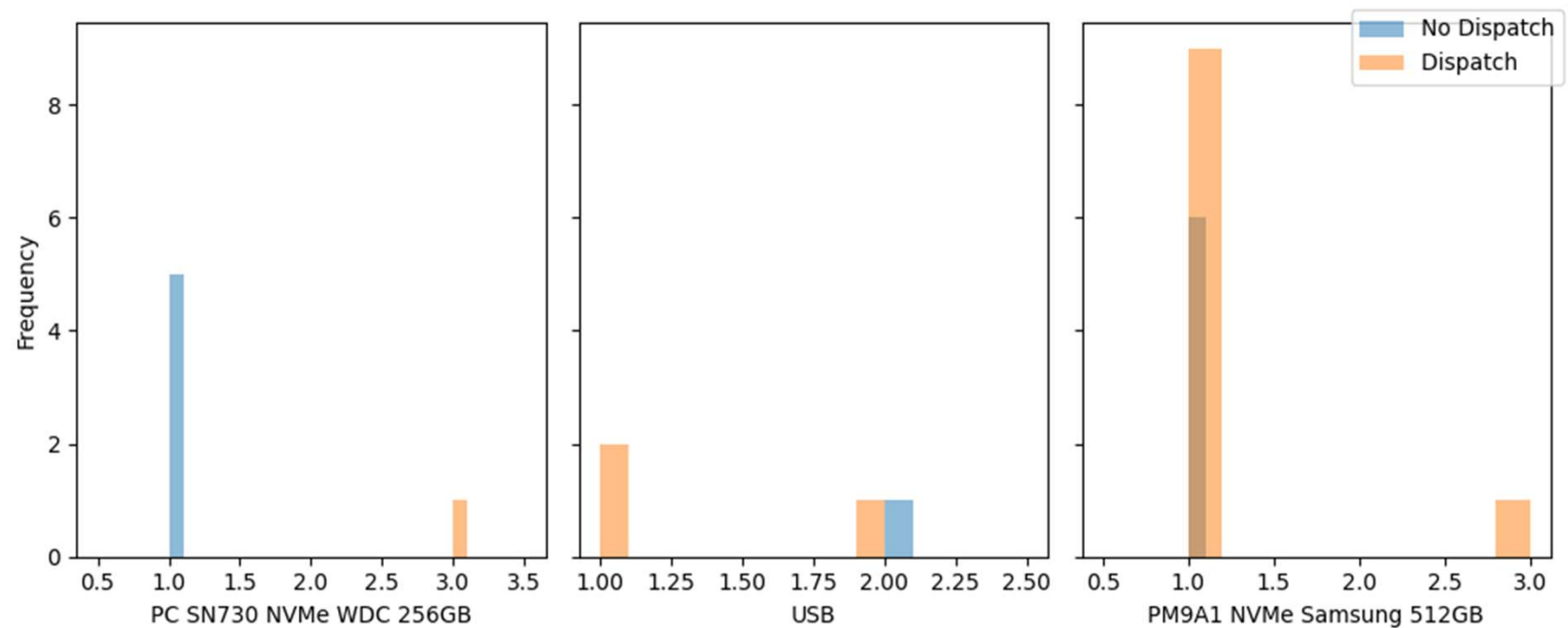
Heatmap Analysis for features

Histogram for features with high correlation

Histogram for features with high correlation

Model 1 : LDA + LG

- Goal to use Dimensionality reduction and Logistic Regression
- All NaN replaced with zero in dataframe
- Data set is split for train, test in the ratio of 80,20
- Standard scalar applied to both train and test dataset
- Data is transformed with LDA
- Transformed data fitted into Logistic Regression Model
- Metrics calculated for the model

Model 1 : LDA + LG

LDA MB Replacement Required: PRC curve
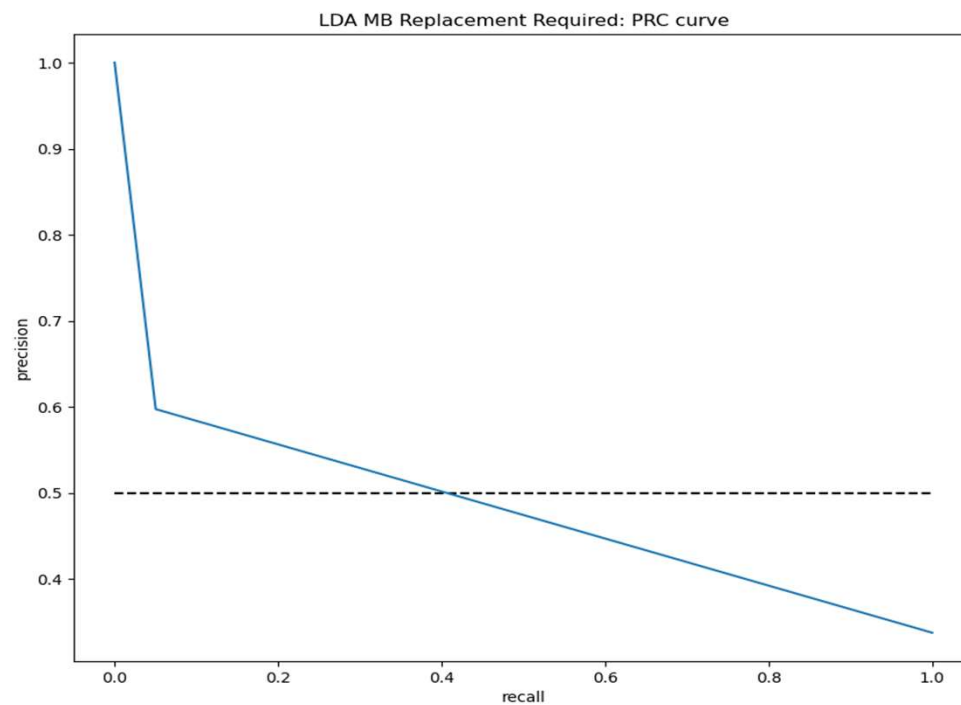
F1 Score (average=macro)
0.4448410991217211

Precision Score (average=macro)
0.6337369227994227

Recall Score (average=macro)
0.5165031176361854

Model 1 : XGBOOST

- XGBOOST one of the popular models
- All NaN replaced with zero in dataframe
- Data set is split for train, test in the ratio of 80,20
- Training data is fed into XGBClassifier
- Hyper parameters used
  - objective='binary:logistic', n_estimators=100, seed=123
- Metrics calculated for the model

Model 2 : XGBOOST

XGBOOST MB Replacement Required: PRC curve
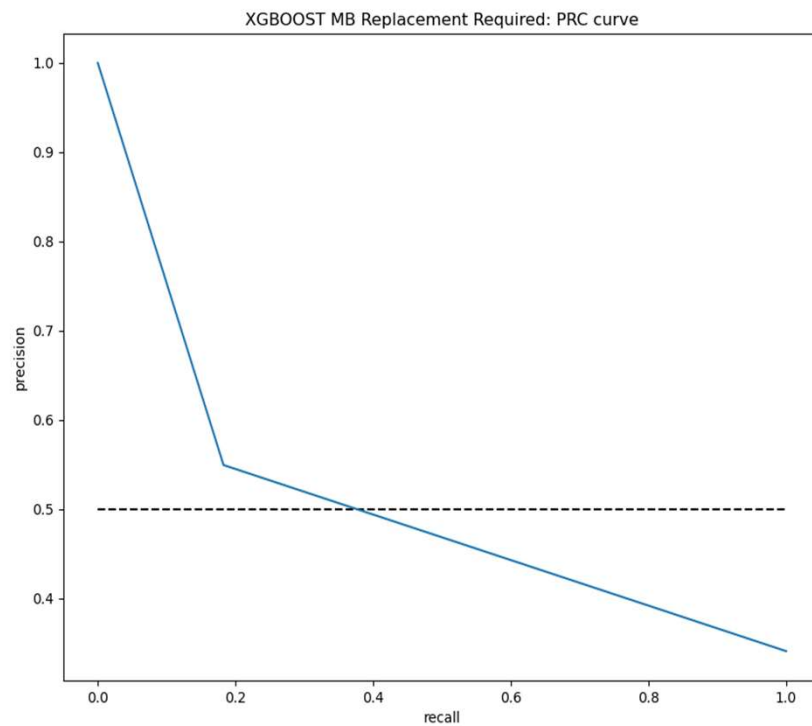
F1 Score (average=macro)
0.5303832359422089

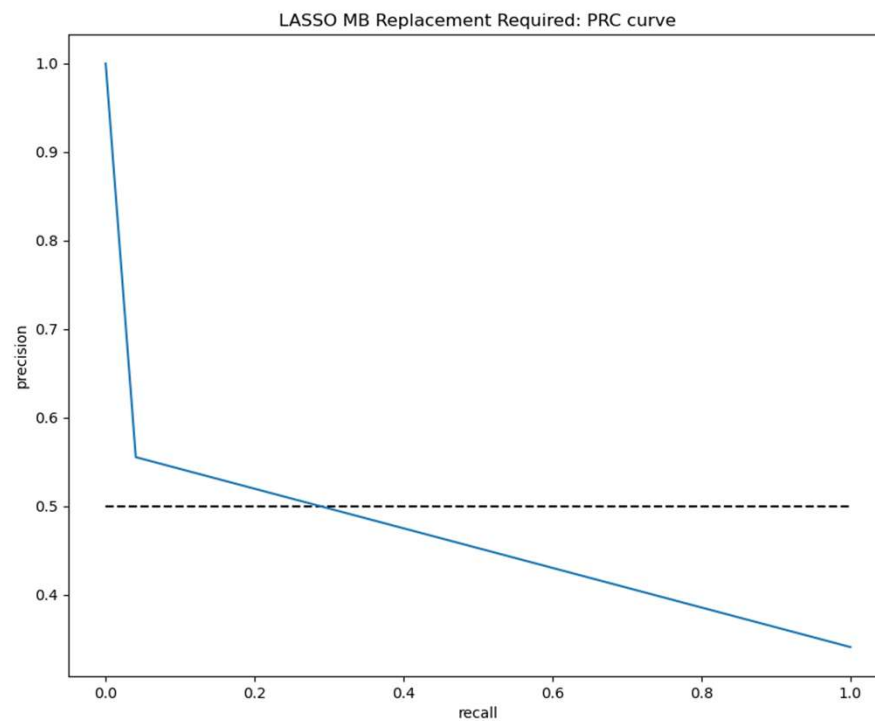Precision Score (average=macro)
0.6175666869700573

Recall Score (average=macro)
0.552580227823843

Model 3 : LASSO + LG

- Goal is to do feature selection using LASSO and then feed into logistic regression model

- Feature selection done using SelectFromModel function

- 48 input features were selected out of 60

- Selected feature are fit into logistic regression model

- Model parameters calculated

Model 3 : LASSO + LG
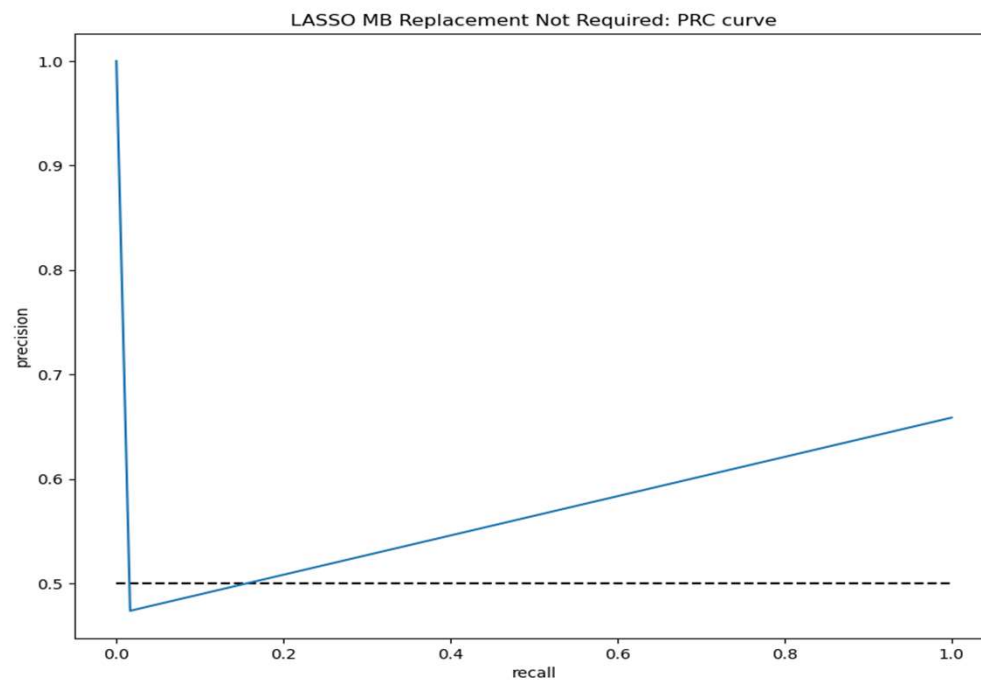

LASSO MB Replacement Required: PRC curve

F1 Score (average=macro)
0.4341923512182133

Precision Score (average=macro)
0.609965404142517

Recall Score (average=macro)
0.5118529972360879

Conclusion

LASSO MB Replacement Not Required: PRC curve

F1 Score (average=macro)
0.792239093757532

Precision Score (average=macro)
0.6632364810330912

Recall Score (average=macro)
0.9835427887492519

Conclusion

- All models considered behave similarly

- Model able to predict MB replacement not required class with high precision and recall

- Current events not sufficient to predict the other class accurately

Actual Positive : Class 0, No MB replacement required
Actual Negative: Class 1, MB replacement required

	Predicted Positive 0	Predicted Negative 1
Actual Positive 0	TP	FN Recall very high, hence FN low
Actual Negative 1	FP	TN