Brief Report
HAI, Assignment 2

Modal-Based SVM Model:

I use 8 features for the SVM classification. Vector features include 1D feature as magnitude and length, and 2D features by combining them.

A cross validation approach of 5 folds shows that the accuracy is 90% for the given set, and 81.8% for my own gesture set. The confusion matrix is as below:

[[1 0 0 0 0 0 0 0 0 0] [0 1 0 0 0 0 0 0 0 0] [0 0 1 0 0 0 0 0 0 0] [0 0 0 1 0 0 0 0 0 0] [0 0 0 0 1 0 0 0 0 0] [0 0 0 0 0 1 0 0 0 0] [0 0 0 0 0 0 1 0 0 0] [0 0 0 0 0 0 0 1 0 0] [0 0 0 0 0 0 0 0 1 0] [0 0 0 0 0 0 0 0 0 1]]	[[1 0 0 0 0 0 0 0 0 0 0] [0 0 0 1 0 0 0 0 0 0 0] [0 0 1 0 0 0 0 0 0 0 0] [0 0 0 1 0 0 0 0 0 0 0] [0 0 0 0 1 0 0 0 0 0 0] [0 0 0 0 0 1 0 0 0 0 0] [0 0 0 0 0 0 1 0 0 0 0] [0 0 0 0 0 0 0 1 0 0 0] [0 0 0 0 0 0 0 0 1 0 0] [0 0 0 0 0 0 0 0 0 1 0] [0 0 0 0 0 0 0 0 0 1 0]]

My own set per gesture accuracy is as below:

	precision	recall	f1–score	support
At Rest	1.00	1.00	1.00	1
Backhand Tennis	1.00	1.00	1.00	1
Baseball Throw	1.00	1.00	1.00	1
Forehand Tennis	0.50	1.00	0.67	1
Midair Clockwise O	1.00	1.00	1.00	1
Midair Counter Clockwise O	1.00	1.00	1.00	1
Midair S	1.00	1.00	1.00	1
Midair Zorro Z	1.00	1.00	1.00	1
Shake	1.00	1.00	1.00	1
Underhand Bowling	0.00	0.00	0.00	1
Your Custom Gesture	1.00	1.00	1.00	1
avg / total	0.86	0.91	0.88	11

The given set [er gesture accuracy is as below:

	precision	recall	f1–score	support
At Rest	1.00	1.00	1.00	1
Backhand Tennis	1.00	1.00	1.00	1
Baseball Throw	1.00	1.00	1.00	1
Forehand Tennis	0.50	1.00	0.67	1
Midair Clockwise O	1.00	1.00	1.00	1
Midair Counter Clockwise O	1.00	1.00	1.00	1
Midair S	1.00	1.00	1.00	1
Midair Zorro Z	1.00	1.00	1.00	1
Shake	1.00	1.00	1.00	1
Underhand Bowling	0.00	0.00	0.00	1
Your Custom Gesture	1.00	1.00	1.00	1
avg / total	0.86	0.91	0.88	11

For Dynamic Time Wrapping, I calculated a euclidean distance using it. But I haven't figured out how to use it as a shape-matching classifier and be applied to machine learning process.

Overall, the assignment is very challenging for me. I spent quite a lot time understanding the frequency analysis, and eventually chose to visualize Fourier transform. Another problem is the integration of multi-feature into SVM. The data structure of SVM input is complicated to me. I spent several hours on debugging the training data structure, testing data structure, and feature inputs.

Since I have no experience with machine learning, or data science before, I learned a lot from the basics to high level concepts. For instance, how data visualization works in python and what kinds of visualization should we choose are basic but useful - since data is becoming a common design material nowadays.

I also gained practical understanding of model based machine learning - how they train and test, how to perform cross validation evaluations on them.

Link to work:
https://github.com/ZFengyi/HAI