Project 2: Pain vs No Pain

1. RF Chosen based on performance.

Datatype: All					
Classifier	Precision	Recall	Accuracy	AVG	
SVM	0.635216	0.562500	0.562500	0.586739	SVM
DT	0.558480	0.558333	0.558333	0.558382	
RF	0.581251	0.581250	0.581250	0.581250	RF
Naïve Bayes	0.637118	0.552083	0.552083	0.580428	
Max	Naïve Bayes	RF	RF		

2. Average of 10 experiments

Datatype	Precision	Recall	Accuracy
dia	0.670479	0.670479	0.670000
sys	0.727221	0.727221	0.726667
eda	0.564384	0.564384	0.564167
res	0.518466	0.518466	0.518333
all	0.588576	0.588576	0.588542

The datatype with the highest Accuracy to Pain was Systolic Blood Pressure, and Diastolic Blood Pressure. Pain produces physiological stress response that includes increased heart rate and breathing rate. This means that the heart is pumping at a faster rate, which is why Blood pressure increases. Moreover, Systolic scores higher than diastolic as systolic is the pressure measured during heart beats, and diastolic is measured during the rests between beats.

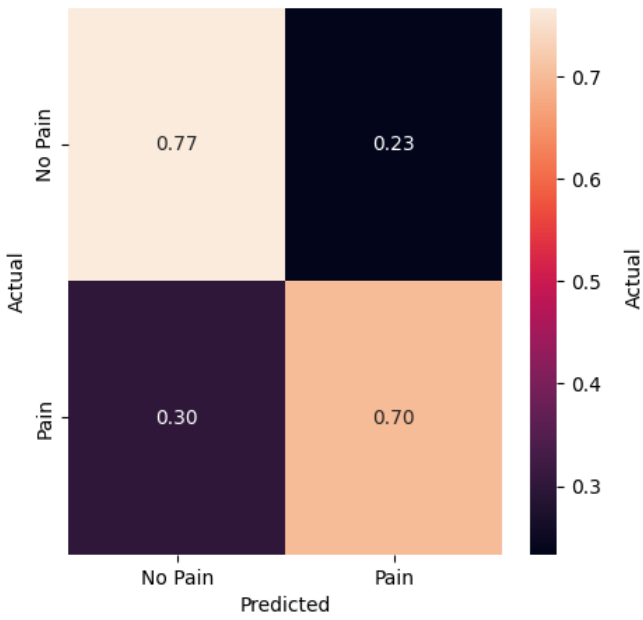


Figure 2: Sys

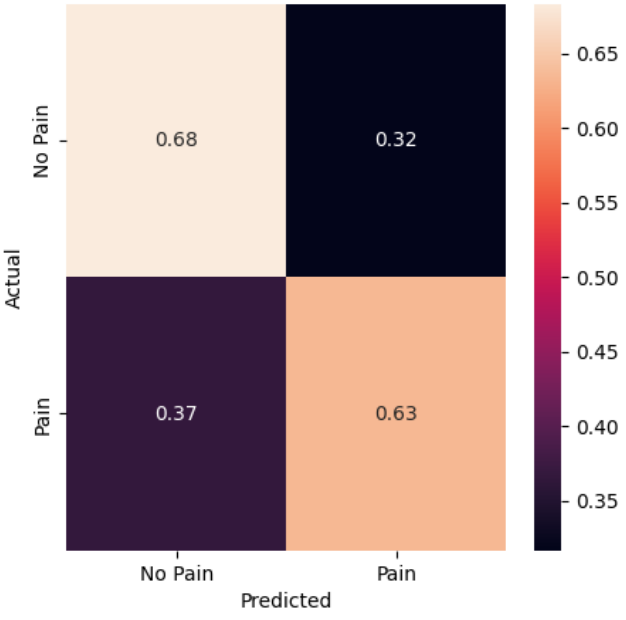


Figure 1: Dia

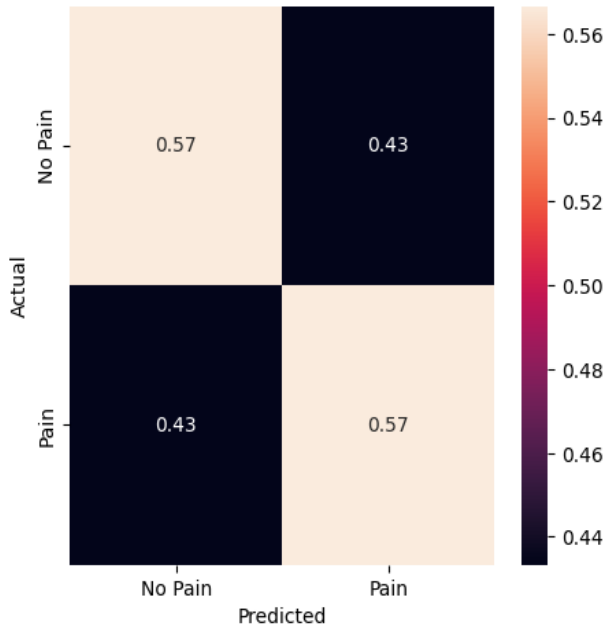


Figure 3: Eda

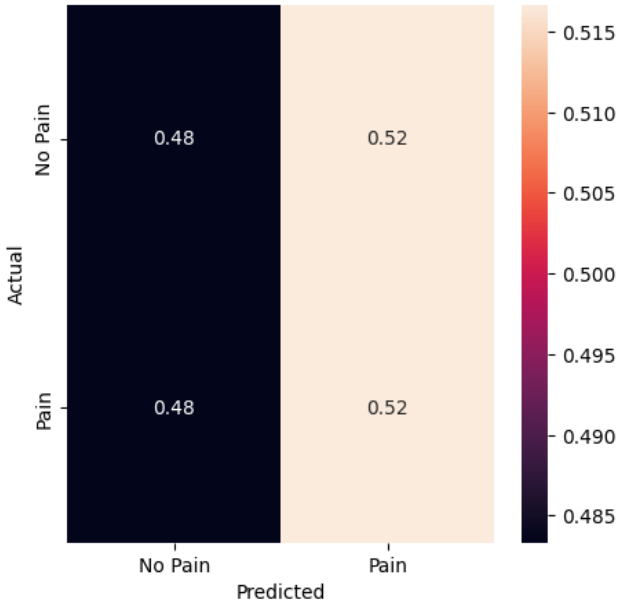


Figure 4: Res

3.

Datatype	Precision	Recall	Accuracy
all	0.588576	0.588576	0.588542
avg of 4	0.620137	0.620137	0.619792

It did not have the highest performance. However, the fusion performed better than Respiration and EDA. It seems that the RF classifier is not able to distinguish pain and no pain very well for Respiration, therefore adding respiration and possibly EDA may have reduced the model's ability to classify. People may have greater control over respiration when in pain whereas BP could be more involuntary and hence a better indicator of pain or no pain.

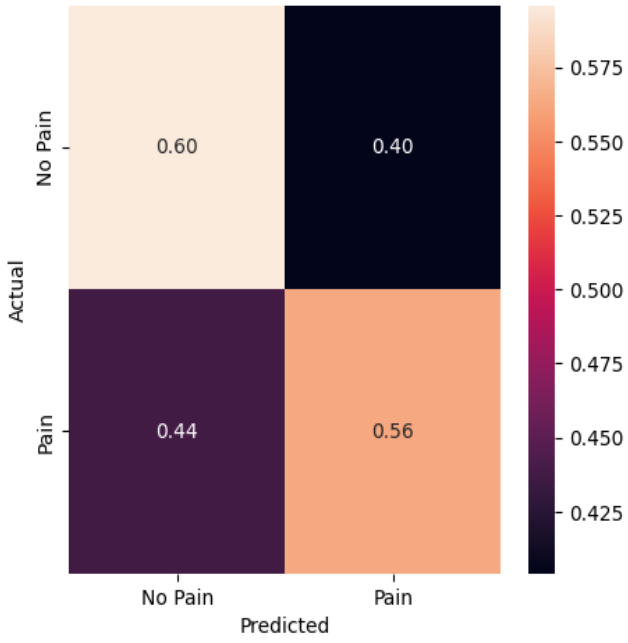
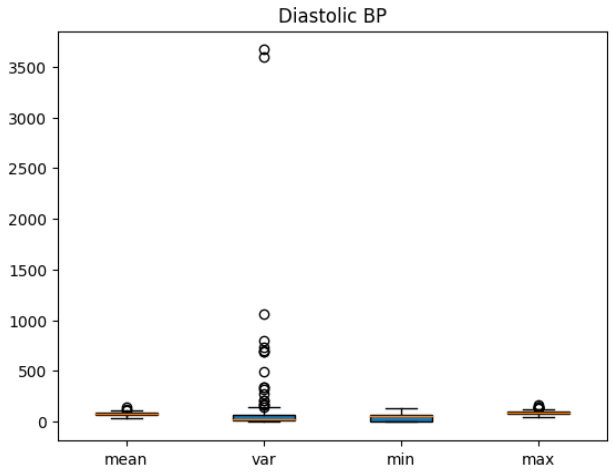
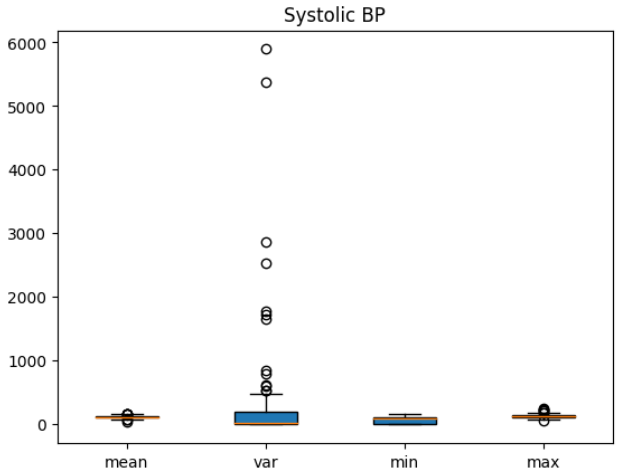


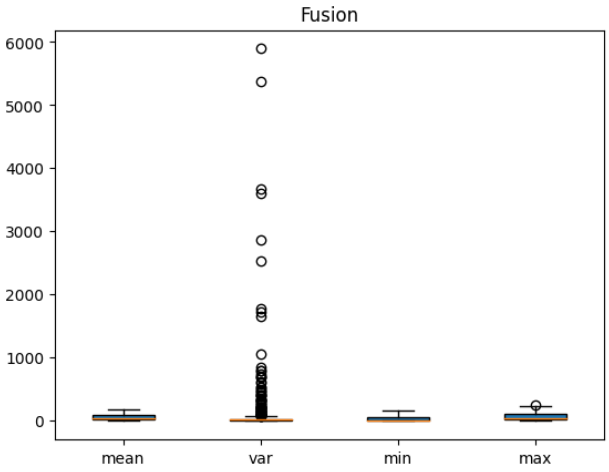
Figure 5: Fusion (ALL)

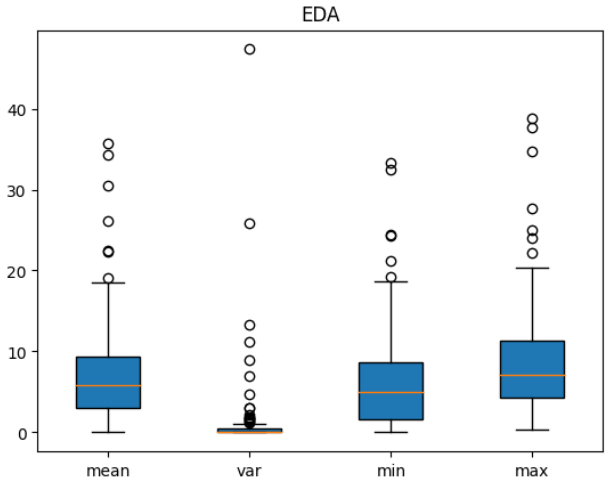
4.

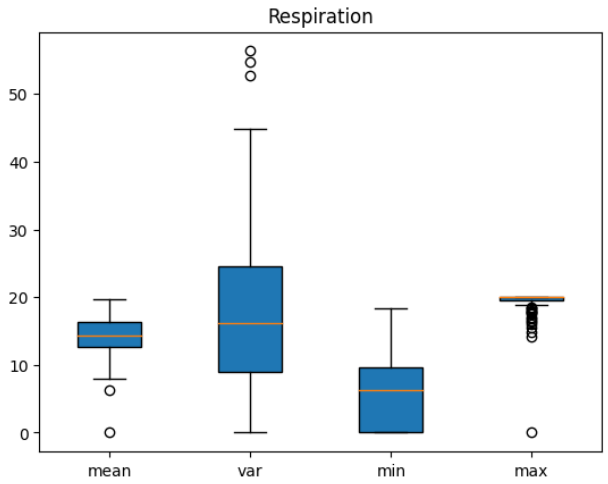


Very high variability can be seen throughout most datatypes as the box plot is barely visible while the whiskers and scatters are very long. However, low variability can be seen on EDA and Respiration. This may have a direct relation towards performance of the classifier on each data type. The low variability may have made the data a poor training data for our classifier, compared to Diastolic, Systolic and Fusion.

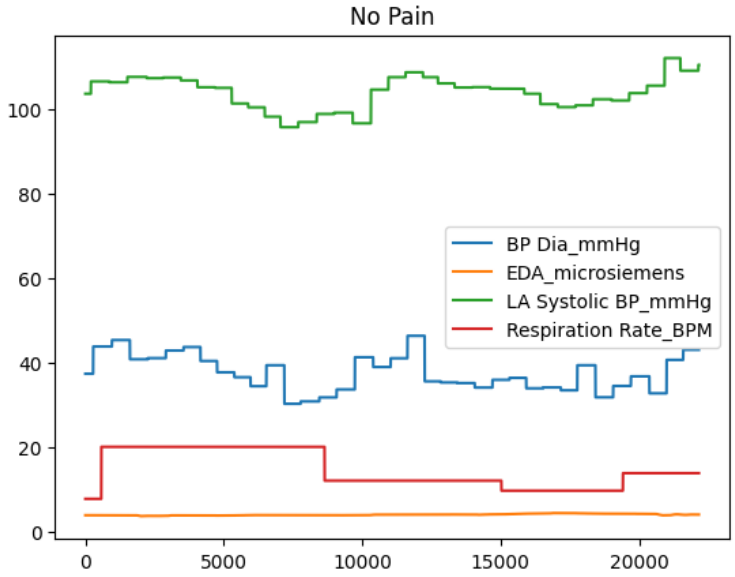


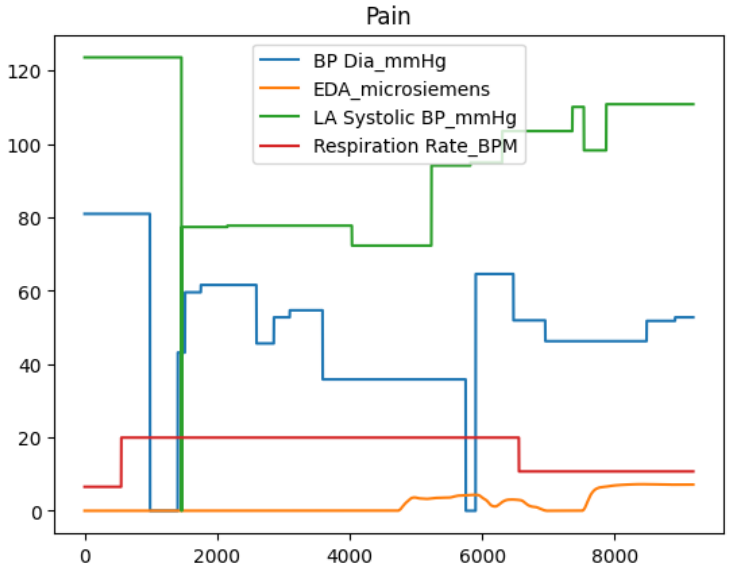






5.





Physiological signals with greater variety are better for pain recognition, as seen on our classifier results. Here, during NO_PAIN, the graphs are relatively level. However, during PAIN, Diastolic BP and Systolic BP show the most variation compared to their no pain state. Whereas Respiration remains relatively level, and EDA has a slight increase. Moreover, the classifier has performed the best on Diastolic BP, and Systolic BP.

Therefore, physiological signals with greater variability can be better for pain recognition because they may reflect a more dynamic and responsive nervous system.