

AER850 Introduction to Machine Learning

Assignment 3

Marks. 10

Due on: March 23rd 2023, 2 pm

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- This is an individual assignment.
 - Submission instructions: Make a copy of this jupyter notebook file into your local TMU drive. Add kdkumar@torontomu.ca and "Acunsolo@torontomu.ca" as the collaborators. *Name the file as 'Last_First_AER 850 Assignment 3'. *
 - Also download the file as an .ipynb file WITH OUTPUTS and the file name (Last_First_AER 850 Assignment 3) and upload it to D2L.
 - Submit the assignment report along with your code on D2L by the due date.
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Bearing Fault Multi-Classification Problem

Bearing is one of the most widely used machine element in rotating machines; its failure can cause serious breakdown of a machine. Figure 1 shows a typical rolling element bearing, which consists of the cage, ball, inner race and outer race.

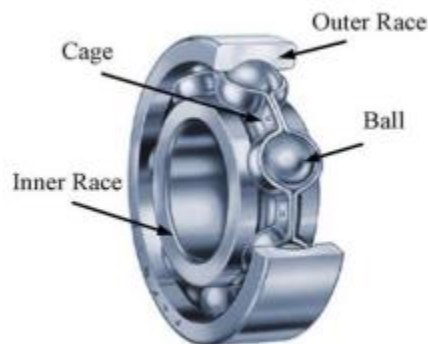


Figure 1. A Typical Rolling Element Bearing (<https://arxiv.org/abs/1901.08247>)

You are given bearing dataset (<https://engineering.case.edu/bearingdatacenter/download-data-file>) which contain vibration data of normal and fault bearings. The data was recorded for motor loads of 0 to 3 hp (motor speed of 1797 to 1720 RPM) using accelerometers at the drive end (DE) and fan end (FE) and the data is stored as Matlab files. The sampling rate is 12 kHz/ 48 kHz and each Matlab file contains between ~120k to ~240k sample points. It is a **multiclass classification** problem, where in the input to the AI model will be the vibration signal data at DE while the output will be the type of defects:

- 0 : Normal (N),
- 1 : Fault at Ball (B),

- 2 : Fault at Inner Raceway (IR),
- 3 : Fault at Outer Raceway (OR),

Build an artificial neural network or feed forward neural network (FFNN) or convolutional neural network (CNN) classifier to classify the type of bearing defects.