Smartphone based Photoplethysmography - PPG

-CS21B033 (Hari Hara Naveen S)

A. Warmup - Data Collection [10 points]

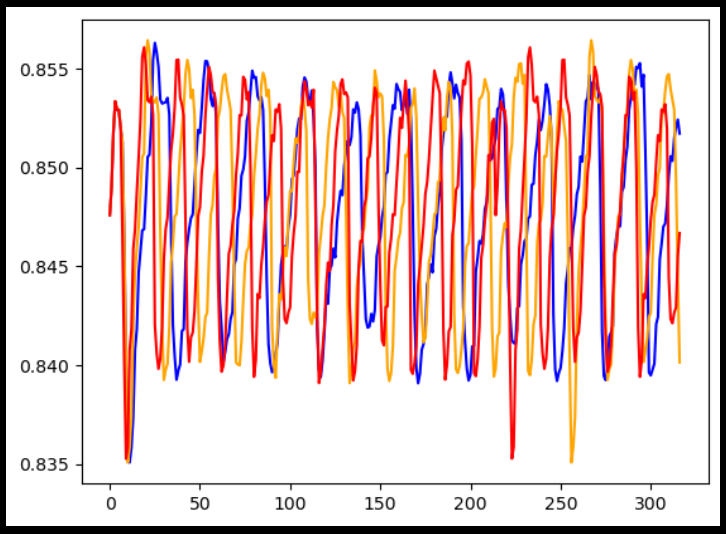
a. 3 video samples were taken, and cropped (not compressed) to 480x480
b. Only the first 317 frames (~10 seconds for video 1) were taken
c. Note that videos have different frame rates

B. Sensing Metric [5 points]

a. Sensory metric is the average R intensity value of all pixels in frame
b. We take mean intensity (B, G, R) of all pixels in the frame for all frames
c. Average is normalized by dividing by 255 (max intensity)

C. Temporal Variation of Intensity Value [10 points]

a. The average R value is plotted and peaks are signify that a heartbeat event has occurred
b. All videos are plotted in the same graph
    i. Resting : Blue
    ii. Mild Exercise : Orange
    iii. Rigorous Exercise : Red
c. In case you want a cleaner plot kindly uncomment the `plt.show()`



D. Likelihood Distributions [20 marks]

a. Using meticulous visual cues the a minima and maxima is identified for each video and a snippet of 20 frames is sliced (6 snippets in total)
b. For each snippet 3 histograms (for B, G, R) are plotted
c. `retrieve_name(var)` function is used to find all variable names pointing to the specific python reference, it helps with assigning titles to histograms

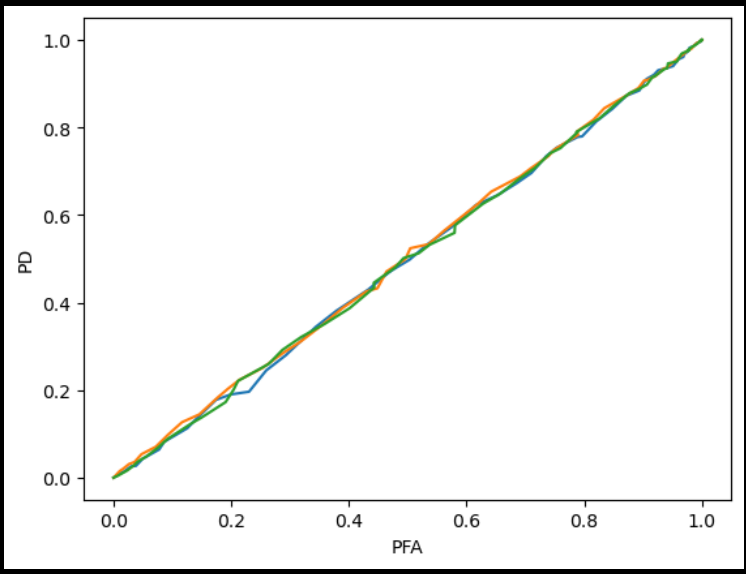
E. Threshold Based Detection and ROC curve

for each threshold (0 to 255 inclusive):
for each snippet (6 in total):
We generate a 500*20 (500 samples per frame in the snippet) random indexes between 0 and 480*480 (dim of each frame)

For each sample we compare its R value to the threshold (normalized by dividing by 255) and based on it we add to the truePositive (TP), falsePositive (FP), trueNegative (TN), falseNegative (FN) counters. Note that max snippets are considered heartbeat (event) and min snippets are no event

For every video we calculate

pd = TP/(TP+FN), pfa = FP/(FP+TN)
maxThreshold and max pd/pfa ratio
and store these values



F. Are "good" samples spatially correlated?

a. We had stored max thresholds for each video sample in list named `tholds`
b. For this Max threshold we randomly choose pixels and check if they are good (TP, TN) or bad (FP, FN) and plot them.
c. Green => good samples, Black => bad samples
d. We see no discernable pattern as my camera is oddly positioned and could not get the corner of of finger, only the center of my finger was captured
e. Edge of finger is where majority of bad samples should lie