

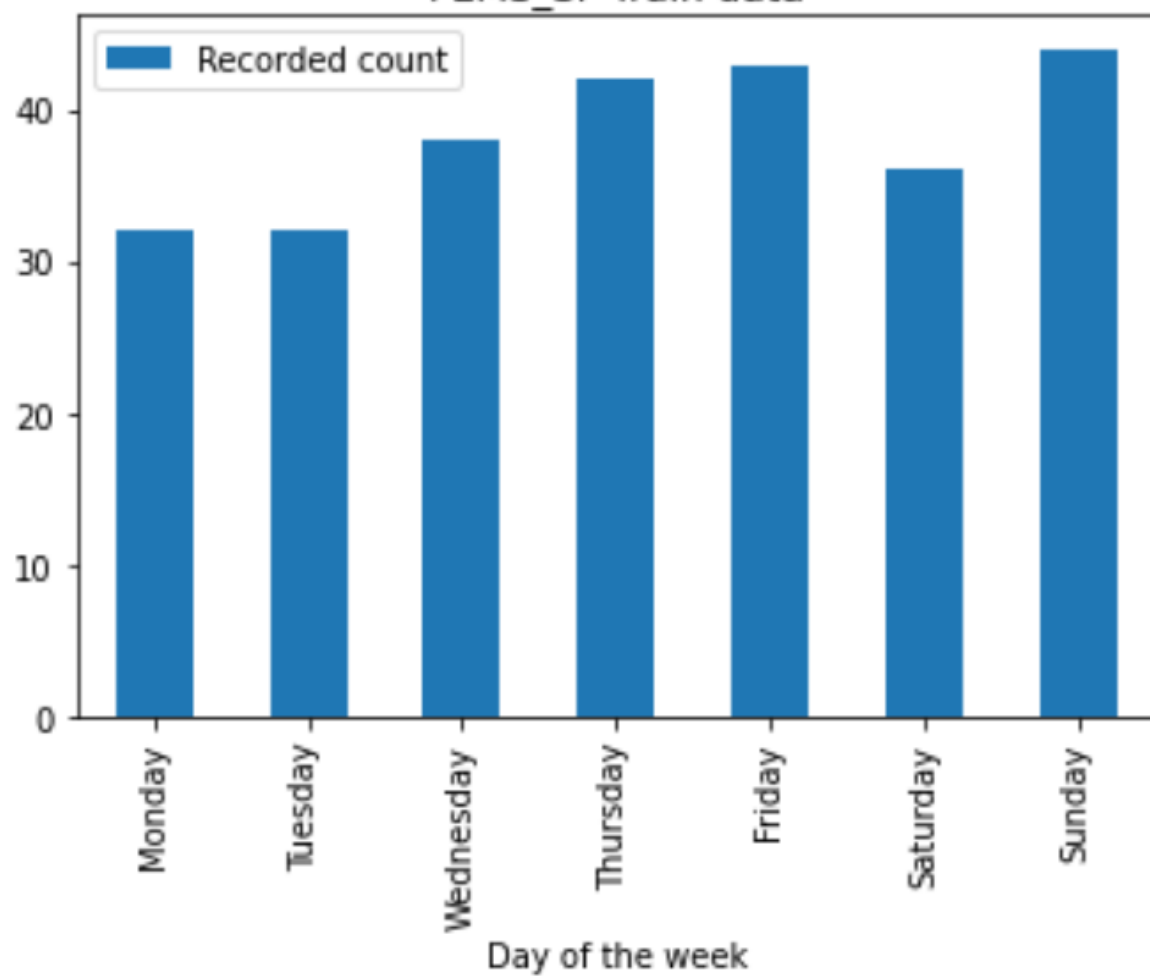
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 - **Accuracy**
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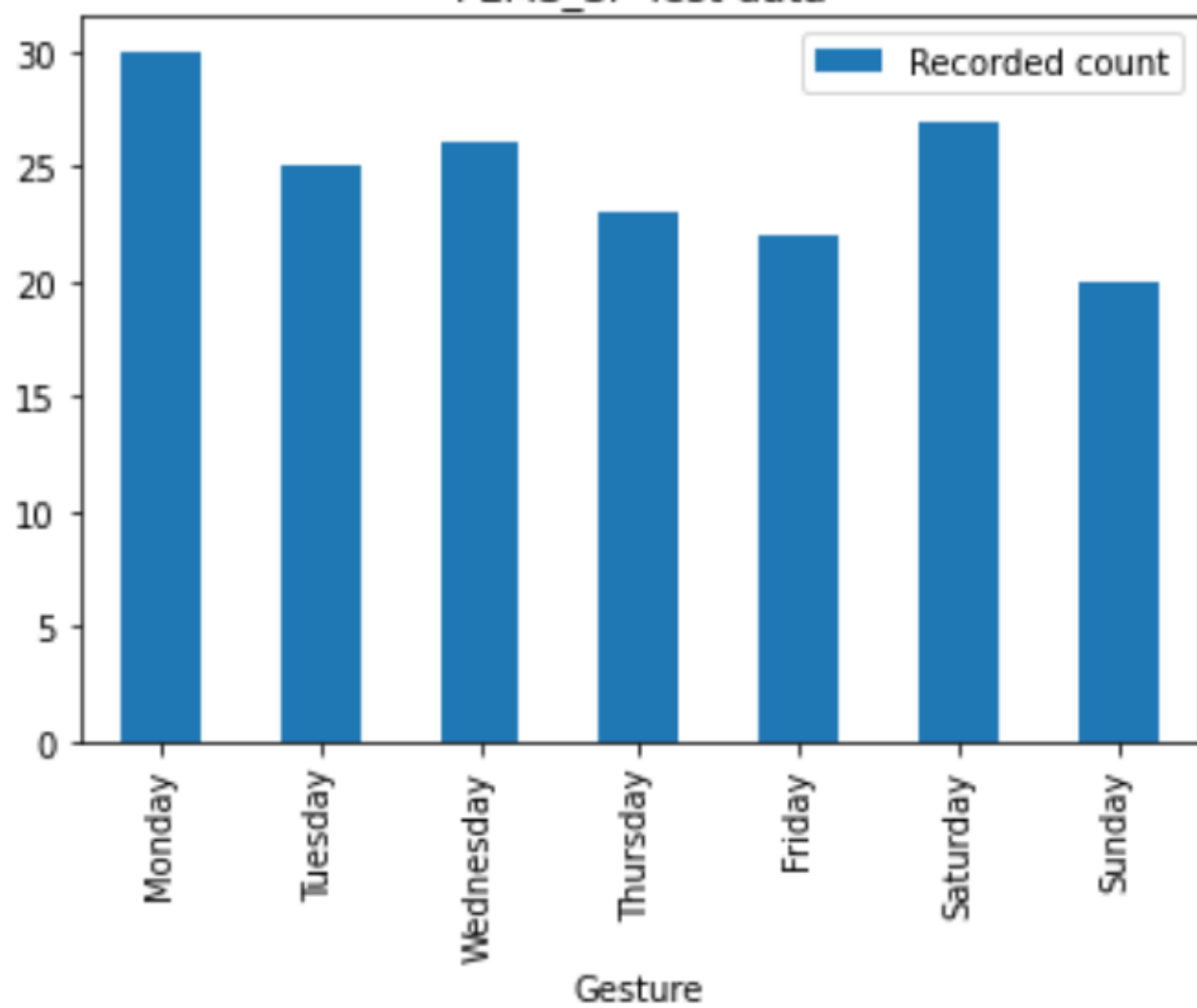
Exploratory Data Analysis

Class Equilibrium

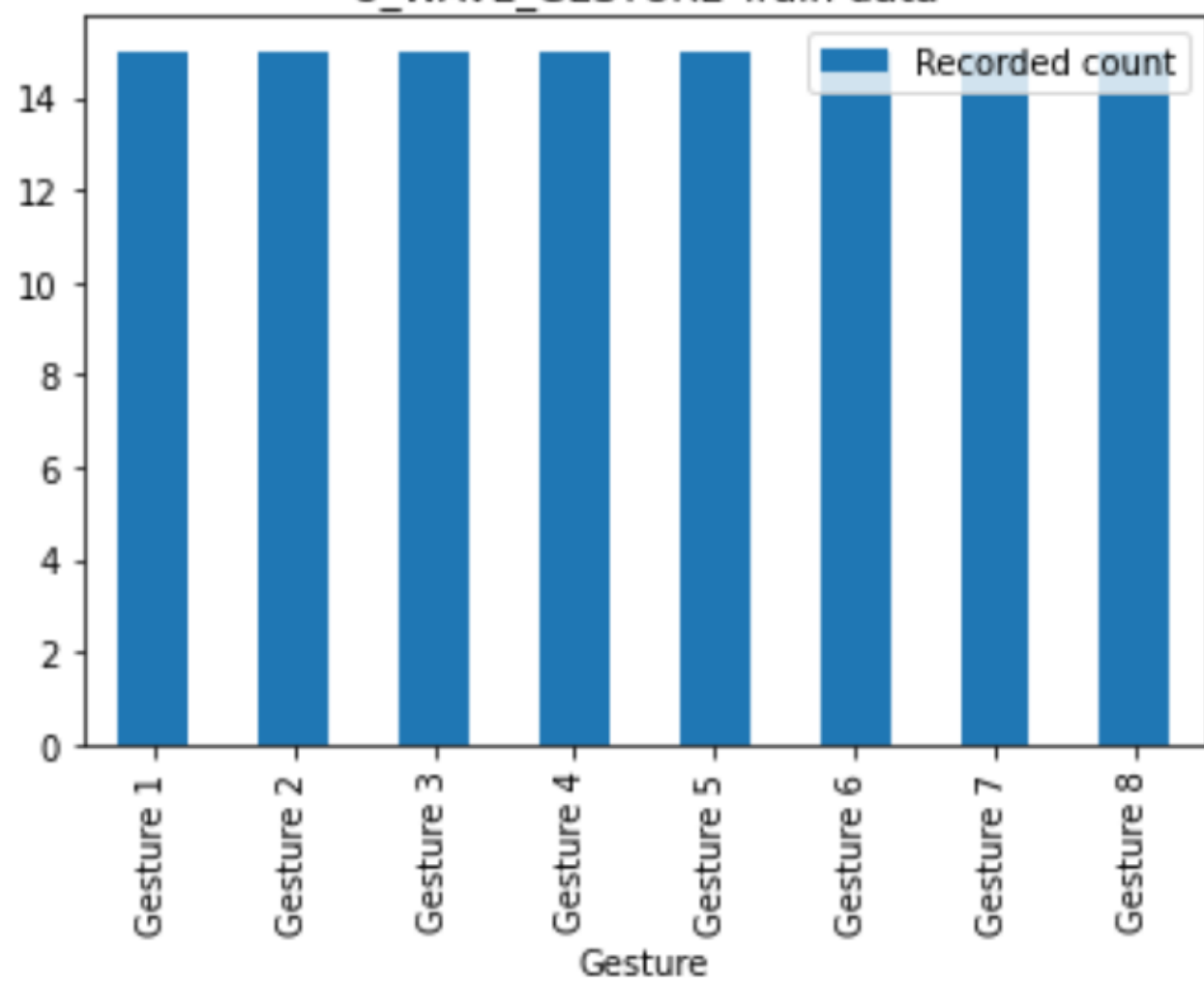
PEMS_SF Train data

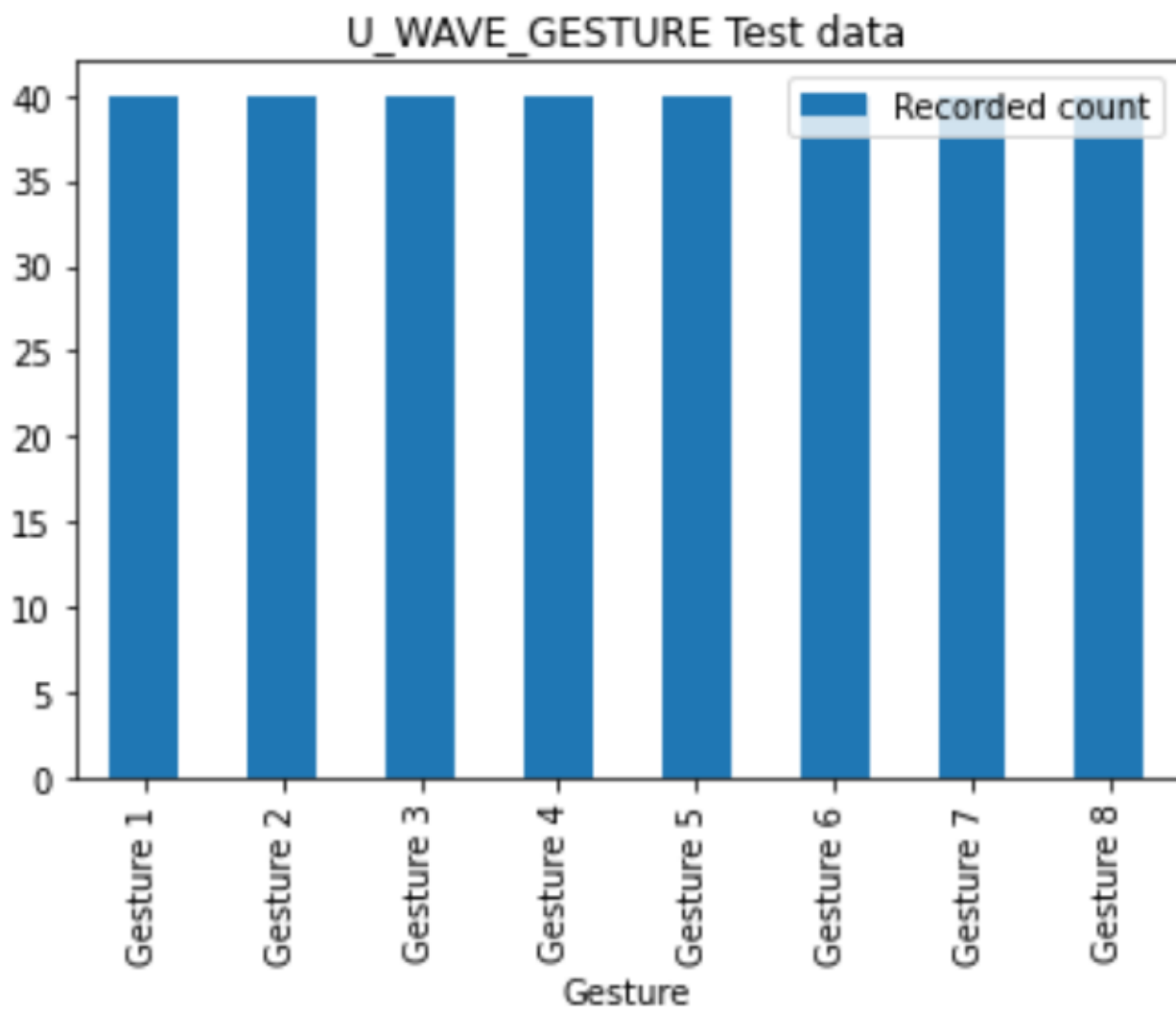


PEMS_SF Test data



U_WAVE_GESTURE Train data

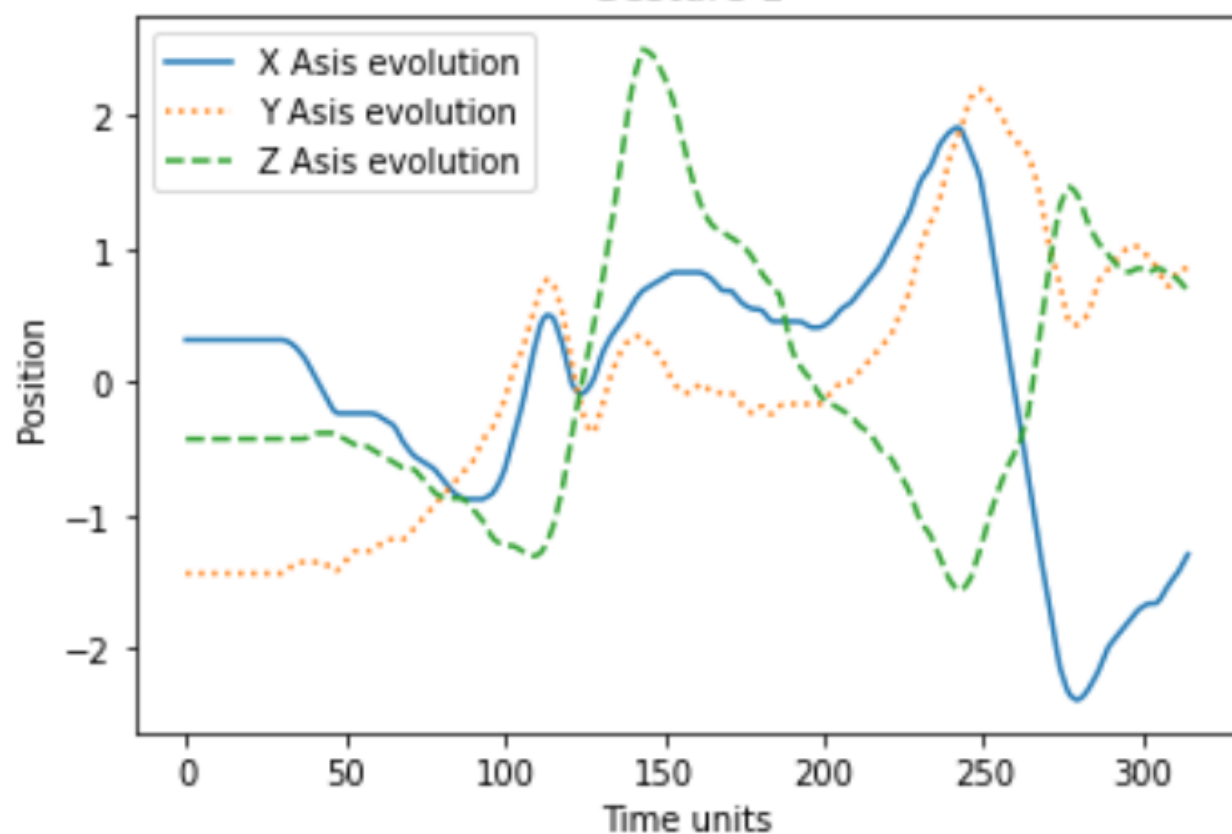




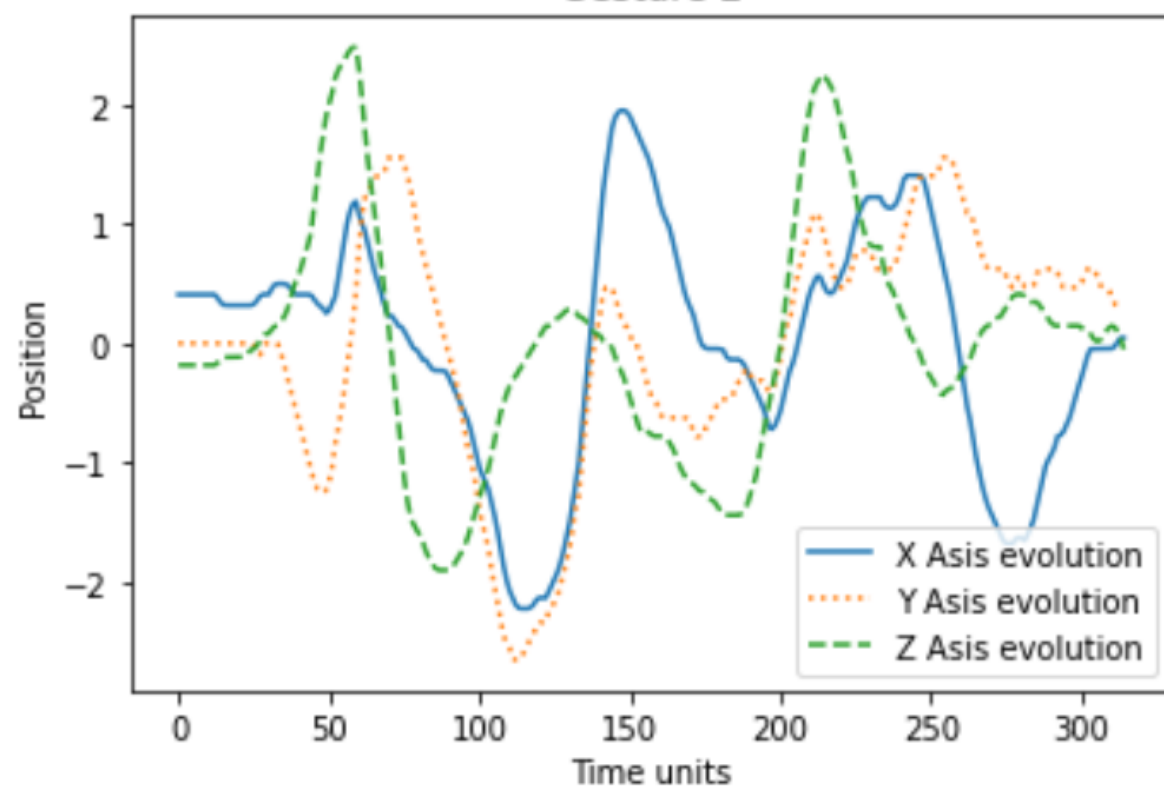
U Wave Gesture axis evolution

Random example for each gesture

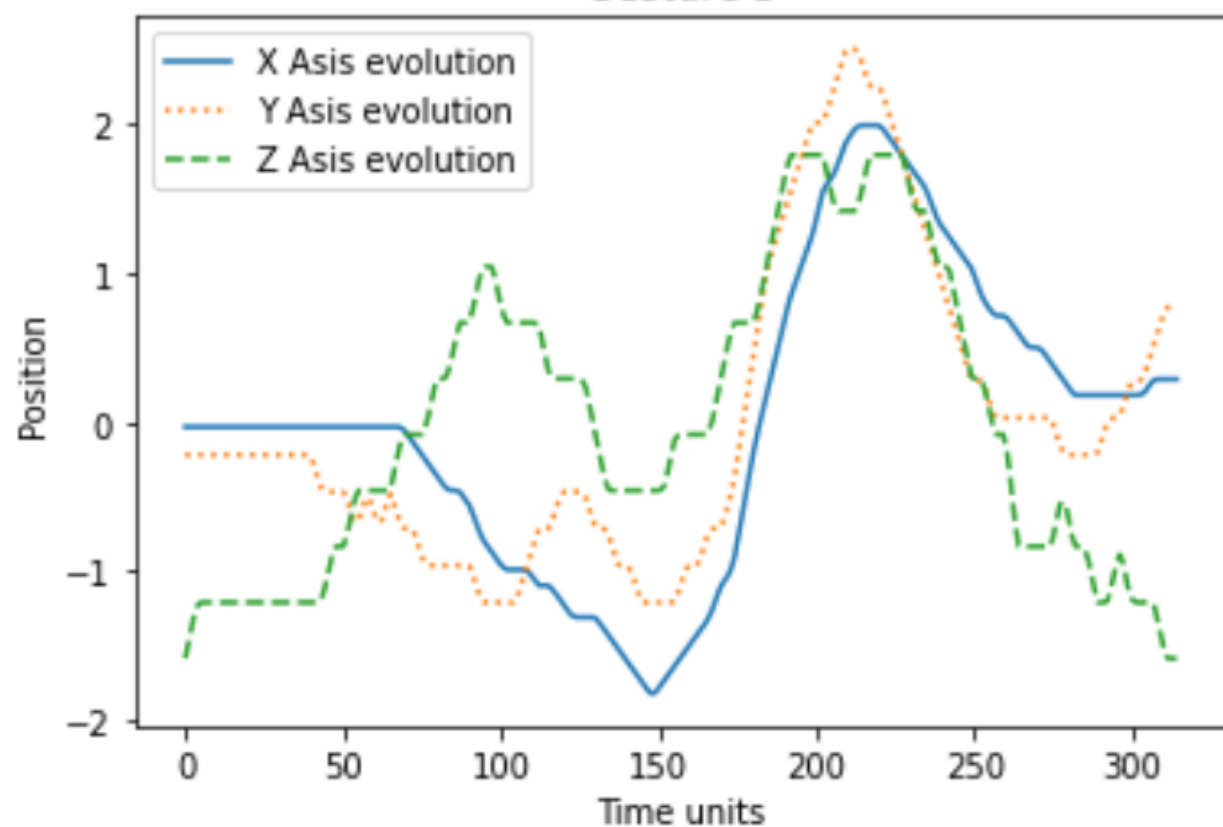
Gesture 1



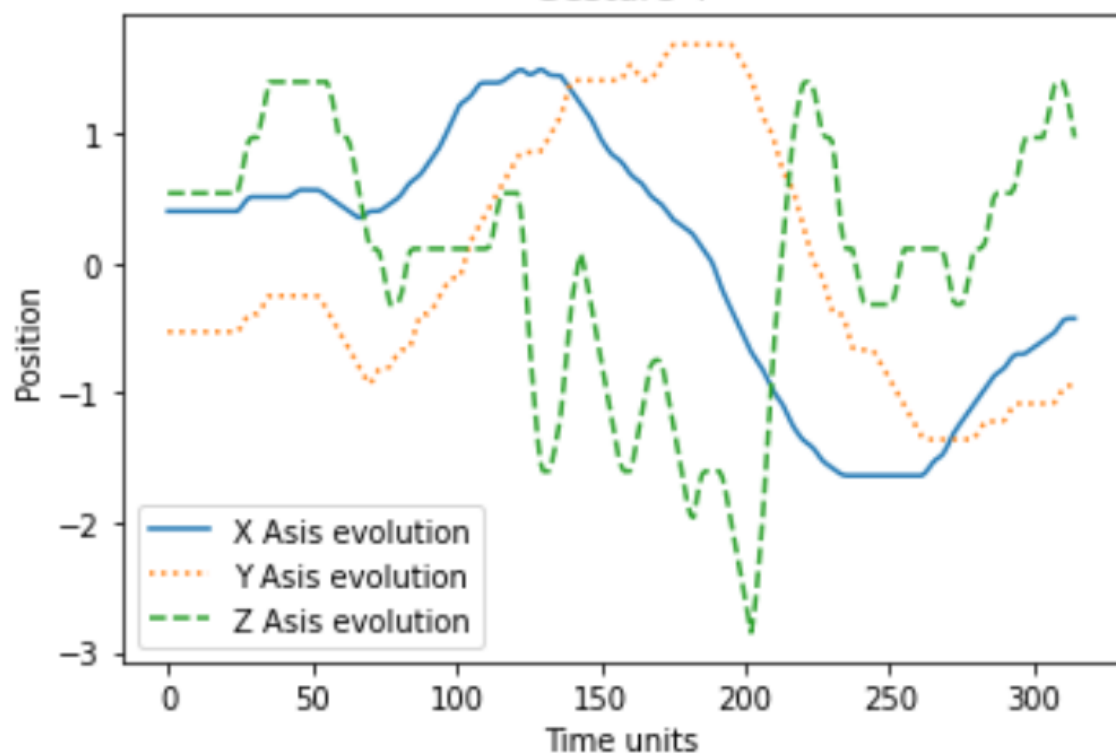
Gesture 2



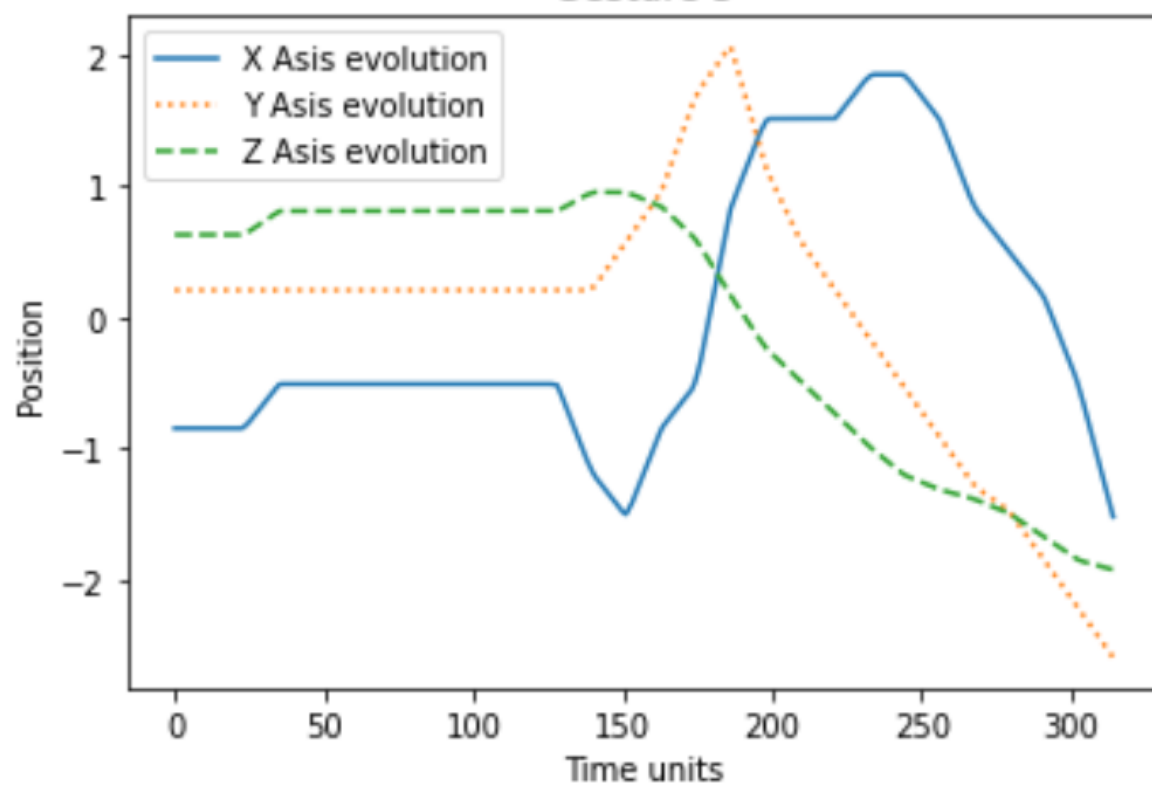
Gesture 3



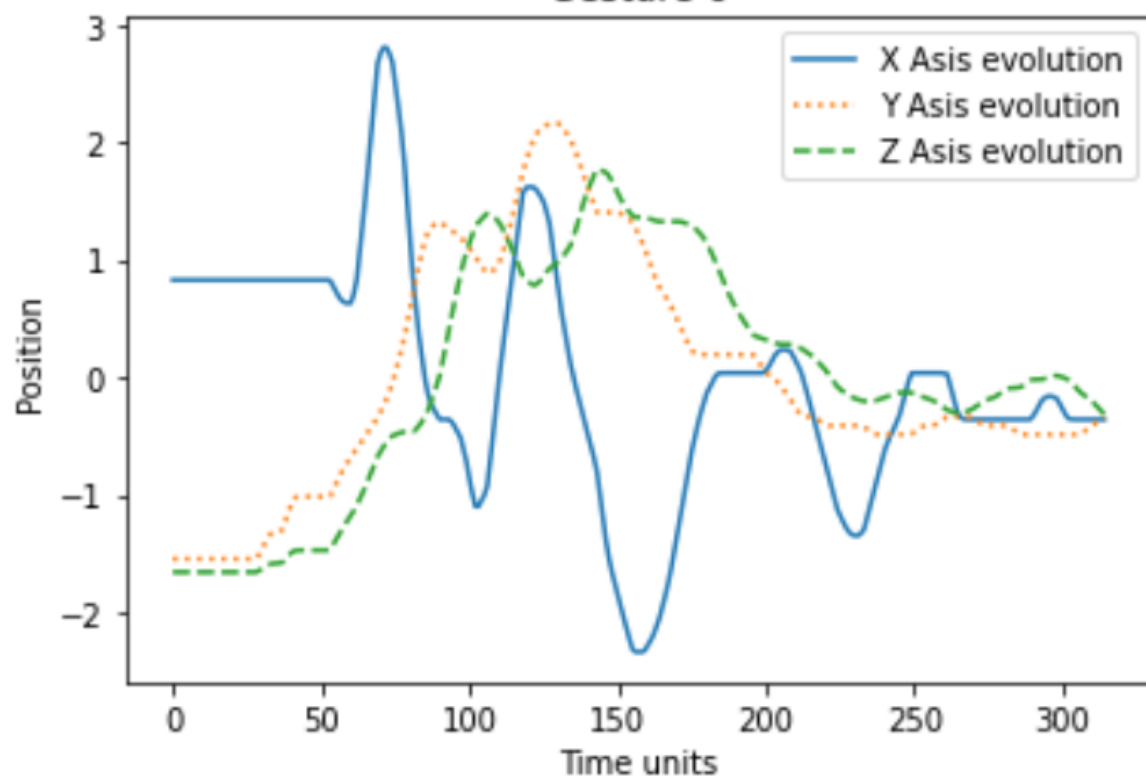
Gesture 4



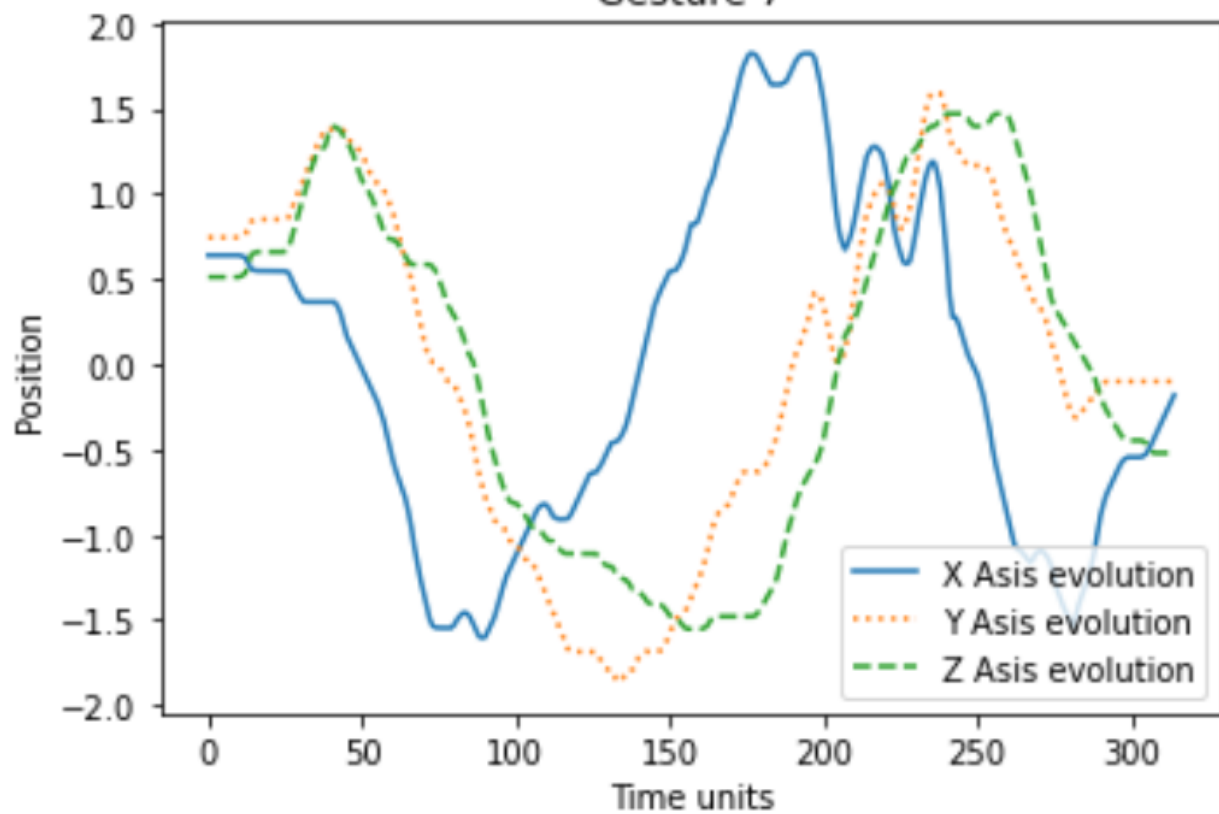
Gesture 5



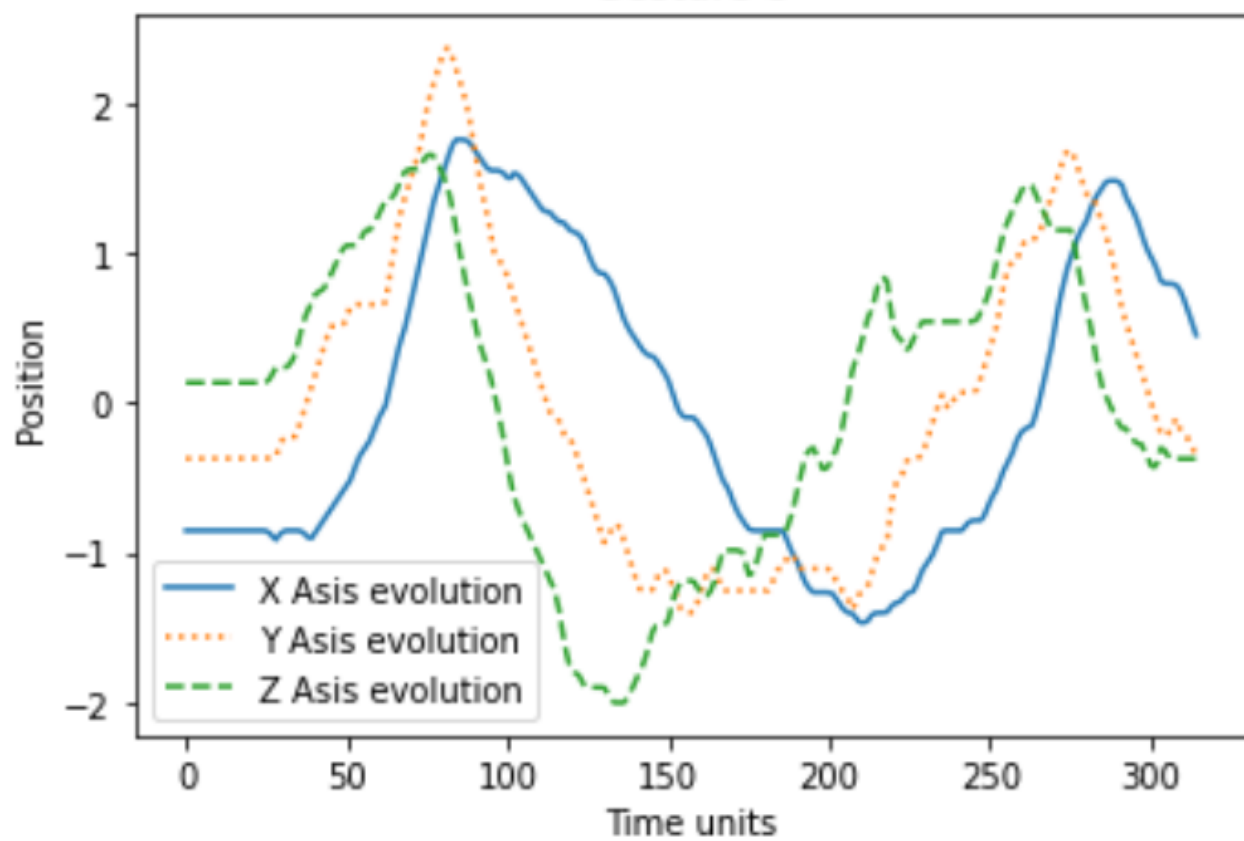
Gesture 6



Gesture 7

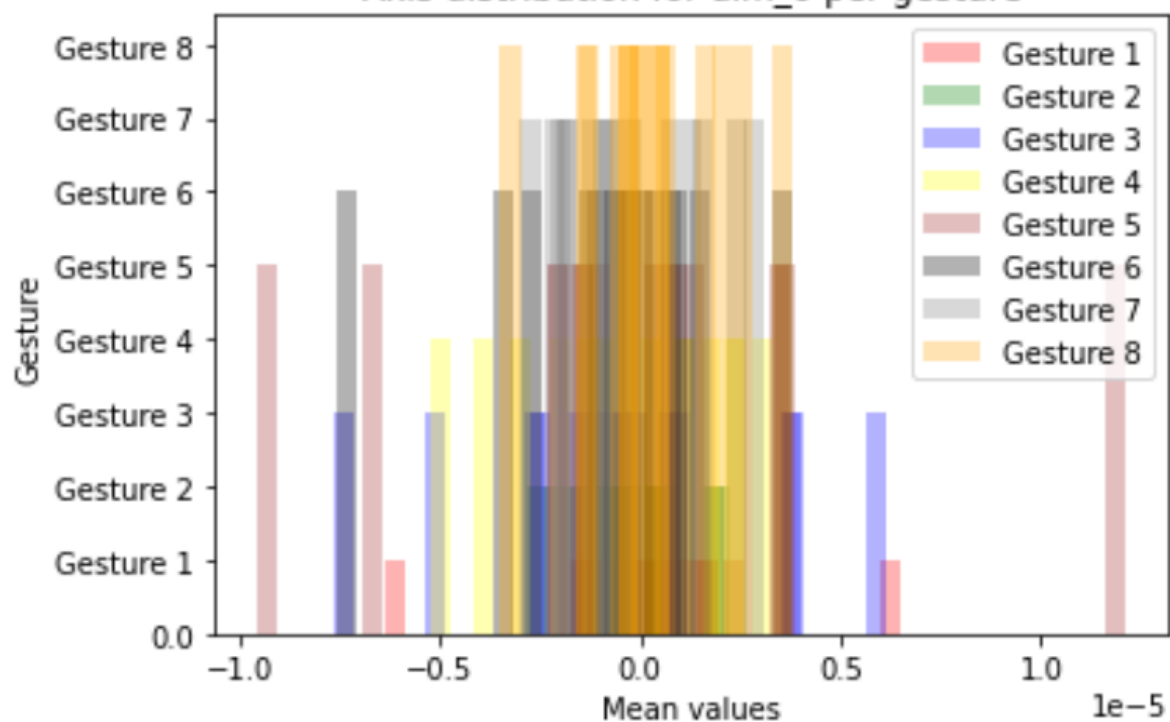


Gesture 8

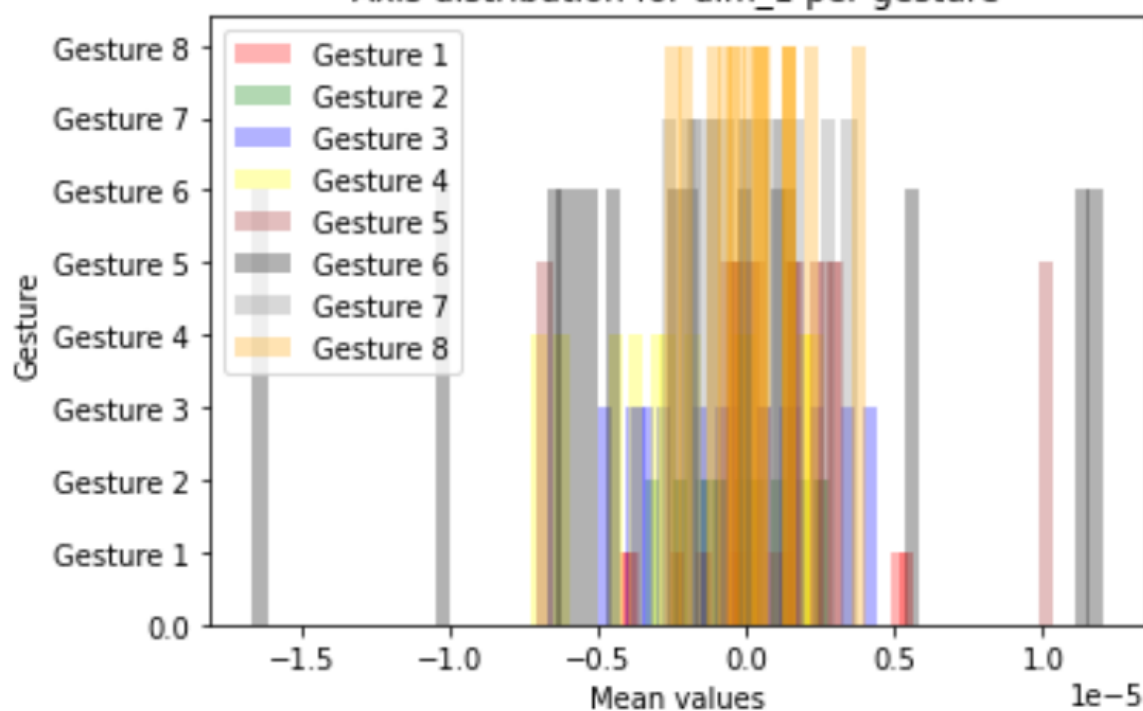


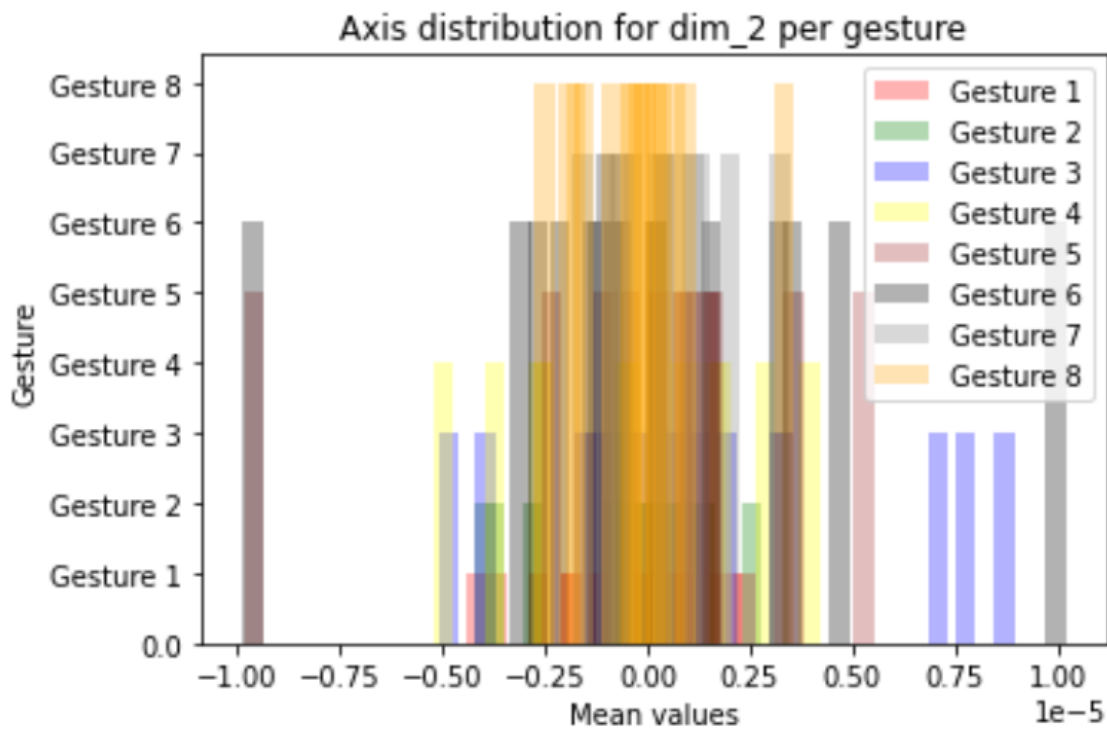
Axis evolution distribution per gesture

Axis distribution for dim_0 per gesture



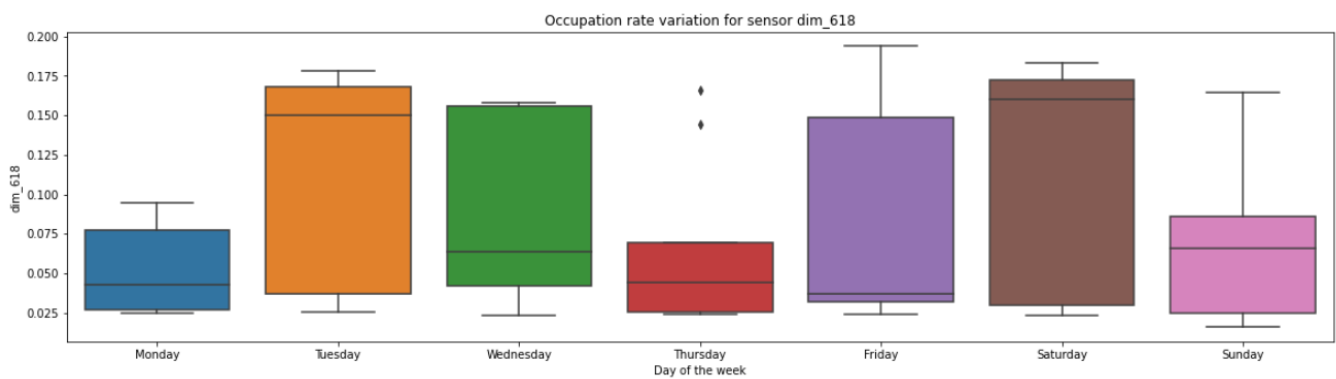
Axis distribution for dim_1 per gesture



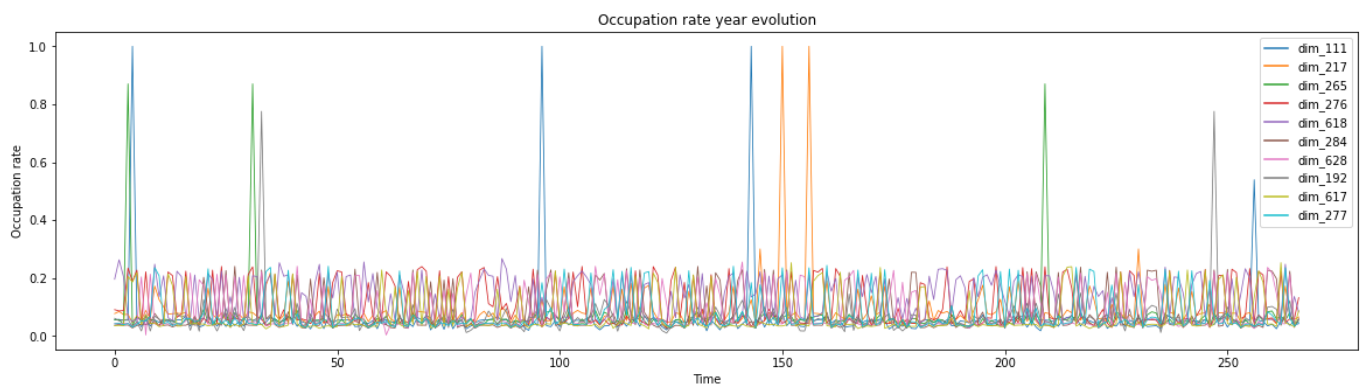


PEMS-SF Analysis

Best sensors deviation week days



Best sensors occupation rate year evolution



Feature selection & classic algorithms

PEMS-SF

Random forest

```
{
  "accuracy_score": 0.8959537572254336,
  "precision_score": [1.0, 1.0, 1.0, 0.82608696, 0.95,
    0.77419355, 0.76923077
  ],
  "recall_score": [0.86666667, 1.0, 0.84615385, 0.82608696, 0.86363636,
    0.88888889, 1.0
  ],
  "f1_score": [0.92857143, 1.0, 0.91666667, 0.82608696, 0.9047619,
    0.82758621, 0.86956522
  ],
  "confusion_matrix": [
    [26, 0, 0, 0, 0, 0, 4],
    [0, 25, 0, 0, 0, 0, 0],
    [0, 0, 22, 4, 0, 0, 0],
    [0, 0, 0, 19, 0, 4, 0],
    [0, 0, 0, 0, 19, 3, 0],
    [0, 0, 0, 0, 1, 24, 2],
    [0, 0, 0, 0, 0, 0, 20]
  ],
  "parameters": {
    "max_depth": 20,
    "min_samples_split": 2,
    "n_estimators": 200
  }
}
```

SVM

```
{
  "accuracy_score": 0.7167630057803468,
  "precision_score": [0.82758621, 0.85714286, 0.66666667, 0.59090909,
0.7,{
    "accuracy_score": 0.930635838150289,
    "precision_score": [1.0, 0.88888889, 0.96, 1.0, 0.91666667,
      0.92592593, 0.83333333
    ],
    "recall_score": [0.86666667, 0.96, 0.92307692, 0.86956522, 1.0,
      0.92592593, 1.0
    ],
    "f1_score": [0.92857143, 0.92307692, 0.94117647, 0.93023256,
0.95652174,
      0.92592593, 0.90909091
    ],
    "confusion_matrix": [
      [26, 0, 0, 0, 0, 2, 2],
      [0, 24, 1, 0, 0, 0, 0],
      [0, 0, 24, 0, 2, 0, 0],
```

```

        [0, 3, 0, 20, 0, 0, 0],
        [0, 0, 0, 0, 22, 0, 0],
        [0, 0, 0, 0, 0, 25, 2],
        [0, 0, 0, 0, 0, 0, 20]
    ]
}

    0.6, 0.81818182
],
"recall_score": [0.8, 0.72, 0.61538462, 0.56521739, 0.63636364,
    0.77777778, 0.9
],
"f1_score": [0.81355932, 0.7826087, 0.64, 0.57777778, 0.66666667,
    0.67741935, 0.85714286
],
"confusion_matrix": [
    [24, 0, 0, 0, 0, 2, 4],
    [3, 18, 0, 2, 0, 2, 0],
    [0, 2, 16, 4, 2, 2, 0],
    [0, 0, 3, 13, 2, 5, 0],
    [0, 0, 2, 3, 14, 3, 0],
    [0, 1, 3, 0, 2, 21, 0],
    [2, 0, 0, 0, 0, 0, 18]
],
"parameters": {
    "C": 2,
    "degree": 2,
    "gamma": "scale",
    "kernel": "poly"
}
}

```

Gradient Boosted Trees

```

{
    "accuracy_score": 0.930635838150289,
    "precision_score": [1.0, 0.88888889, 0.96, 1.0, 0.91666667,
        0.92592593, 0.83333333
    ],
    "recall_score": [0.86666667, 0.96, 0.92307692, 0.86956522, 1.0,
        0.92592593, 1.0
    ],
    "f1_score": [0.92857143, 0.92307692, 0.94117647, 0.93023256,
        0.95652174,
        0.92592593, 0.90909091
    ],
    "confusion_matrix": [
        [26, 0, 0, 0, 0, 2, 2],
        [0, 24, 1, 0, 0, 0, 0],
        [0, 0, 24, 0, 2, 0, 0],
        [0, 3, 0, 20, 0, 0, 0],
        [0, 0, 0, 0, 22, 0, 0],

```

```

        [0, 0, 0, 0, 0, 25, 2],
        [0, 0, 0, 0, 0, 0, 20]
    ],
    "parameters": {
        "learning_rate": 0.1,
        "max_depth": 2,
        "n_estimators": 100
    }
}

```

U Wave Gesture

Random forest

```

{
    "accuracy_score": 0.375,
    "precision_score": [0.30666667, 0.58695652, 0.36956522, 0.11111111,
0.41666667,
        0.35897436, 0.375, 0.375
    ],
    "recall_score": [0.575, 0.675, 0.425, 0.05, 0.25, 0.35, 0.375, 0.3],
    "f1_score": [0.4, 0.62790698, 0.39534884, 0.06896552, 0.3125,
        0.35443038, 0.375, 0.33333333
    ],
    "confusion_matrix": [
        [23, 1, 2, 6, 0, 2, 3, 3],
        [2, 27, 0, 0, 0, 0, 7, 4],
        [9, 0, 17, 5, 5, 4, 0, 0],
        [7, 0, 17, 2, 4, 7, 0, 3],
        [10, 1, 5, 0, 10, 12, 1, 1],
        [10, 0, 5, 5, 5, 14, 0, 1],
        [9, 8, 0, 0, 0, 0, 15, 8],
        [5, 9, 0, 0, 0, 0, 14, 12]
    ],
    "parameters": {
        "max_depth": 15,
        "min_samples_split": 7,
        "n_estimators": 200
    }
}

```

SVM

```

{
    "accuracy_score": 0.403125,
    "precision_score": [0.29487179, 0.60465116, 0.5, 0.3125, 0.43478261,
        0.39473684, 0.39285714, 0.39583333
    ],
}

```

```

    "recall_score": [0.575, 0.65, 0.375, 0.25, 0.25, 0.375, 0.275, 0.475],
    "f1_score": [0.38983051, 0.62650602, 0.42857143, 0.27777778,
0.31746032,
    0.38461538, 0.32352941, 0.43181818
],
    "confusion_matrix": [
        [23, 0, 0, 6, 0, 3, 3, 5],
        [4, 26, 0, 0, 0, 0, 5, 5],
        [6, 1, 15, 12, 2, 4, 0, 0],
        [8, 0, 11, 10, 4, 4, 0, 3],
        [10, 3, 2, 0, 10, 12, 1, 2],
        [11, 0, 2, 4, 7, 15, 0, 1],
        [11, 5, 0, 0, 0, 0, 11, 13],
        [5, 8, 0, 0, 0, 0, 8, 19]
    ],
    "parameters": {
        "C": 4,
        "degree": 1,
        "gamma": "scale",
        "kernel": "poly"
    }
}

```

Gradient Boosted Trees

```

{
    "accuracy_score": 0.35625,
    "precision_score": [0.3442623, 0.55813953, 0.31111111, 0.28571429,
0.33333333,
    0.32692308, 0.32258065, 0.31818182
],
    "recall_score": [0.525, 0.6, 0.35, 0.1, 0.25, 0.425, 0.25, 0.35],
    "f1_score": [0.41584158, 0.57831325, 0.32941176, 0.14814815,
0.28571429,
    0.36956522, 0.28169014, 0.33333333
],
    "confusion_matrix": [
        [21, 1, 3, 2, 3, 3, 3, 4],
        [5, 24, 0, 0, 0, 0, 4, 7],
        [6, 1, 14, 8, 2, 8, 1, 0],
        [4, 0, 14, 4, 5, 9, 0, 4],
        [6, 1, 6, 0, 10, 15, 1, 1],
        [7, 0, 8, 0, 7, 17, 0, 1],
        [6, 10, 0, 0, 1, 0, 10, 13],
        [6, 6, 0, 0, 2, 0, 12, 14]
    ],
    "parameters": {
        "learning_rate": 0.05,
        "max_depth": 4,
        "n_estimators": 5
    }
}

```

```
}  
}
```

Neural networks

U Wave Gesture

Multi-Layered Perceptron

```
{  
  "accuracy_score": 0.853125,  
  "precision_score": [0.9, 0.90697674, 0.85714286, 0.9, 0.68627451,  
    0.75, 1.0, 0.925  
  ],  
  "recall_score": [0.9, 0.975, 0.9, 0.675, 0.875, 0.825, 0.75, 0.925],  
  "f1_score": [0.9, 0.93975904, 0.87804878, 0.77142857, 0.76923077,  
    0.78571429, 0.85714286, 0.925  
  ],  
  "confusion_matrix": [  
    [36, 0, 0, 0, 0, 4, 0, 0],  
    [0, 39, 0, 0, 0, 1, 0, 0],  
    [0, 0, 36, 1, 3, 0, 0, 0],  
    [0, 0, 0, 27, 12, 0, 0, 1],  
    [0, 1, 1, 0, 35, 3, 0, 0],  
    [4, 0, 1, 2, 0, 33, 0, 0],  
    [0, 3, 4, 0, 0, 1, 30, 2],  
    [0, 0, 0, 0, 1, 2, 0, 37]  
  ],  
  "parameters": {  
    "activation": "relu",  
    "solver": "adam",  
    "alpha": 0.001,  
    "learning_rate": "constant",  
    "hidden_layer_sizes": (100, 100, 100, 100, 100),  
    "max_iter": 100000  
  }  
}
```

Convolutional Neural Network

```
{  
  "accuracy_score": 0.859375,  
  "precision_score": [0.94594595, 0.86666667, 0.8372093, 0.86666667,  
0.74,  
    0.85365854, 0.88235294, 0.925  
  ],  
  "recall_score": [0.875, 0.975, 0.9, 0.65, 0.925, 0.875, 0.75, 0.925],  
  "f1_score": [0.90909091, 0.91764706, 0.86746988, 0.74285714,
```



```

0.82222222,
    0.86419753, 0.81081081, 0.925
],
"confusion_matrix": [
    [35, 0, 1, 0, 0, 4, 0, 0],
    [0, 39, 0, 0, 0, 1, 0, 0],
    [0, 0, 36, 1, 1, 0, 2, 0],
    [0, 0, 0, 26, 11, 1, 0, 2],
    [0, 1, 1, 0, 37, 0, 1, 0],
    [0, 0, 2, 2, 0, 35, 1, 0],
    [0, 5, 3, 1, 0, 0, 30, 1],
    [2, 0, 0, 0, 1, 0, 0, 37]
]
}

```

Long short-term memory

```

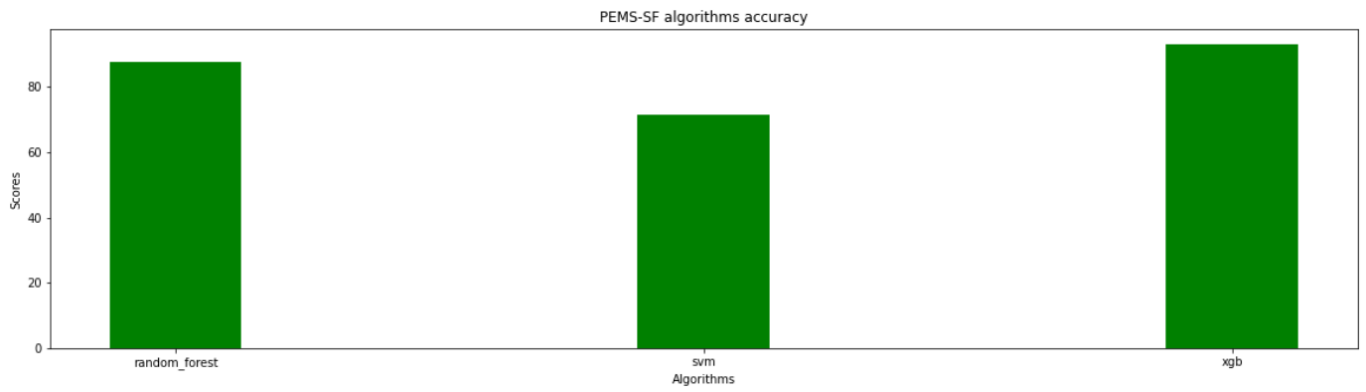
{
    "accuracy_score": 0.86875,
    "precision_score": [0.92307692, 0.95238095, 0.85365854, 0.92307692,
0.65454545,
    0.80487805, 1.0, 0.95121951
],
    "recall_score": [0.9, 1.0, 0.875, 0.6, 0.9, 0.825, 0.875, 0.975],
    "f1_score": [0.91139241, 0.97560976, 0.86419753, 0.72727273,
0.75789474,
    0.81481481, 0.93333333, 0.96296296
],
    "confusion_matrix": [
        [36, 0, 1, 0, 0, 3, 0, 0],
        [0, 40, 0, 0, 0, 0, 0, 0],
        [0, 0, 35, 0, 4, 1, 0, 0],
        [0, 0, 0, 24, 14, 1, 0, 1],
        [0, 0, 1, 0, 36, 2, 0, 1],
        [3, 0, 1, 2, 1, 33, 0, 0],
        [0, 2, 3, 0, 0, 0, 35, 0],
        [0, 0, 0, 0, 0, 1, 0, 39]
    ]
}

```

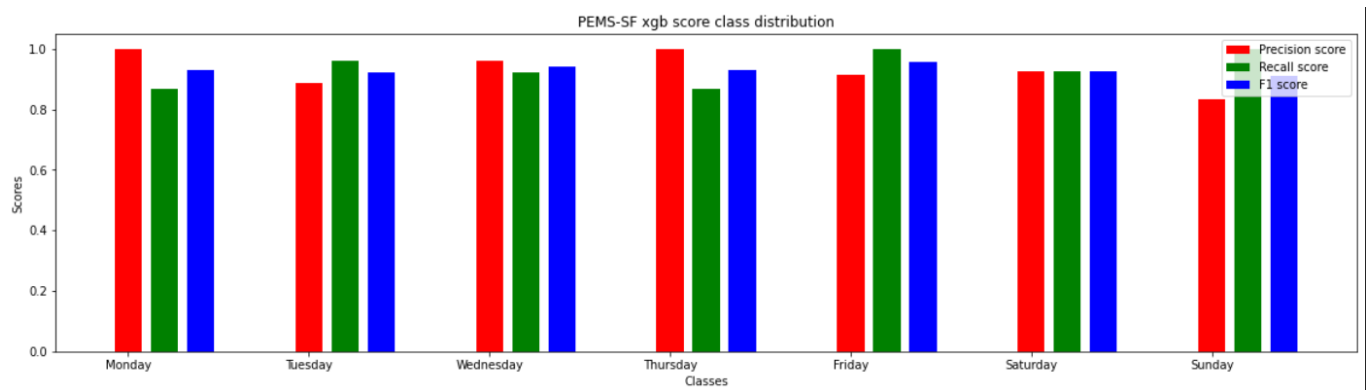
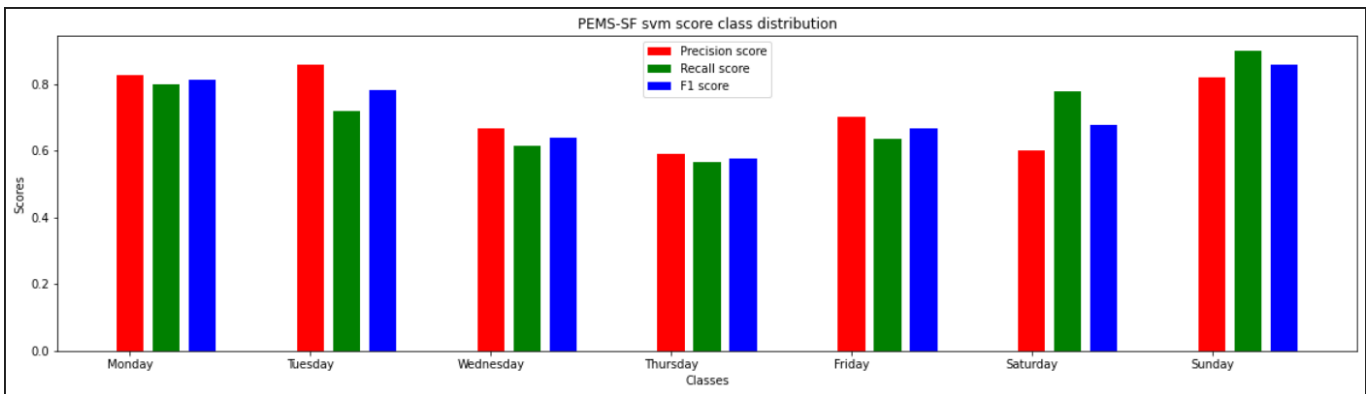
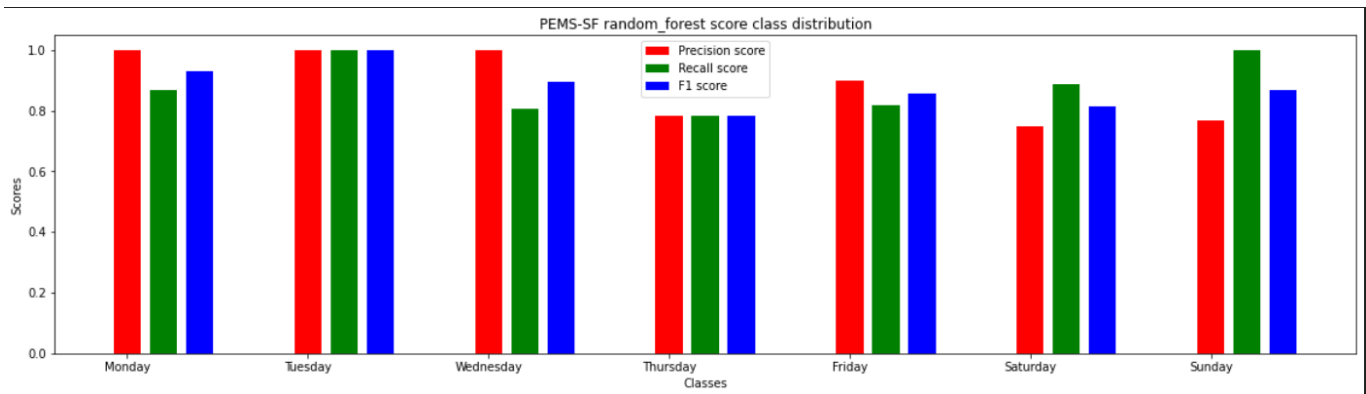
Final overview

PEMS-SF

Accuracy

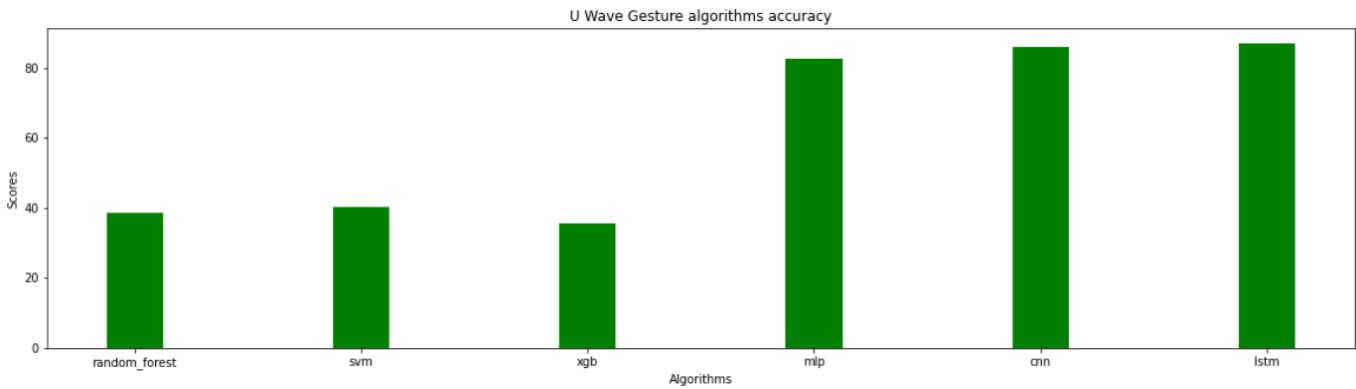


Algorithms efficiency with respect to classes



U Wave Gesture

Accuracy



Algorithms efficiency with respect to classes

