APS Failure at Scania Trucks Data Set

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For this assigment I used the following supervised learning methods:

- Random Forest
- Extreme Gradient Boosting (XGBoost)

Dataset

Abstract

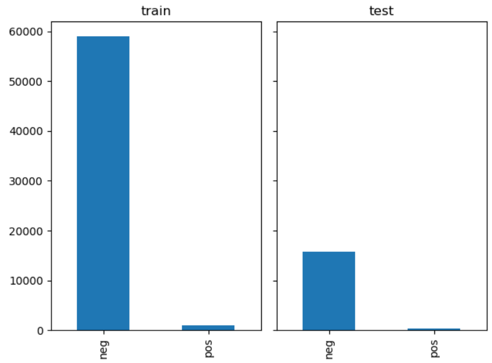
According to the datasets' description, positive class consists of component failures for a specific component of the APS system. The negative class consists of trucks with failures for components not related to the APS. The attribute names of the data have been anonymized for proprietary reasons

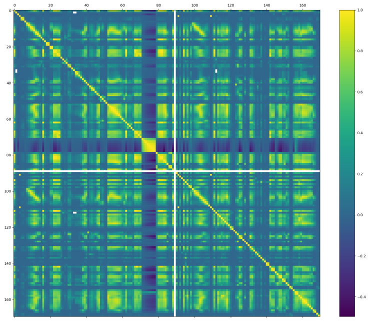
The dataset contains 170 features and 60000 samples for the training set

Exploratory Data Analysis

During EDA the followings things were observed:

- I had to skip some lines from the csv files because it contained description
- classes are strong imbalanced (98.3% are negative, only 1.6)
- a lot of `NA` values
- a lot of 0 values
- some of the features tend to correlated beteen them (see the correlatioin matrix)





RandomForest Classifier

Description

Random forests or random decision forests are an ensemble learning method for classification, regression and other tasks that operates by constructing a multitude of decision trees at training time and outputting the class that is the mode of the classes or mean prediction of the individual

Basic model

```
rf = RandomForestClassifier(max_depth=100)
rf.fit(X_train, Y_train)

imp.fit(X_test)
X_test = imp.transform(X_test)
Y_pred = rf.predict(X_test)
cm = confusion_matrix(Y_test, Y_pred)
cost_confusion_matrix(cm)
#Restult is 67700
```

Tuning hyperparameters

To find the optimal hyperparameters, its commont to think of set of candidate hyper parameters, train models and compare their performance via cross validation. Where there are many parameters `Randomized Search Cross Validation` is recommended 1

We're doing a RandomSearchCV

```
{
'bootstrap': [True, False],
 'max_depth': [10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, None],
 'max_features': ['auto', 'sqrt'],
 'min_samples_leaf': [1, 2, 4],
 'min_samples_split': [2, 5, 10],
 'n_estimators': [2, 7, 13, 18, 24, 29, 35, 40, 46, 52]
}
```

And we get best params

```
{
'n_estimators': 40,
'min_samples_split': 5,
'min_samples_leaf': 1,
'max_features': 'sqrt',
'max_depth': 70,
'bootstrap': False
}
```

Our cost 51200.

Other random forest

```
{
'n_estimators': [100, 311, 522, 733, 944, 1155, 1366, 1577, 1788, 2000],
'max_features': ['auto', 'sqrt'],
'max_depth': [10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, None],
'min_samples_split': [2, 5, 10],
'min_samples_leaf': [1, 2, 4],
'bootstrap': [True, False]
}
```

Finished in about 13 hours `[Parallel(n_jobs=-1)]: Done 300 out of 300 | elapsed: 795.3min finished`

Best parameters

```
{
'n_estimators': 311,
'min_samples_split': 2,
'min_samples_leaf': 1,
'max_features': 'sqrt',
'max_depth': None,
'bootstrap': False
}
```

52690

Feature selection

We try to reduce dimensionality and I used `SelectFromModel`. From 170 features, my model got down to 43 features

Referencess

1. Géron, A. (2017), Hands-on machine learning with Scikit-Learn and TensorFlow : concepts, tools, and techniques to build intelligent systems , O'Reilly Media , Sebastopol, CA .