

EC ENGR 180DA, Winter 2022: Kellen Cheng (905155544)
IMU Lab (Partners: Ryan Doan, Newton Yee, Grace Zhao)
Due 3 February, 2022 at 7:00 PM

1 IMU Lab

- (a) **Solution:** (Task 1) We saw gravity acceleration when idle, as we displayed 1G when converting the raw output to G units. This conversion was done via ozzmaker's tutorial on converting raw IMU gravity acceleration to the appropriate units (i.e. to G-force and then multiplying by 9.81). All other variables were confirmed to be working correctly.
- (b) **Solution:** (Task 2) Some values drift when idle, at least when using the base given code. This is seen in the behavior of the gyroscope. A good feature for idle v. non-idle is to look at the accelerometer values, as x and y should be close to 0 if idle. At an idle threshold of 0.25 for AccX, we recorded 100% accuracy. All 3 idles are correctly classified as idle, and all 3 non-idle are correctly classified as non-idle in our confusion matrix, with no false positives or false negatives.
- (c) **Solution:** (Task 3) The simple classifier simply used the time series of all gyroscope rates and accelerometer values. Thus, each individual gesture was reshaped from a 99x6 numpy array into a 1x(99 * 6) array. As a result, it does make use of all 6 features (i.e. gyroscope rates and also accelerometer raw values). I used a simple singular decision tree to classify structurally, receiving a testing error of 60%, an expected value for a non-hyperparameter tested singular simple decision tree model.
- (d) **Solution:** (Task 4) Yes you can use the same features, and arguably increased our accuracy as we were exposed to rotation motions, which helped distinctly separate the upwards push and lift motions more clearly via the Decision Tree. Circular rotation motions were tracked perfectly on the test set. Our features simply involved a 1D time series array of all of our accelerometer and gyroscope rate values (6 values). Actions that might be easier include changing our classifier, maybe incorporating some sort of measurement on largest deviation between inputs, mean, max, etc. This classifier performed correctly on 4 out of 7 test cases.
- (e) **Solution:** (Task 5) Please see the folder titled "IMU" on my warmup repository to see all the gesture test and train files, as well as the python file titled "IMU-classification.py".