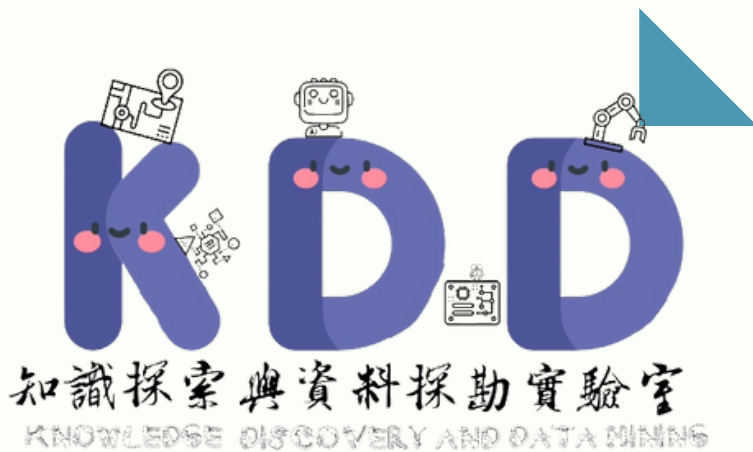




國立中興大學  
NATIONAL  
CHUNG HSING UNIVERSITY

# Experimental Log

Smart Motorcycle Online Diagnosis  
and Detection and Evaluation  
System for Driving Behavior



Department of Electrical Engineering, National Chung Hsing University  
Student: Yen, Wei-Liang (William)  
Supervisor: Prof. Hsiao-Ping Tsai

---

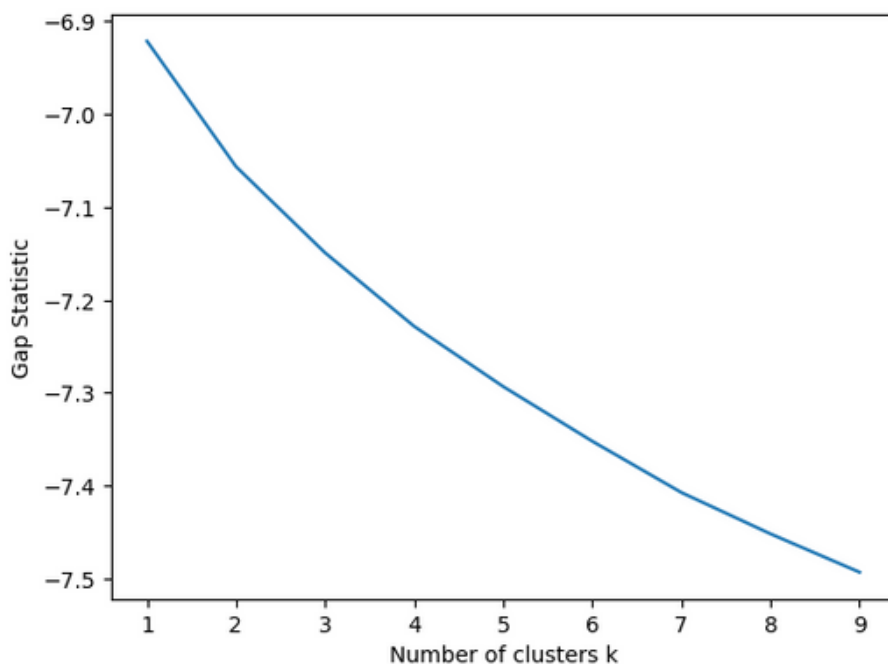
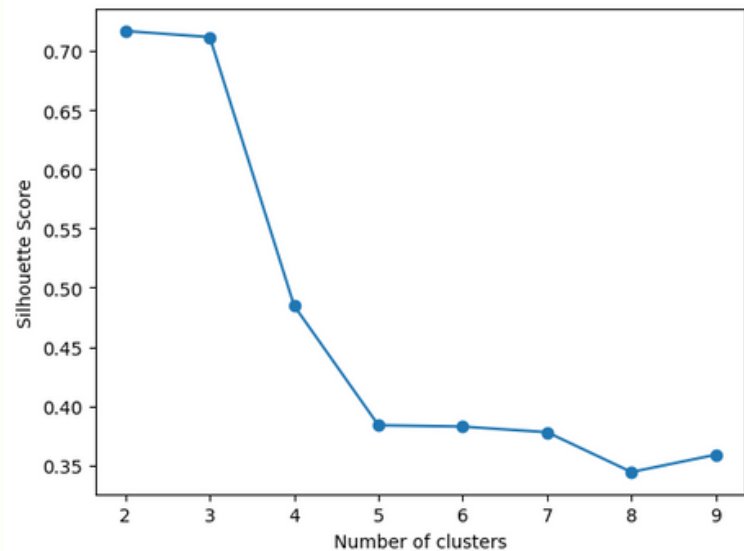
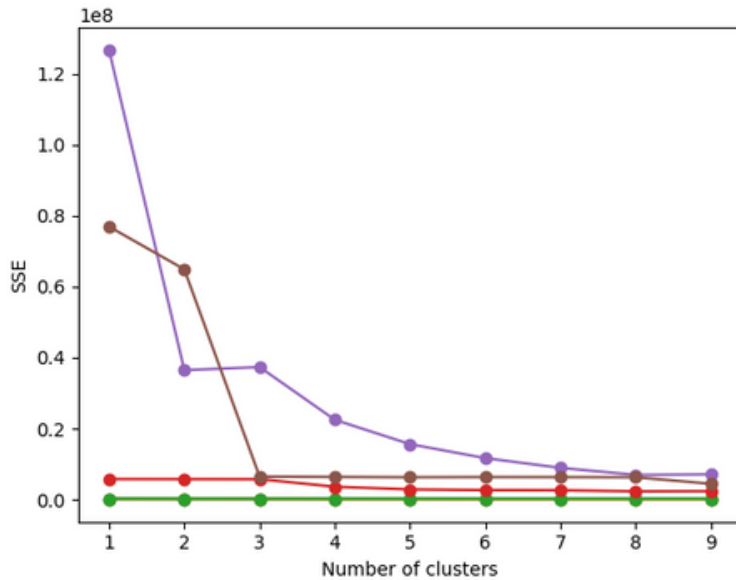
# Last week's review comments

- Subtract the initial angle from the three-axis angles in the dataset and perform K-means clustering.
- Design some rules for manually labeling the data.

# Fixes and Improvements

Q: Subtract the initial angle from the three-axis angles in the dataset and perform K-means clustering.

A: Cluster the dataset into 9 clusters and implement the Elbow Method, Silhouette Score, and Gap Statistic algorithms to observe which number of clusters is most suitable.



# Fixes and Improvements

Q: Subtract the initial angle from the three-axis angles in the dataset and perform K-means clustering.

A: A chart showing the proportion of the data for each label in a four-clustered dataset.

```
In [46]: Data['Label'].value_counts().sort_index()
```

```
Out[46]: 0      18843
         1       2084
         2        713
         3       6556
         Name: Label, dtype: int64
```

```
In [47]: Data_left['Label'].value_counts().sort_index()
```

```
Out[47]: 0        664
         1        186
         2        132
         3        463
         Name: Label, dtype: int64
```

```
In [48]: Data_right['Label'].value_counts().sort_index()
```

```
Out[48]: 0        470
         1        153
         2          8
         3       365
         Name: Label, dtype: int64
```

# Fixes and Improvements

*Q: Subtract the initial angle from the three-axis angles in the dataset and perform K-means clustering.*

*A: Artificial intelligence categorizes the data into four types: leftward acceleration, leftward deceleration, rightward acceleration, and rightward deceleration. The following is a chart showing the distribution of data and labels.*

```
In [63]: Data_QL = Data[ (Data['Z-axis Angle'] > 0) & (Data['X-axis Acceleration'] > -6.31352) ]
Data_QL['Label'].value_counts().sort_index()

Out[63]: 0    16182
         1     2059
         3     5788
         Name: Label, dtype: int64

In [64]: Data_SL = Data[ (Data['Z-axis Angle'] > 0) & (Data['X-axis Acceleration'] < -6.31352) ]
Data_SL['Label'].value_counts().sort_index()

Out[64]: 0     2416
         1        19
         3     445
         Name: Label, dtype: int64

In [65]: Data_QR = Data[ (Data['Z-axis Angle'] < 0) & (Data['X-axis Acceleration'] > -6.31352) ]
Data_QR['Label'].value_counts().sort_index()

Out[65]: 0      34
         1       6
         2    711
         3    322
         Name: Label, dtype: int64

In [66]: Data_SR = Data[ (Data['Z-axis Angle'] < 0) & (Data['X-axis Acceleration'] < -6.31352) ]
Data_SR['Label'].value_counts().sort_index()

Out[66]: 0      4
         2      2
         3      1
         Name: Label, dtype: int64
```

# Fixes and Improvements

*Q: Subtract the initial angle from the three-axis angles in the dataset and perform K-means clustering.*

```
#快偏左 (實際上是左轉)
Data_QL_LL = Data[ (Data['Z-axis Angle'] > 0) & (Data['X-axis Acceleration'] > -6.31352) & (Data['Action'] == 'left') ]
Data_QL_LL['Label'].value_counts().sort_index()
```

```
0    472
1    185
3    379
Name: Label, dtype: int64
```

```
#慢偏左 (實際上是左轉)
Data_SL_LL = Data[ (Data['Z-axis Angle'] > 0) & (Data['X-axis Acceleration'] < -6.31352) & (Data['Action'] == 'left') ]
Data_SL_LL['Label'].value_counts().sort_index()
```

```
0    190
1     1
3     66
Name: Label, dtype: int64
```

```
#快偏右 (實際上是右轉)
Data_QR_RR = Data[ (Data['Z-axis Angle'] < 0) & (Data['X-axis Acceleration'] > -6.31352) & (Data['Action'] == 'right') ]
Data_QR_RR['Label'].value_counts().sort_index()
```

```
0     1
1     1
2     8
3    21
Name: Label, dtype: int64
```

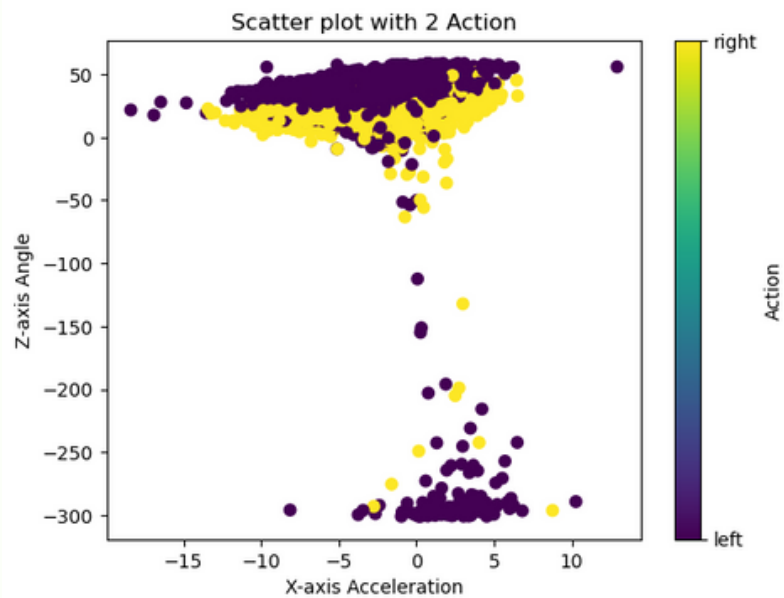
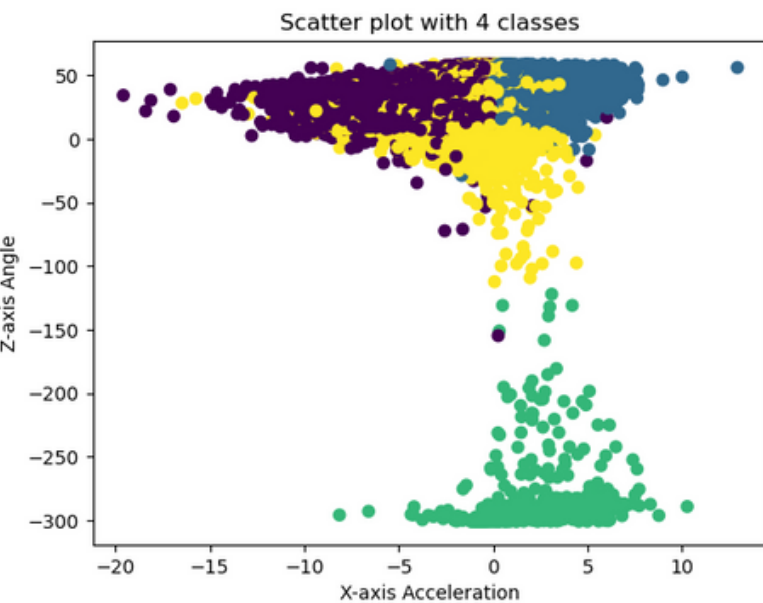
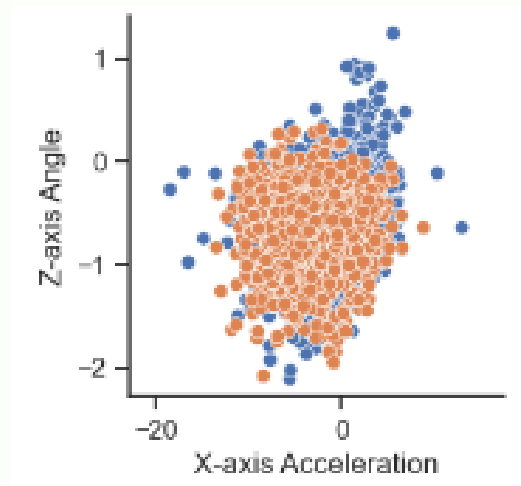
```
#慢偏右 (實際上是右轉)
Data_SR_RR = Data[ (Data['Z-axis Angle'] < 0) & (Data['X-axis Acceleration'] < -6.31352) & (Data['Action'] == 'right') ]
Data_SR_RR['Label'].value_counts().sort_index()
```

```
0     1
Name: Label, dtype: int64
```

# Fixes and Improvements

	X-axis Acceleration	Y-axis Acceleration	Z-axis Acceleration	X-axis Angle	Y-axis Angle	Z-axis Angle
count	18843.000000	18843.000000	18843.000000	18843.000000	18843.000000	18843.000000
mean	-4.064917	-0.776097	9.175878	0.154495	-5.484763	30.901481
std	2.113461	1.709193	2.476757	8.996582	21.529903	13.287975
min	-19.577390	-11.518490	-11.614270	-24.082580	-83.793020	-154.935420
25%	-5.382170	-1.326390	7.661450	-5.591060	-15.054225	17.690890
50%	-3.943250	-0.502780	9.078810	-1.338750	-1.121510	33.219760
75%	-2.571380	0.239430	10.469850	3.610485	9.517585	40.225735
max	6.011840	11.001360	22.029050	72.764270	28.769210	58.829860
	X-axis Acceleration	Y-axis Acceleration	Z-axis Acceleration	X-axis Angle	Y-axis Angle	Z-axis Angle
count	2084.000000	2084.000000	2084.000000	2084.000000	2084.000000	2084.000000
mean	1.867969	-1.332688	10.331866	1.610894	208.114440	32.412733
std	2.129351	2.744432	3.071673	15.273900	43.038795	13.461080
min	-11.446690	-10.362110	1.091750	-61.139490	132.759880	-28.902920
25%	0.718250	-2.940675	8.522763	-7.416197	169.830950	20.849045
50%	1.636435	-0.809235	10.265145	-0.706195	209.603310	29.691070
75%	2.965215	0.405225	11.986575	9.634792	247.622335	43.405173
max	12.919110	6.485900	29.580370	78.029420	276.186150	58.806210
	X-axis Acceleration	Y-axis Acceleration	Z-axis Acceleration	X-axis Angle	Y-axis Angle	Z-axis Angle
count	713.000000	713.000000	713.000000	713.000000	713.000000	713.000000
mean	1.925146	0.734589	8.571925	-9.309888	145.354620	-288.366593
std	2.249213	3.492753	4.799782	24.814085	79.553686	24.362008
min	-8.137890	-9.603130	-15.009250	-90.434250	-83.731740	-301.125920
25%	0.263350	-1.192310	6.033390	-20.042280	104.394780	-298.975590
50%	1.486790	0.919370	9.253590	-8.776660	151.527670	-296.013990
75%	3.485950	2.669540	11.812990	2.273300	201.954570	-289.936680
max	10.263930	11.760330	20.614070	73.617190	275.327230	-122.285400
	X-axis Acceleration	Y-axis Acceleration	Z-axis Acceleration	X-axis Angle	Y-axis Angle	Z-axis Angle
count	6556.000000	6556.000000	6556.000000	6556.000000	6556.000000	6556.000000
mean	-2.495853	2.583247	9.61713	-20.486446	57.382578	26.407703
std	2.317376	2.044296	3.23344	13.317089	28.622598	18.517106
min	-16.464940	-7.891280	-13.84807	-92.653990	20.533370	-112.455600
25%	-3.888180	1.280900	7.98946	-25.414170	34.529705	12.275045
50%	-2.223030	2.056630	9.99579	-15.774735	47.961325	30.798920
75%	-0.873890	3.397978	11.57358	-11.707630	73.567572	39.056793
max	5.386950	13.000520	21.05461	-4.637250	137.587150	58.822720

# Fixes and Improvements





# Fixes and Improvements

Q: Subtract the initial angle from the three-axis angles in the dataset and perform K-means clustering.

A: A chart showing the proportion of the data for each label in a five-clustered dataset.

```
In [54]: Data['Label'].value_counts().sort_index()
```

```
Out[54]: 0      3343
         1      8595
         2      1789
         3       710
         4     13759
         Name: Label, dtype: int64
```

```
In [55]: Data_left['Label'].value_counts().sort_index()
```

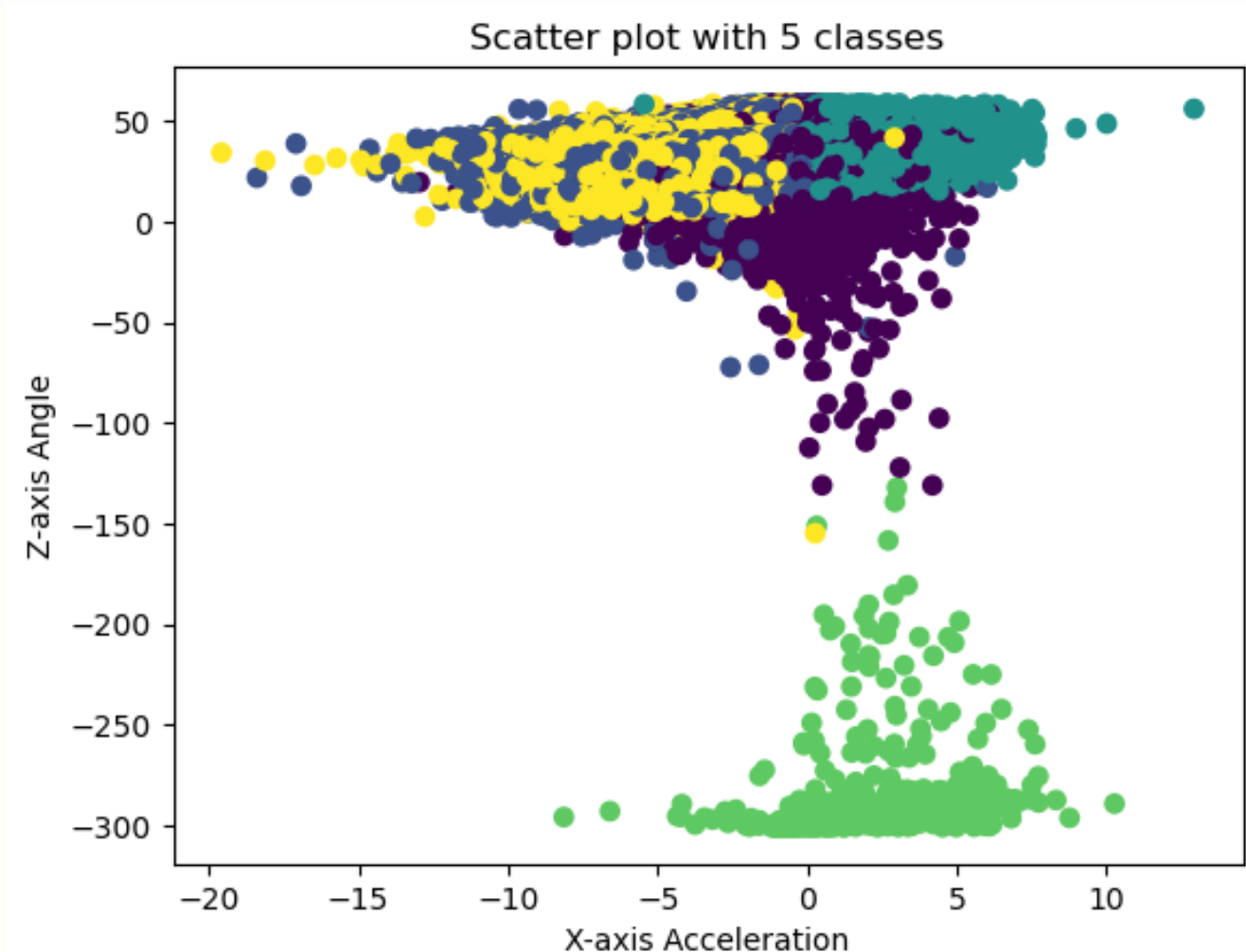
```
Out[55]: 0      313
         1      479
         2      162
         3      132
         4      359
         Name: Label, dtype: int64
```

```
In [56]: Data_right['Label'].value_counts().sort_index()
```

```
Out[56]: 0      292
         Name: Label, dtype: int64
```

# Fixes and Improvements

Q: Subtract the initial angle from the three-axis angles in the dataset and perform K-means clustering.



---

# Progress this week

- 測試分群效果 (卡關)