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]          [[1 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 1 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 1 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 1 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 1 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]           [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 1 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	1.00	1.00	1.00	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	1.00	1.00	1.00	1
avg / total	1.00	1.00	1.00	10

For Dynamic Time Wrapping, I calculated a euclidean distance using it. I should use a for loop on all distance to find the closest one - which is the prediction gesture

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