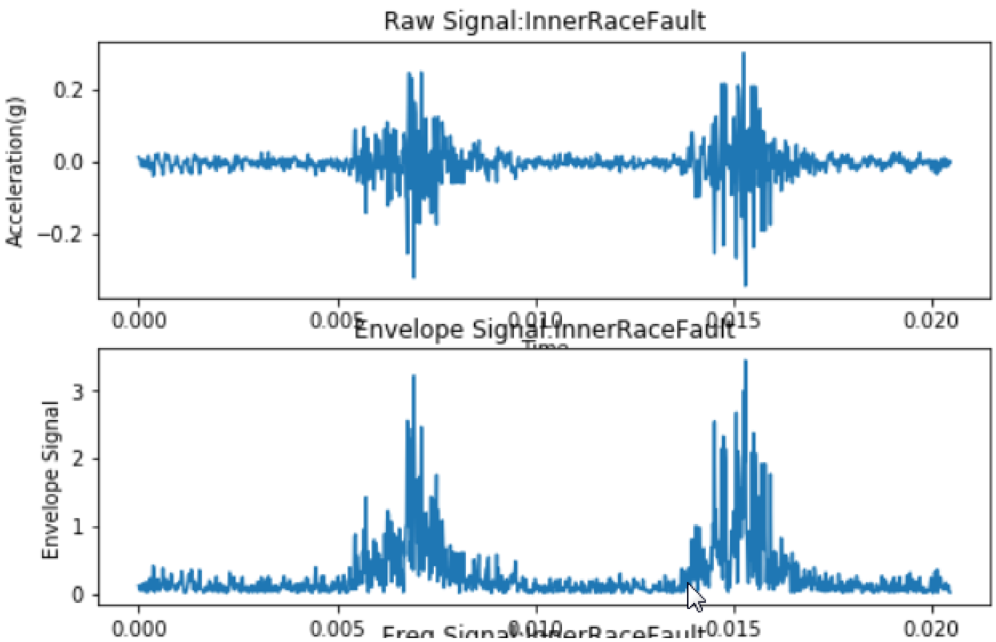
INTRODUCTION

This report summarizes the findings from rolling element bearing based on accelerometer readings along with strong masking signals for other machine components. Envelope spectrum analysis and applying Kurtosis   method is applied to get the features in the frequency domain to diagnose different kind of bearing faults.

This dataset has been provided by MFPT and the original data source can be found at http://www.mfpt.org/FaultData/FaultData.htm. A bearing fault dataset has been provided to facilitate research into bearing analysis. The dataset comprises 4 sets of data. The first 4 sets of data come from a bearing test rig with: baseline (good condition bearing), an outer race fault, outer race fault with various loads and inner race fault with various loads.

OBSERVATIONS

Dataset- The data is accelerometer readings with different sample rates.
Each data set contains an acceleration signal "gs", sampling rate "sr", shaft speed "rate", load weight "load", and four critical frequencies representing different fault locations: ballpass frequency outer race (BPFO), ballpass frequency inner race (BPFI), fundamental train frequency (FTF), and ball spin frequency (BSF).
Time series signal and the envelope signal is plotted for every fault. Here is an example of Inner race fault



In the above plots, considering inner race faults the peaks can be seen at 0.006 and 0.015 sec. Converting to its frequency it is 0.015-0.06 = 0.09sec F = 1/T = 118.875Hz which is ball pass frequency inner race (BPFI).
It is shown that inner race fault signal has significantly larger impulsiveness, making envelope spectrum analysis capture the fault signature at BPFI effectively

PREDICTIVE MODELS

The features for this analysis are considered in frequency domain that is spectral kurtosis is considered for each fault and passed these features as in put to Logistic Regression model. Here I classified/labeled data as 1-baseline or healthy bearing 2-Innerrace fault 3-Outerracefault.
The output of the logistic regression model is it predicts what kind of fault is in the data given a list od Kurtosis features.

Dataset-

Fault	Feature0	Feature1	Feature2	Feature3	Feature4	Feature5
1	0.88684	0.872315	0.959959	0.889801	0.863367	-3
2	5.764569	5.230378	5.380296	5.275635	4.804841	-1.17067
1	0.909748	0.863396	0.94067	0.890696	0.880313	-3
3	29.4561	34.43743	36.85509	35.87939	38.53654	-1.20175
2	0.974941	0.909589	0.84944	0.901776	0.957121	-3

CONCLUSION

This result show how spectral kurtosis and envelope spectrum to identify different types of faults in rolling element bearings. The algorithm is then applied to a batch of data sets in disk, which helped show the kurtosis value and amplitudes of envelope spectrum at BPFI and BPFO are two important condition indicators for bearing diagnostics. The fault diagnosis using envelope spectrum analysis and kurtosis gives a good distinction in the data to classify bearing if it is healthy, or if it has any innerrace faults or outerrace faults. Logistic regression with 83% accuracy gives correct predictions for this data set.