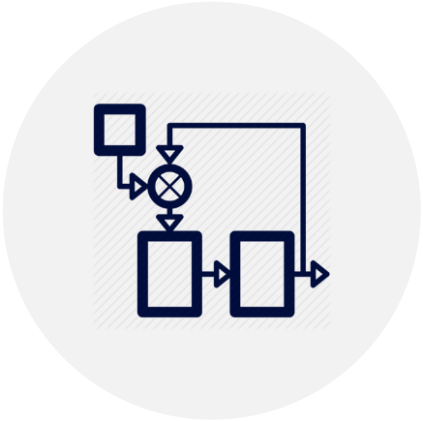
FAULT DETECTION

SAMPLE METHODOLOGIES EXPLAINED

PROGNOSTICS HEALTH MANAGEMENT (PHM) - PROCESS OF PREDICTING THE FUTURE RELIABILITY OF A PRODUCT BY ASSESSING THE EXTENT OF DEVIATION OR DEGRADATION OF A PRODUCT FROM ITS EXPECTED NORMAL OPERATING CONDITIONS

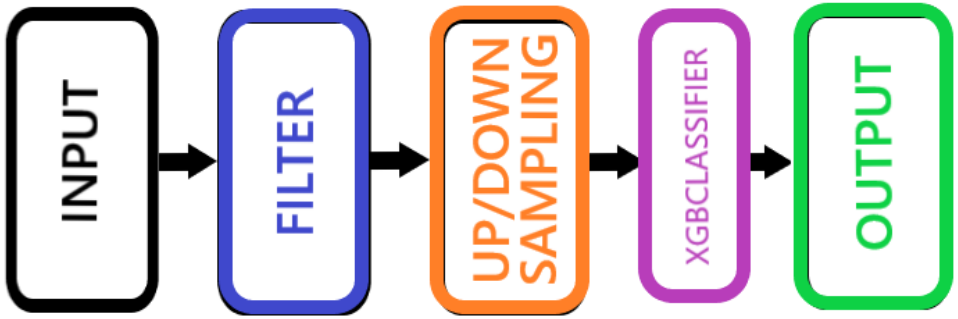
EXPENDABLE DEVICES

PERFORMANCE PARAMETERS

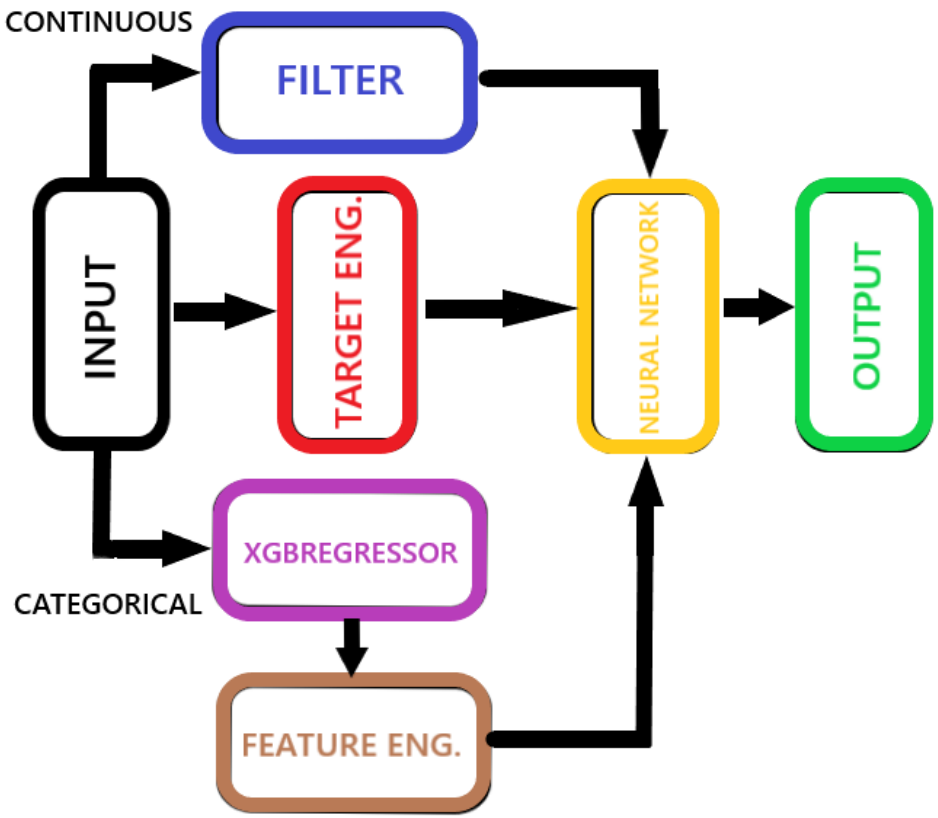


DAMAGE MODELING

DAMAGE MODELING

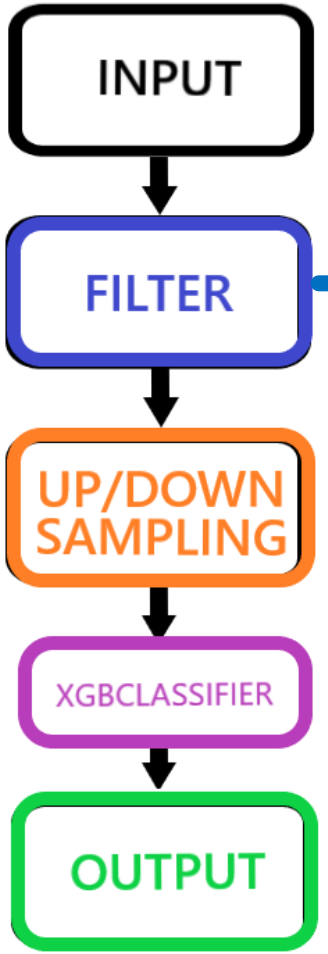


FAULT CLASSIFICATION

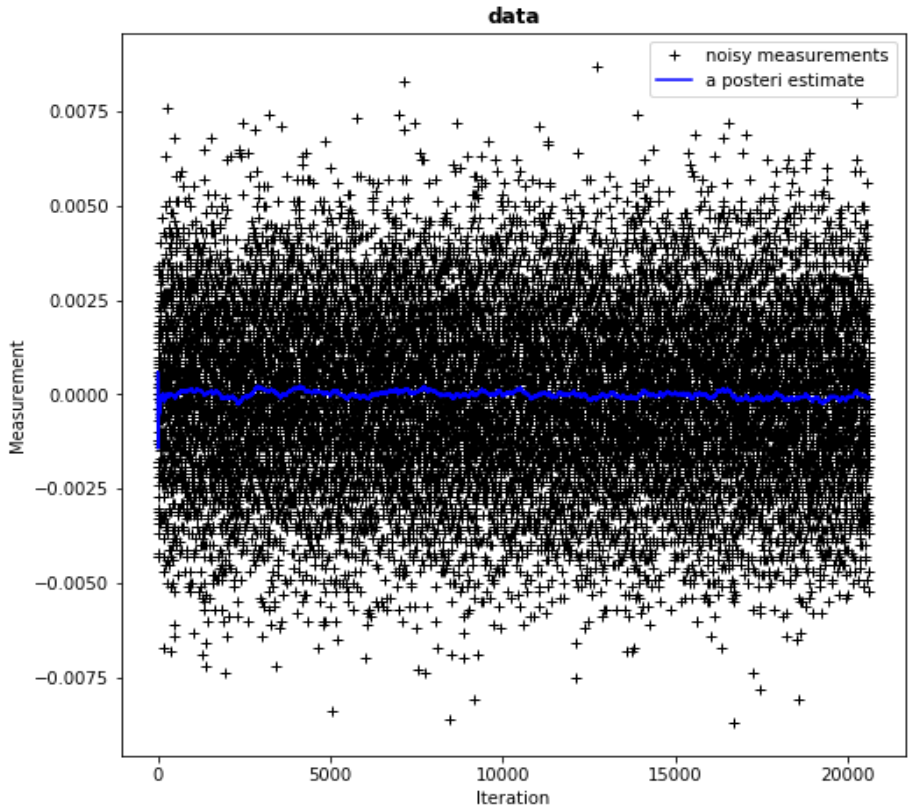


REMAINING USEFUL LIFE

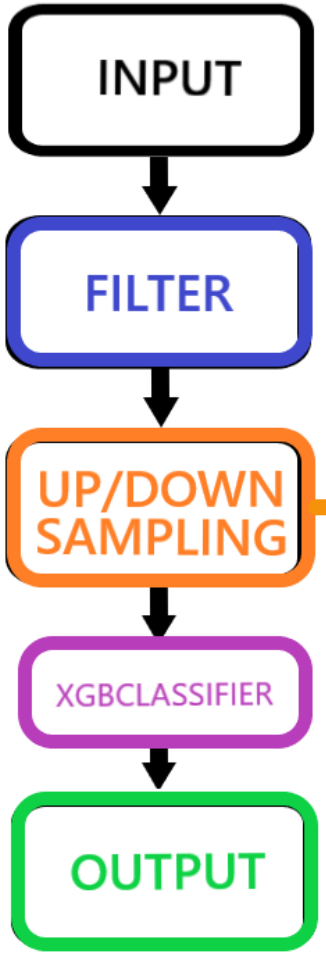
KALMAN FILTER



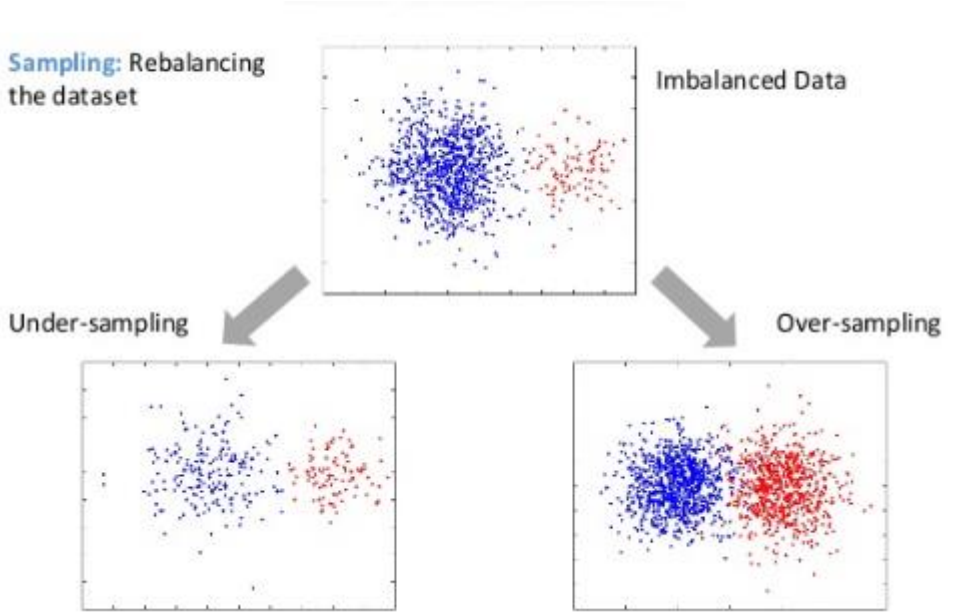
AKA: **linear quadratic estimation (LQE) uses a series of measurements observed over time,** containing statistical noise and other inaccuracies, and produces estimates of unknown variables that tend to be more precise than those based on a single measurement alone.



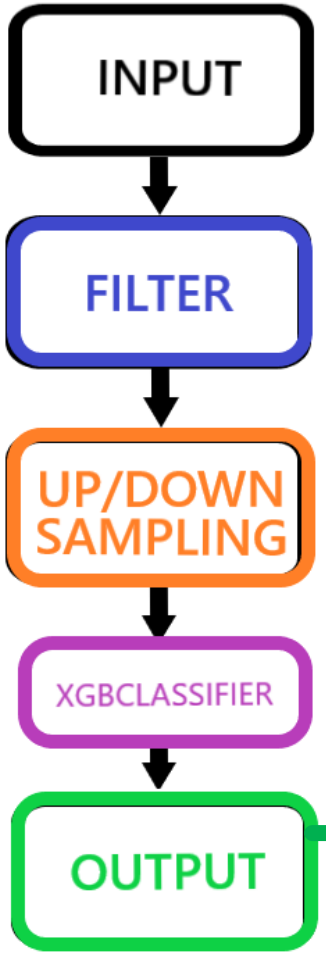
UP / DOWN SAMPLING



SMOTE stands for Synthetic Minority / Majority Oversampling Technique. This is a statistical technique for increasing or decreasing the number of cases in your dataset in a balanced way. The module works by generating new or removing instances from existing cases that you supply as input. This implementation of SMOTE does not change the number of non-target cases.

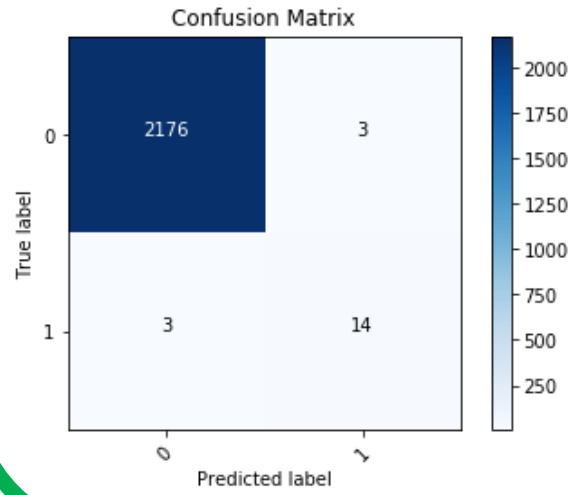


RESULTS



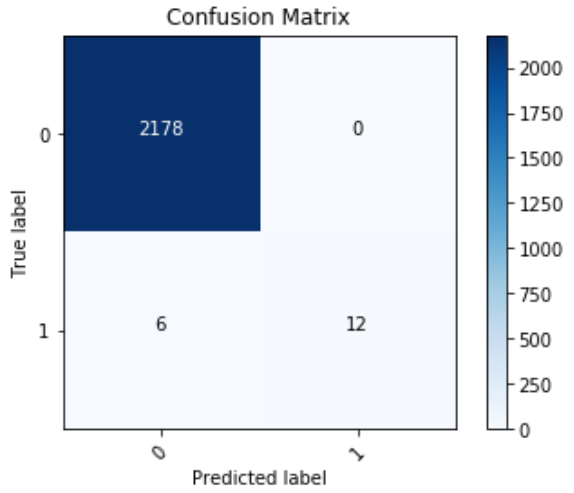
Out-Of-Box

PRECISION: 0.91
RECALL: 0.91
F1: 0.91
CROSS-VAL: 0.997



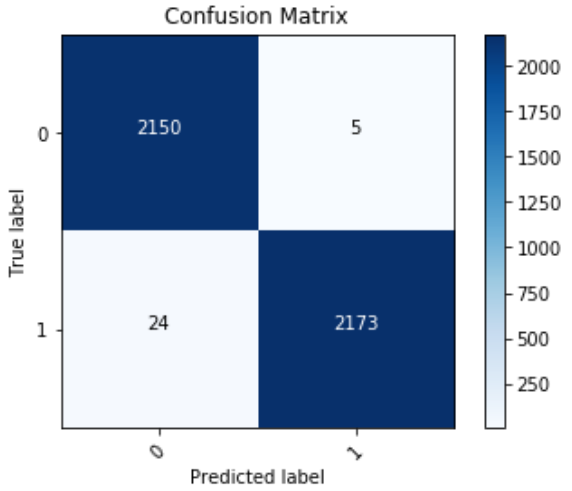
After Filter

PRECISION: 1.00
RECALL: 0.83
F1: 0.90
CROSS-VAL: 0.997

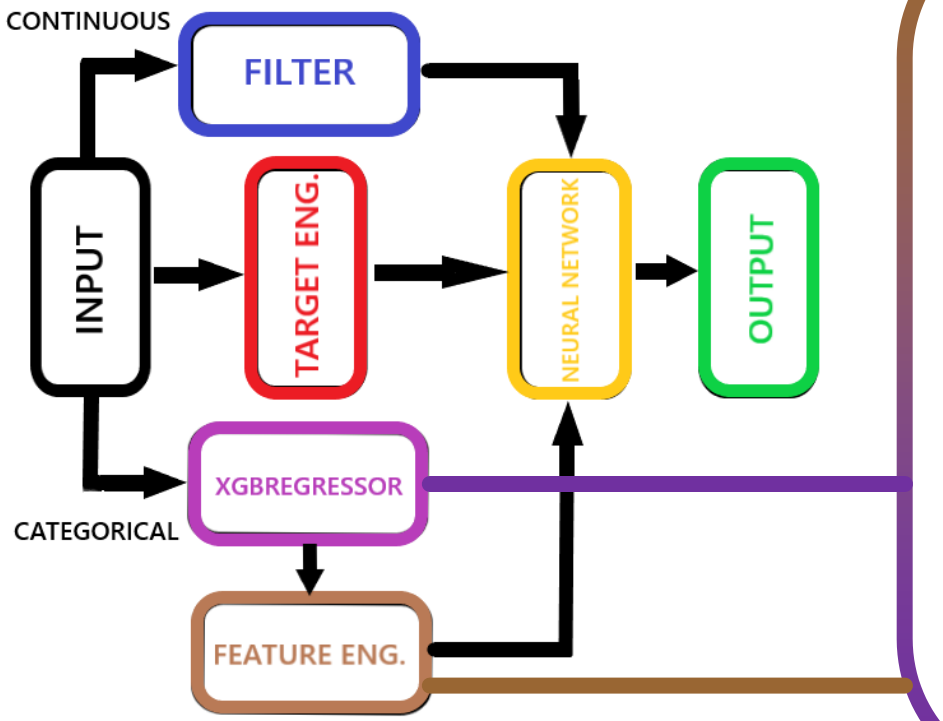


After Filter + Upsample

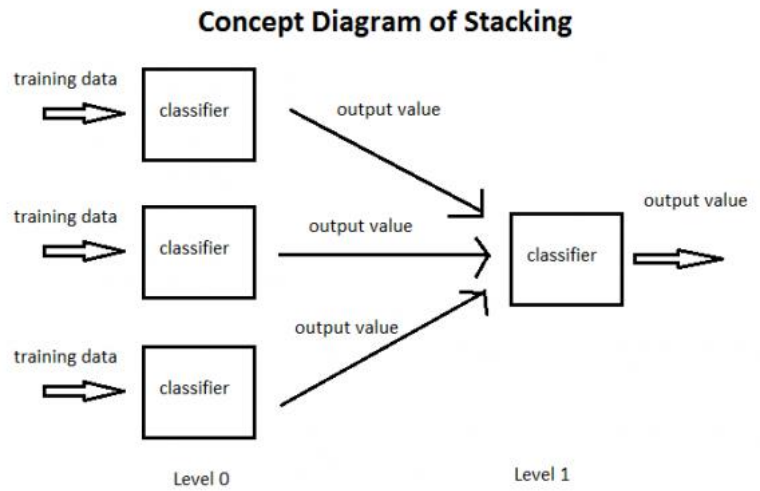
PRECISION: 0.99
RECALL: 0.99
F1: 0.99
CROSS-VAL: 0.956



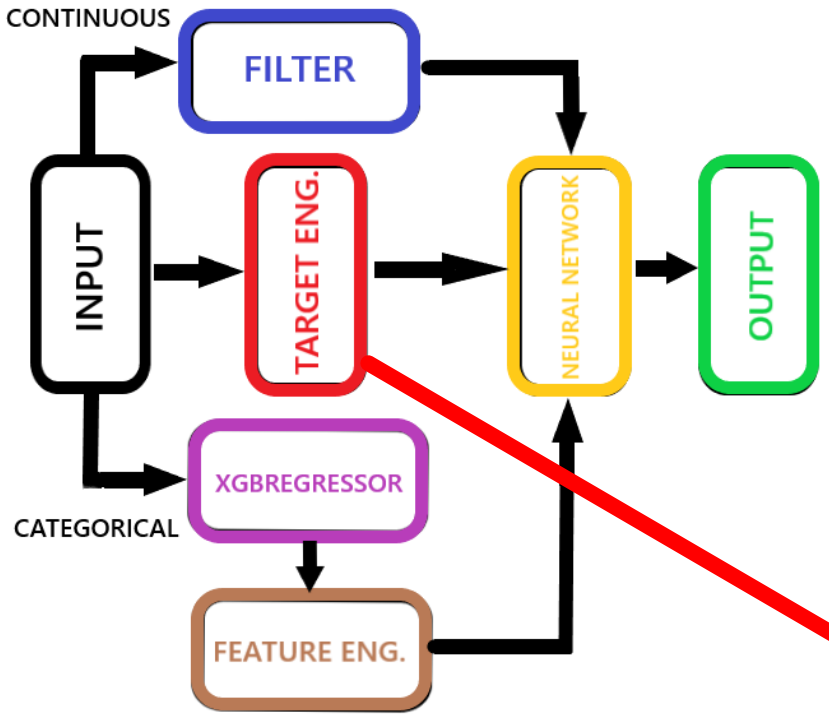
MODEL STACKING



Stacking, called meta ensembling, is a model ensembling technique used to combine information from multiple predictive models to produce a new one. In stacking, the combining mechanism is that the output of the initial modelwill be used as training data for another model.



TARGET ENGINEERING

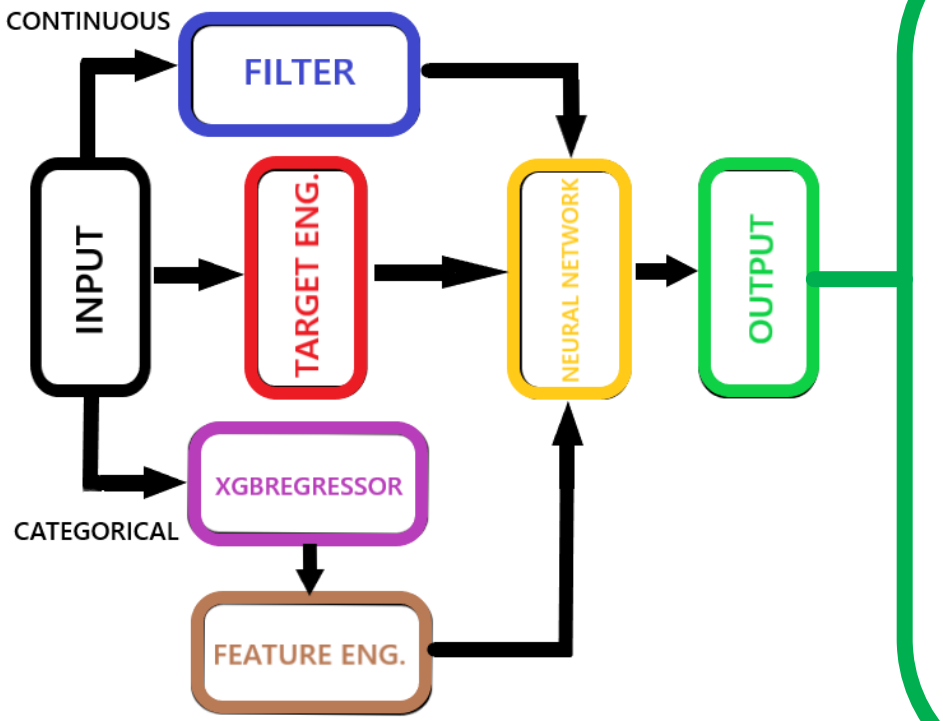


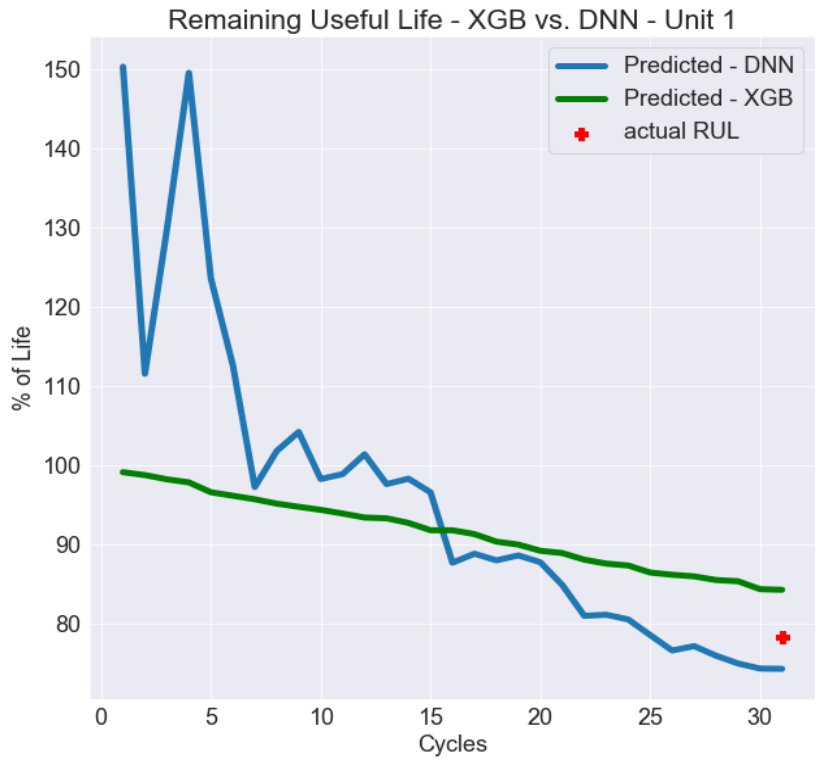
Feature engineering is the process of using **domain knowledge** of the data to create features that make machine learning algorithms work. If engineering is done correctly, it increases the predictive power of machine learning algorithms and help facilitate the machine learning process. **Feature engineering is an art.**

```
unit = 1
rul_perc = []
while unit <= 100:
    cycles = train['cycle'][train['unit']==unit].values
    val = sorted(cycles, reverse=True)
    percent = [i / max(val) for i in val]
    rul_perc.append(percent)
    unit = unit + 1
```

- ITERATES THROUGH EACH UNIT
- PULLS / REVERSE SORTS VALUES
- CONVERTS TO % OF REMAINING LIFE

RESULTS





ROOT MEAN SQUARED ERROR (RMSE)

XGB – 48.40

DNN – 34 - 40

THANK YOU

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