**Hand Postures**

In this dataset, the value of all the feature are very unusable, because of the unlabeled features.

**The classifier I used:**

1. Naïve Bayes
2. SVM
3. Perceptron
4. OneVsRest
5. KNN
6. Decision Tree
7. Random Forest

**Pre Processing**

1. Standardization

I used only standardization because of the range of the value in different features are very different.

If using the raw data to train the classifier, the best I get is only 60 %.

So I decided to define new features, such as mean of all x,y,z markers,and standard deviation of all x,y,z markers

**Using only 6 features(mean of x,y,z and std of x,y,z)**

Corss-Validation Accuracy of mean and std, test accuracy, confusion are shown below.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | ﻿cross\_val\_acc mean | ﻿cross\_val\_acc std | Test Accuracy | Confusion Matrix |
| Naïve Bayes | ﻿﻿﻿0.834 | ﻿0.119 | ﻿﻿71.14 % | ﻿﻿ [[4418 48 0 0 0]  [ 8 4214 0 144 36]  [2754 0 923 426 676]  [ 0 0 0 2988 926]  [ 0 565 0 507 2466]] |
| SVM | ﻿0.773 | ﻿﻿﻿0.15 | ﻿﻿﻿85.82 % | ﻿﻿﻿ [[4348 48 70 0 0]  [ 189 3627 57 0 529]  [1594 0 2856 329 0]  [ 0 0 1 3913 0]  [ 19 4 95 57 3363]] |
| Perceptron | ﻿0.802 | ﻿﻿﻿﻿0.107 | ﻿﻿﻿﻿82.25 % | ﻿ [[4202 48 216 0 0]  [ 28 4205 112 57 0]  [1671 2 2924 123 59]  [ 0 532 0 2983 399]  [ 0 78 26 395 3039]] |
| OneVsRest | ﻿0.771 | ﻿0.132 | ﻿﻿﻿79.63 % | ﻿﻿﻿ [[4406 48 0 0 12]  [ 28 4221 64 89 0]  [2742 61 1961 15 0]  [ 0 994 4 2916 0]  [ 0 31 21 188 3298]] |
| KNN | ﻿﻿﻿0.786 | ﻿﻿﻿﻿0.107 | ﻿88.41 % | ﻿﻿ [[4327 92 12 6 29]  [ 133 4015 16 0 238]  [ 709 61 3901 108 0]  [ 0 212 408 3289 5]  [ 6 87 1 322 3122]] |
| Decision Tree | ﻿0.773 | ﻿﻿﻿﻿0.141 | ﻿﻿﻿﻿75.8 % | ﻿﻿﻿﻿ [[4231 89 96 0 50]  [ 35 2777 149 0 1441]  [ 348 0 2043 35 2353]  [ 0 0 1 3886 27]  [ 0 367 46 68 3057]] |
| Random Forest | ﻿﻿﻿0.796 | ﻿﻿﻿0.09 | ﻿﻿﻿67.99 % | ﻿﻿﻿ [[4410 22 7 0 27]  [ 21 1601 53 0 2727]  [1375 0 1039 70 2295]  [ 0 0 1 3891 22]  [ 0 85 21 28 3404]] |

Then I tried to add 6 more features, which are maximum of x,y,z and minimum of x,y,z. The result of adding both maximum and minimum are better than before.

**Using 12 features(mean of x,y,z & std of x,y,z & maximum of x,y,z & minimum of x,y,z)**

Corss-Validation Accuracy of mean and std, test accuracy, confusion are shown below.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | ﻿cross\_val\_acc mean | ﻿cross\_val\_acc std | Test Accuracy | Confusion Matrix |
| Naïve Bayes | ﻿0.813 | ﻿0.134 | ﻿﻿﻿﻿78.1 % | ﻿﻿﻿ [[4373 45 0 0 48]  [ 31 4199 0 139 33]  [ 343 0 1647 357 2432]  [ 0 660 0 2953 301]  [ 0 130 0 102 3306]] |
| SVM | ﻿﻿0.848 | ﻿﻿﻿0.111 | ﻿﻿﻿﻿91.44 % | ﻿ [[4327 53 6 1 79]  [ 37 3574 208 0 583]  [ 95 0 4272 274 138]  [ 0 124 44 3746 0]  [ 0 32 14 119 3373]] |
| Perceptron | ﻿0.86 | ﻿﻿﻿﻿0.103 | ﻿﻿84.07 % | ﻿﻿ [[4329 48 69 0 20]  [ 21 4215 31 135 0]  [ 171 45 4356 207 0]  [ 0 869 1150 1895 0]  [ 205 36 241 114 2942]] |
| OneVsRest | ﻿﻿0.866 | ﻿0.109 | ﻿﻿83.98 % | ﻿﻿ [[4172 48 88 0 158]  [ 0 4283 3 85 31]  [ 4 319 4151 149 156]  [ 0 849 1 1907 1157]  [ 0 20 3 309 3206]] |
| KNN | ﻿﻿0.814 | ﻿ ﻿0.144 | ﻿﻿75.01 % | ﻿﻿ [[4219 44 65 12 126]  [ 119 3035 53 0 1195]  [ 51 169 3436 848 275]  [ 0 115 1402 2397 0]  [ 0 377 23 399 2739]] |
| Decision Tree | ﻿﻿﻿0.768 | ﻿﻿﻿﻿0.137 | ﻿﻿﻿70.25 % | ﻿﻿ ﻿[[4323 64 25 0 54]  [ 31 2063 82 60 2166]  [ 0 1647 3079 41 12]  [ 0 924 113 2870 7]  [ 0 999 47 4 2488]] |
| Random Forest | ﻿﻿0.847 | ﻿﻿﻿0.106 | ﻿﻿89.45 % | ﻿﻿ ﻿[[4343 48 40 0 35]  [ 31 3596 60 8 707]  [ 31 61 4632 17 38]  [ 0 928 16 2921 49]  [ 0 111 18 28 3381]] |

We can see from above, most of the test accuracy in 12 features are better than only 6 features.