

I will have to extract features from the data, deploy the classifiers. I using Sklearn , Pandas ,metrics , DecisionTreeClassifier, KNeighborsClassifier and I used Python as my preferred language. I wrote my code using Atom and my Integrated development environment ; I used Linux terminal.

## 1) The data of the .pts file for 5 man and 5 woman and each person have 4pts file.

```
waiyat@waiyat-Hitro-W851S-01:~/Desktop/homework1$ python3 main.py
n-001-01.pts n-001-02.pts n-001-03.pts n-001-05.pts n-002-01.pts n-002-02.pts n-002-03.pts n-002-05.pts n-003-01.pts ... w-003-05.pts w-004-01.pts w-004-02.pts w-004-03.pts w-004-05.pts w-005-01.pts w-005-02.pts w-005-03.pts w-005-05.pts
0 [328.444, 275.496] [344.626, 270.69] [329.17, 291.426] [345.898, 260.392] [327.193, 263.825] [367.138, 251.974] [297.638, 294.369] [342.987, 266.127] [324.151, 259.223] ... [332.051, 275.241] [330.158, 264.661] [319.793, 264.16] [335.584, 260.285] [317.468, 279.797] [342.907, 261.356] [335.164, 269.079] [358.968, 281.628] [350.278, 274.329]
1 [434.921, 275.029] [449.912, 272.639] [436.553, 289.928] [451.765, 264.157] [437.671, 258.127] [479.587, 255.641] [407.577, 271.745] [456.0, 270.684] [435.74, 256.488] ... [441.418, 268.861] [439.702, 262.773] [428.005, 264.775] [443.4, 270.046] [430.481, 274.329] [451.443, 263.362] [445.836, 264.775] [467.558, 283.978] [458.734, 275.241]
2 [331.713, 401.121] [332.867, 381.687] [331.667, 419.288] [345.008, 384.627] [342.887, 379.987] [363.471, 356.478] [329.804, 405.208] [353.013, 381.873] [330.168, 381.751] ... [353.013, 385.519] [345.439, 375.502] [319.179, 365.609] [335.14, 373.426] [334.785, 390.076] [347.473, 384.66] [334.55, 379.135] [365.079, 410.432] [357.57, 400.101]
3 [427.449, 400.187] [440.572, 390.183] [433.057, 416.79] [434.196, 387.137] [432.444, 376.537] [476.531, 358.923] [414.778, 391.285] [435.949, 384.608] [435.193, 383.392] ... [428.658, 381.873] [430.887, 371.491] [429.235, 364.094] [422.09, 380.081] [416.81, 385.519] [441.14, 387.47] [451.084, 378.52] [459.097, 411.372] [445.975, 401.013]
4 [271.936, 270.826] [284.216, 262.555] [273.73, 289.928] [291.137, 259.137] [280.652, 244.57] [320.691, 218.086] [249.063, 282.787] [296.506, 249.722] [273.633, 242.815] ... [286.401, 268.861] [284.358, 240.108] [279.214, 242.026] [297.78, 230.215] [272.81, 263.392] [292.298, 241.583] [289.666, 251.248] [310.549, 265.175] [303.797, 260.658]
5 [356.464, 154.014] [377.935, 246.072] [363.133, 276.042] [381.49, 235.294] [363.40, 239.725] [404.417, 218.361] [323.083, 266.044] [378.532, 241.519] [356.614, 233.625] ... [364.861, 247.099] [357.544, 232.554] [351.765, 235.877] [370.635, 234.995] [348.456, 252.456] [376.431, 237.747] [371.44, 246.33] [395.165, 265.175] [390.38, 256.101]
6 [388.221, 255.882] [411.844, 246.543] [393.1, 275.043] [407.843, 236.549] [399.088, 237.87] [444.752, 222.028] [366.77, 257.342] [418.633, 244.253] [400.072, 232.33] ... [407.696, 249.722] [397.679, 238.083] [392.345, 236.492] [408.349, 240.763] [393.114, 247.099] [419.871, 241.053] [413.864, 245.715] [437.473, 267.995] [434.127, 253.367]
7 [494.688, 268.491] [509.331, 260.2] [495.409, 282.436] [506.09, 256.627] [485.183, 233.669] [527.867, 234.251] [451.745, 243.9] [409.747, 259.747] [481.401, 235.65] ... [478.785, 257.013] [482.108, 238.22] [469.2, 242.062] [487.769, 240.740] [475.139, 256.101] [492.586, 237.275] [495.023, 245.715] [517.858, 266.585] [506.127, 262.481]
8 [263.097, 274.895] [275.738, 270.69] [263.74, 291.026] [282.353, 261.082] [269.558, 263.238] [311.524, 250.14] [245.79, 305.831] [281.013, 264.304] [257.343, 265.214] ... [281.013, 287.089] [276.803, 269.855] [265.688, 266.619] [281.897, 257.623] [266.43, 288.0] [272.072, 264.767] [269.091, 275.227] [288.925, 284.918] [282.835, 282.532]
9 [301.825, 277.831] [310.371, 270.440] [302.109, 294.423] [322.51, 264.157] [302.703, 266.29] [342.602, 253.087] [273.154, 308.07] [322.025, 267.028] [297.080, 263.399] ... [313.822, 279.797] [307.046, 266.55] [290.274, 266.065] [300.519, 261.173] [298.329, 283.443] [315.040, 261.820] [300.111, 272.153] [331.703, 283.580] [325.671, 277.075]
10 [340.459, 277.364] [367.816, 272.630] [354.143, 293.424] [366.431, 262.002] [359.413, 262.822] [394.028, 251.363] [320.682, 280.088] [363.040, 269.772] [350.954, 261.411] ... [332.101, 276.152] [333.205, 265.606] [246.232, 263.545] [358.656, 266.053] [337.519, 279.797] [367.46, 264.180] [359.758, 269.694] [390.464, 280.200] [373.063, 277.063]
11 [411.104, 270.298] [426.914, 274.8] [411.081, 294.922] [429.176, 265.412] [415.235, 261.415] [454.53, 253.087] [382.613, 278.466] [434.127, 273.418] [409.484, 260.317] ... [421.367, 274.329] [417.038, 263.717] [405.256, 264.775] [420.328, 272.265] [411.342, 279.797] [426.481, 264.180] [420.012, 267.234] [441.233, 287.269] [441.418, 277.075]
12 [459.673, 277.831] [479.19, 275.271] [466.521, 293.424] [470.588, 266.607] [463.25, 259.759] [508.31, 256.063] [435.902, 267.424] [473.316, 274.329] [466.372, 259.223] ... [460.557, 272.506] [465.2, 261.828] [450.14, 264.775] [469.134, 274.927] [459.532, 277.063] [481.253, 265.133] [474.118, 266.085] [497.644, 280.209] [480.688, 278.886]
13 [515.246, 276.897] [522.988, 274.329] [510.973, 293.424] [522.839, 264.157] [499.719, 257.029] [542.235, 250.953] [473.348, 257.823] [511.595, 271.595] [495.363, 260.864] ... [491.544, 280.789] [502.973, 255.218] [493.793, 259.241] [505.517, 274.927] [491.544, 280.789] [507.223, 264.661] [506.09, 264.16] [522.559, 284.448] [513.418, 284.354]
14 [368.606, 340.41] [386.883, 332.256] [373.621, 361.35] [389.80, 318.118] [385.969, 318.536] [419.695, 309.421] [358.129, 345.197] [396.759, 327.19] [379.515, 320.849] ... [390.38, 332.658] [382.569, 321.794] [372.055, 320.725] [375.959, 324.62] [370.329, 339.638] [401.456, 331.238] [392.959, 337.326] [419.139, 358.722] [411.342, 344.506]
15 [355.53, 351.151] [370.871, 344.972] [359.137, 371.839] [372.706, 326.902] [370.187, 327.788] [403.806, 319.199] [346.607, 356.719] [384.0, 334.481] [363.684, 333.813] ... [373.975, 339.049] [368.404, 331.71] [356.069, 328.718] [367.073, 333.494] [358.481, 343.595] [383.086, 339.264] [376.359, 347.163] [401.276, 366.714] [396.759, 353.62]
16 [391.957, 350.217] [404.779, 345.443] [393.6, 372.339] [409.808, 326.902] [399.575, 327.788] [435.472, 319.063] [375.412, 352.399] [414.076, 334.481] [395.776, 332.912] ... [407.696, 338.127] [395.318, 331.71] [389.885, 328.718] [391.932, 333.937] [385.823, 344.506] [412.316, 339.264] [413.249, 344.089] [429.951, 367.654] [425.013, 353.62]
17 [374.253, 355.527] [385.07, 389.178] [376.119, 414.293] [387.765, 367.059] [386.155, 367.268] [420.918, 354.034] [366.29, 389.845] [396.759, 368.203] [379.936, 371.223] ... [392.203, 368.203] [385.349, 366.438] [373.285, 355.771] [379.589, 366.77] [374.886, 375.494] [395.243, 379.588] [391.115, 368.683] [413.408, 404.791] [409.519, 390.087]
18 [374.253, 416.925] [386.006, 421.015] [378.616, 440.265] [387.765, 393.412] [386.155, 394.529] [420.918, 388.257] [370.131, 412.409] [396.759, 394.633] [380.627, 401.242] ... [396.759, 396.456] [386.354, 387.031] [375.129, 392.662] [378.178, 392.504] [376.709, 402.835] [394.307, 401.988] [394.804, 414.181] [414.438, 431.116] [406.785, 418.329]
19 [373.276, 483.314] [390.18, 491.438] [380.614, 505.195] [387.765, 468.706] [388.628, 472.462] [424.584, 475.65] [383.093, 480.58] [396.759, 463.899] [380.993, 468.179] ... [386.759, 463.873] [387.291, 448.888] [380.648, 451.686] [372.854, 449.297] [376.709, 461.165] [392.002, 460.428] [397.078, 475.05] [414.438, 482.355] [406.785, 474.835]
20 [280.342, 404.39] [281.39, 393.080] [279.723, 418.289] [286.118, 383.373] [282.728, 382.655] [309.691, 356.478] [271.714, 414.329] [285.57, 382.785] [271.630, 385.033] ... [288.304, 386.43] [299.467, 379.389] [280.444, 364.379] [292.546, 369.433] [287.302, 390.076] [287.658, 387.47] [285.077, 381.595] [303.968, 403.381] [297.418, 398.278]
21 [499.835, 402.522] [511.685, 397.247] [501.082, 416.291] [509.49, 389.647] [499.719, 377.464] [542.534, 359.534] [485.83, 381.684] [503.302, 388.253] [486.799, 383.939] ... [490.633, 380.962] [498.724, 368.530] [485.8, 364.994] [486.882, 383.187] [483.342, 386.43] [494.946, 388.842] [499.042, 374.831] [504.695, 411.042] [491.544, 401.924]
```

## 2) Experimental Results and Analysis

- K- NN confussion matrix precision matrix , recall rate matrix, accuracy matrix report

confusion matrix report knn:

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

precision matrix report micro knn:  
0.3

recal rate matrix report micro knn:  
0.3

accuracy matrix report micro knn:  
0.3

### - Decision Tree confusion matrix precision matrix , recall rate matrix, accuracy matrix report

```
confusion matrix report decision tree :
```

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

```
precision matrix report micro tree:
0.4
```

```
recall rate matrix report micro tree:
0.4
```

```
accuracy matrix report micro knn:
0.4
```

### 3)Appendices

#### - first feature ,eye length ratio:

```
[22 rows x 40 columns]
```

```
-----first defining feature:eye length ratio-----
values
m-001-01.pts 0.193307
m-001-02.pts 0.211407
m-001-03.pts 0.224320
m-001-05.pts 0.183316
m-002-01.pts 0.208663
m-002-02.pts 0.233480
m-002-03.pts 0.234001
m-002-05.pts 0.182113
m-003-01.pts 0.239009
m-003-02.pts 0.241601
m-003-03.pts 0.241439
m-003-05.pts 0.176839
m-004-01.pts 0.236852
m-004-02.pts 0.248213
m-004-03.pts 0.227190
m-004-05.pts 0.205735
m-005-01.pts 0.245517
m-005-02.pts 0.226269
m-005-03.pts 0.224396
m-005-05.pts 0.190446
w-001-01.pts 0.266238
w-001-02.pts 0.263351
w-001-03.pts 0.269563
w-001-05.pts 0.243968
w-002-01.pts 0.206976
w-002-02.pts 0.212474
w-002-03.pts 0.251717
w-002-05.pts 0.214471
w-003-01.pts 0.221773
w-003-02.pts 0.249003
w-003-03.pts 0.231339
w-003-05.pts 0.186264
w-004-01.pts 0.212665
w-004-02.pts 0.210412
w-004-03.pts 0.224594
w-004-05.pts 0.174750
w-005-01.pts 0.232957
w-005-02.pts 0.228974
w-005-03.pts 0.252312
w-005-05.pts 0.205563
```

## -second feature, eye distance:

```
-----second defining feature:eye distance-----
values
m-001-01.pts 0.423768
m-001-02.pts 0.428316
m-001-03.pts 0.434374
m-001-05.pts 0.445299
m-002-01.pts 0.480300
m-002-02.pts 0.487658
m-002-03.pts 0.482573
m-002-05.pts 0.490274
m-003-01.pts 0.468884
m-003-02.pts 0.472005
m-003-03.pts 0.475170
m-003-05.pts 0.484628
m-004-01.pts 0.465986
m-004-02.pts 0.463249
m-004-03.pts 0.462137
m-004-05.pts 0.466788
m-005-01.pts 0.480971
m-005-02.pts 0.461281
m-005-03.pts 0.475740
m-005-05.pts 0.509464
w-001-01.pts 0.485008
w-001-02.pts 0.473683
w-001-03.pts 0.468425
w-001-05.pts 0.490362
w-002-01.pts 0.471466
w-002-02.pts 0.473970
w-002-03.pts 0.470886
w-002-05.pts 0.499997
w-003-01.pts 0.504649
w-003-02.pts 0.525497
w-003-03.pts 0.504316
w-003-05.pts 0.520126
w-004-01.pts 0.483404
w-004-02.pts 0.474155
w-004-03.pts 0.482668
w-004-05.pts 0.502350
w-005-01.pts 0.461638
w-005-02.pts 0.468592
w-005-03.pts 0.464895
w-005-05.pts 0.470358
```

## -third feature , nose ratio

```
-----third defining feature:nose ratio-----
values
m-001-01.pts 0.166008
m-001-02.pts 0.147227
m-001-03.pts 0.155068
m-001-05.pts 0.162857
m-002-01.pts 0.135395
m-002-02.pts 0.135987
m-002-03.pts 0.134480
m-002-05.pts 0.138033
m-003-01.pts 0.147836
m-003-02.pts 0.163104
m-003-03.pts 0.160229
m-003-05.pts 0.172419
m-004-01.pts 0.131490
m-004-02.pts 0.157853
m-004-03.pts 0.151583
m-004-05.pts 0.151421
m-005-01.pts 0.121272
m-005-02.pts 0.139369
m-005-03.pts 0.129880
m-005-05.pts 0.117398
w-001-01.pts 0.153618
w-001-02.pts 0.161916
w-001-03.pts 0.158053
w-001-05.pts 0.159330
w-002-01.pts 0.145683
w-002-02.pts 0.164410
w-002-03.pts 0.155271
w-002-05.pts 0.154558
w-003-01.pts 0.145611
w-003-02.pts 0.162833
w-003-03.pts 0.146116
w-003-05.pts 0.166846
w-004-01.pts 0.134872
w-004-02.pts 0.164669
w-004-03.pts 0.123000
w-004-05.pts 0.139589
w-005-01.pts 0.136272
w-005-02.pts 0.172923
w-005-03.pts 0.142806
w-005-05.pts 0.145519
```

#### -fourth feature , lips size ratio

```
-----fourth defining feature:lips size ratio-----
values
m-001-01.pts 4.474276
m-001-02.pts 3.392057
m-001-03.pts 3.887081
m-001-05.pts 3.382285
m-002-01.pts 3.287606
m-002-02.pts 3.304399
m-002-03.pts 3.762010
m-002-05.pts 3.139655
m-003-01.pts 3.498118
m-003-02.pts 4.235138
m-003-03.pts 4.639975
m-003-05.pts 4.861229
m-004-01.pts 6.940880
m-004-02.pts 2.581968
m-004-03.pts 3.639051
m-004-05.pts 3.873172
m-005-01.pts 10.428257
m-005-02.pts 2.860667
m-005-03.pts 4.972352
m-005-05.pts 4.347035
w-001-01.pts 3.109574
w-001-02.pts 3.019783
w-001-03.pts 2.828372
w-001-05.pts 2.838913
w-002-01.pts 3.267069
w-002-02.pts 2.416921
w-002-03.pts 3.648804
w-002-05.pts 3.324506
w-003-01.pts 3.506388
w-003-02.pts 2.878349
w-003-03.pts 3.225940
w-003-05.pts 2.646336
w-004-01.pts 4.149002
w-004-02.pts 2.979602
w-004-03.pts 3.418983
w-004-05.pts 2.998043
w-005-01.pts 4.164947
w-005-02.pts 2.572673
w-005-03.pts 3.569338
w-005-05.pts 3.217431
```

#### -fifth feature, Lip length ratio

```
-----fifth defining feature:Lip length ratio-----
values
m-001-01.pts 0.436174
m-001-02.pts 0.469056
m-001-03.pts 0.456299
m-001-05.pts 0.398878
m-002-01.pts 0.412910
m-002-02.pts 0.485635
m-002-03.pts 0.397557
m-002-05.pts 0.380838
m-003-01.pts 0.483682
m-003-02.pts 0.517285
m-003-03.pts 0.484581
m-003-05.pts 0.433144
m-004-01.pts 0.438517
m-004-02.pts 0.529262
m-004-03.pts 0.449905
m-004-05.pts 0.442907
m-005-01.pts 0.436841
m-005-02.pts 0.491058
m-005-03.pts 0.440961
m-005-05.pts 0.400737
w-001-01.pts 0.456926
w-001-02.pts 0.566145
w-001-03.pts 0.494729
w-001-05.pts 0.425128
w-002-01.pts 0.402367
w-002-02.pts 0.560891
w-002-03.pts 0.408763
w-002-05.pts 0.434727
w-003-01.pts 0.436727
w-003-02.pts 0.513504
w-003-03.pts 0.416152
w-003-05.pts 0.374169
w-004-01.pts 0.428669
w-004-02.pts 0.535934
w-004-03.pts 0.452216
w-004-05.pts 0.419175
w-005-01.pts 0.450758
w-005-02.pts 0.548580
w-005-03.pts 0.467995
w-005-05.pts 0.455344
```



### -sixth feature ,eye-brow length ratio

```
-----Six defining feature:Eye-brow length ratio-----
values
m-001-01.pts 0.426725
m-001-02.pts 0.398077
m-001-03.pts 0.414964
m-001-05.pts 0.422004
m-002-01.pts 0.374373
m-002-02.pts 0.367551
m-002-03.pts 0.369922
m-002-05.pts 0.357961
m-003-01.pts 0.350703
m-003-02.pts 0.375362
m-003-03.pts 0.351115
m-003-05.pts 0.375743
m-004-01.pts 0.369298
m-004-02.pts 0.334638
m-004-03.pts 0.376879
m-004-05.pts 0.361749
m-005-01.pts 0.336540
m-005-02.pts 0.324257
m-005-03.pts 0.352962
m-005-05.pts 0.359320
w-001-01.pts 0.362947
w-001-02.pts 0.358082
w-001-03.pts 0.345001
w-001-05.pts 0.386084
w-002-01.pts 0.335148
w-002-02.pts 0.342187
w-002-03.pts 0.355736
w-002-05.pts 0.330837
w-003-01.pts 0.349374
w-003-02.pts 0.347421
w-003-03.pts 0.390451
w-003-05.pts 0.385204
w-004-01.pts 0.372969
w-004-02.pts 0.337624
w-004-03.pts 0.355883
w-004-05.pts 0.365996
w-005-01.pts 0.358155
w-005-02.pts 0.346600
w-005-03.pts 0.362173
w-005-05.pts 0.376004
```

### -seventh feature , aggressive ratio

```
-----seventh defining feature:aggressive ratio-----
values
m-001-01.pts 0.944518
m-001-02.pts 0.954870
m-001-03.pts 0.960188
m-001-05.pts 0.925923
m-002-01.pts 0.981763
m-002-02.pts 0.972069
m-002-03.pts 0.925943
m-002-05.pts 0.903573
m-003-01.pts 0.962129
m-003-02.pts 0.933771
m-003-03.pts 0.949108
m-003-05.pts 0.936718
m-004-01.pts 0.968076
m-004-02.pts 0.892415
m-004-03.pts 0.984009
m-004-05.pts 1.001245
m-005-01.pts 0.905933
m-005-02.pts 0.888417
m-005-03.pts 0.891447
m-005-05.pts 0.860338
w-001-01.pts 1.055723
w-001-02.pts 0.974968
w-001-03.pts 1.066541
w-001-05.pts 1.043468
w-002-01.pts 0.916886
w-002-02.pts 0.981057
w-002-03.pts 0.939260
w-002-05.pts 0.960822
w-003-01.pts 0.915431
w-003-02.pts 0.921411
w-003-03.pts 0.892855
w-003-05.pts 0.905353
w-004-01.pts 0.933736
w-004-02.pts 0.930847
w-004-03.pts 0.943390
w-004-05.pts 0.946781
w-005-01.pts 0.994792
w-005-02.pts 0.975673
w-005-03.pts 0.973696
w-005-05.pts 1.033303
```

#### 4) Conclusion :

-In conclusion, To get the K- NN and Decision Tree ; confusion matric, precision matric, recall rate matric, accuracy matric report. I need to get to 7 features Euclidian Distance value. And I store each 7 value into one array of data. In the end, I will get 40 arrays of 7 feature point data. I will take 30 arrays into Train data and 10 arrays of Test data. Because of 10 people, in the end; we will get 10 test classes. With that, I can get K- NN and Decision calculation easily.

For K nearest neighbor:

- recall rate , accuracy , precision : 30%

For Decision Tree

- recall rate , accuracy , precision : 40%

therefore I conclude my conclusion.