```
"A:\College\Portfolio\Data Mining and Machine Learning 1\Final Project\Code\venv\Scripts\python.exe" "A:/College/Portfolio/Data Mining and Machine Learning 1/Final Project/Code/BRFSS_EDA_and_ML_Methods.py"
2022-04-27 18:34:52.488386: W tensorflow/stream_executor/platform/default/dso_loader.cc:64] Could not load dynamic library 'cudart64_110.dll'; dlerror: cudart64_110.dll not found
2022-04-27 18:34:52.488712: I tensorflow/stream_executor/cuda/cudart_stub.cc:29] Ignore above cudart dlerror if you do not have a GPU set up on your machine.
   Diabetes  High_BP  High_Cholesterol  Cholesterol_Check   BMI  Ever_Smoked  Had_Stroke  MI_or_CHD  Physical_Activity  Eats_Fruit  Eats_Vegetables  Heavy_Driker  Has_Health_Care  Couldnt_afford_doc  General_Health  Mental_Health  Physical_Health  Difficulty_Walking  Sex  Age  Education  Income
0       0.0       0.0                 0.0                 1.0  23.0          1.0          0.0         0.0                1.0         0.0              1.0           1.0             0.0                 1.0            0.0            0.0              0.0                 0.0  0.0  2.0        6.0     7.0
1       0.0       0.0                 0.0                 1.0  26.0          0.0          0.0         0.0                0.0         1.0              0.0           1.0             0.0                 2.0            0.0            2.0              1.0                 1.0  0.0  2.0        3.0     8.0
2       0.0       0.0                 0.0                 1.0  30.0          0.0          0.0         0.0                0.0         1.0              0.0           1.0             0.0                 2.0            0.0            0.0              1.0                 1.0  0.0  2.0        6.0     8.0
```

```
 8 3        0.0       0.0                 0.0
                    1.0  40.0           1.0          0.0
           0.0                  1.0          1.0
                 1.0             0.0                1.0
                    1.0               2.0            30.0
                 0.0                  0.0  0.0  2.0
           4.0     2.0
 9 4       0.0       0.0                 1.0
                    1.0  24.0           0.0          0.0
           0.0                  1.0          1.0
                 1.0             0.0                1.0
                    0.0               2.0             0.0
                 0.0                  0.0  1.0  7.0
           6.0     8.0
10    Diabetes  High_BP  High_Cholesterol
   Cholesterol_Check   BMI  Ever_Smoked  Had_Stroke
   MI_or_CHD  Physical_Activity  Eats_Fruit
   Eats_Vegetables  Heavy_Drinker  Has_Health_Care
   Couldnt_afford_doc  General_Health  Mental_Health
   Physical_Health  Difficulty_Walking  Sex   Age
   Education  Income
11 0       0.0       1.0                 1.0
                    1.0  40.0           1.0          0.0
           0.0                  0.0          0.0
                 1.0             0.0                1.0
                    0.0               5.0            18.0
                15.0                  1.0  0.0   9.0
           4.0     3.0
12 1       0.0       0.0                 0.0
                    0.0  25.0           1.0          0.0
           0.0                  1.0          0.0
                 0.0             0.0                0.0
                    1.0               3.0             0.0
                 0.0                  0.0  0.0   7.0
           6.0     1.0
13 2       0.0       1.0                 1.0
                    1.0  28.0           0.0          0.0
           0.0                  0.0          1.0
                 0.0             0.0                1.0
                    1.0               5.0            30.0
                30.0                  1.0  0.0   9.0
```

```
13          4.0     8.0
14 3        0.0      1.0                0.0
                     1.0  27.0          0.0          0.0
           0.0                 1.0          1.0
                 1.0             0.0               1.0
                    0.0              2.0             0.0
                 0.0                  0.0  0.0  11.0
           3.0     6.0
15 4        0.0      1.0                1.0
                     1.0  24.0          0.0          0.0
           0.0                 1.0          1.0
                 1.0             0.0               1.0
                    0.0              2.0             3.0
                 0.0                  0.0  0.0  11.0
           5.0     4.0
16 *** Dataframe descriptive Statistics***
17              Diabetes        High_BP
   High_Cholesterol  Cholesterol_Check            BMI
       Ever_Smoked     Had_Stroke      MI_or_CHD
   Physical_Activity     Eats_Fruit  Eats_Vegetables
   Heavy_Drinker  Has_Health_Care  Couldnt_afford_doc
   General_Health  Mental_Health  Physical_Health
   Difficulty_Walking             Sex             Age
         Education          Income
18 count  253680.000000  253680.000000     253680.000000
         253680.000000  253680.000000  253680.000000
   253680.000000  253680.000000      253680.000000
   253680.000000    253680.000000  253680.000000
   253680.000000       253680.000000   253680.000000
   253680.000000    253680.000000       253680.000000
   253680.000000  253680.000000  253680.000000  253680.
   000000
19 mean         0.139333       0.429001          0.424121
              0.962670      28.382364       0.443169
           0.040571       0.094186          0.756544
           0.634256         0.811420       0.056197
             0.951053             0.084177        2.511392
           3.184772         4.242081            0.168224
           0.440342       8.032119       5.050434       6
   .053875
20 std          0.346294       0.494934          0.494210
```

```
20            0.189571       6.608694       0.496761
         0.197294       0.292087           0.429169
         0.481639         0.391175       0.230302
           0.215759             0.277654        1.068477
         7.412847         8.717951            0.374066
         0.496429       3.054220       0.985774       2
   .071148
21 min         0.000000       0.000000          0.000000
              0.000000      12.000000       0.000000
         0.000000       0.000000           0.000000
         0.000000         0.000000       0.000000
           0.000000             0.000000        1.000000
         0.000000         0.000000            0.000000
         0.000000       1.000000       1.000000       1
   .000000
22 25%         0.000000       0.000000          0.000000
              1.000000      24.000000       0.000000
         0.000000       0.000000           1.000000
         0.000000         1.000000       0.000000
           1.000000             0.000000        2.000000
         0.000000         0.000000            0.000000
         0.000000       6.000000       4.000000       5
   .000000
23 50%         0.000000       0.000000          0.000000
              1.000000      27.000000       0.000000
         0.000000       0.000000           1.000000
         1.000000         1.000000       0.000000
           1.000000             0.000000        2.000000
         0.000000         0.000000            0.000000
         0.000000       8.000000       5.000000       7
   .000000
24 75%         0.000000       1.000000          1.000000
              1.000000      31.000000       1.000000
         0.000000       0.000000           1.000000
         1.000000         1.000000       0.000000
           1.000000             0.000000        3.000000
         2.000000         3.000000            0.000000
         1.000000      10.000000       6.000000       8
   .000000
25 max         1.000000       1.000000          1.000000
              1.000000      98.000000       1.000000
```

```
25         1.000000        1.000000            1.000000
           1.000000          1.000000        1.000000
             1.000000             1.000000         5.000000
          30.000000         30.000000             1.000000
           1.000000       13.000000        6.000000        8
   .000000
26 <class 'pandas.core.frame.DataFrame'>
27 RangeIndex: 253680 entries, 0 to 253679
28 Data columns (total 22 columns):
29  #   Column               Non-Null Count   Dtype
30 ---  ------               --------------   -----
31  0   Diabetes             253680 non-null  float64
32  1   High_BP              253680 non-null  float64
33  2   High_Cholesterol     253680 non-null  float64
34  3   Cholesterol_Check    253680 non-null  float64
35  4   BMI                  253680 non-null  float64
36  5   Ever_Smoked          253680 non-null  float64
37  6   Had_Stroke           253680 non-null  float64
38  7   MI_or_CHD            253680 non-null  float64
39  8   Physical_Activity    253680 non-null  float64
40  9   Eats_Fruit           253680 non-null  float64
41  10  Eats_Vegetables      253680 non-null  float64
42  11  Heavy_Drinker        253680 non-null  float64
43  12  Has_Health_Care      253680 non-null  float64
44  13  Couldnt_afford_doc   253680 non-null  float64
45  14  General_Health       253680 non-null  float64
46  15  Mental_Health        253680 non-null  float64
47  16  Physical_Health      253680 non-null  float64
48  17  Difficulty_Walking   253680 non-null  float64
49  18  Sex                  253680 non-null  float64
50  19  Age                  253680 non-null  float64
51  20  Education            253680 non-null  float64
52  21  Income               253680 non-null  float64
53 dtypes: float64(22)
54 memory usage: 42.6 MB
55 *** Dataframe Info ***
56  None
57 *** Dataframe Shape ***
58   (253680, 22)
59 *** Dataframe descriptive Statistics***
60             Diabetes       High_BP  High_Cholesterol
```

```
60   Cholesterol_Check           BMI   Ever_Smoked
   Had_Stroke     MI_or_CHD  Physical_Activity
   Eats_Fruit  Eats_Vegetables  Heavy_Drinker
   Has_Health_Care  Couldnt_afford_doc  General_Health
     Mental_Health  Physical_Health  Difficulty_Walking
              Sex           Age     Education
   Income
61 count  70692.000000  70692.000000      70692.000000
          70692.000000  70692.000000  70692.000000
   70692.000000  70692.000000       70692.000000  70692
   .000000     70692.000000   70692.000000     70692.
   000000        70692.000000    70692.000000   70692.
   000000     70692.000000        70692.000000  70692.
   000000  70692.000000  70692.000000  70692.000000
62 mean        0.500000      0.564859          0.526071
               0.975117     29.884612      0.474382
         0.061973      0.148659           0.704182
         0.613436         0.786383       0.042310
            0.954450            0.093235        2.
   837506       3.721284         5.771855            0.
   253013      0.457958      8.593589      4.921151
         5.698580
63 std         0.500004      0.495779          0.499323
               0.155768      7.157158      0.499347
         0.241108      0.355755           0.456413
         0.486966         0.409862       0.201298
            0.208508            0.290764        1.
   112432       8.120994        10.028243            0.
   434741      0.498233      2.846638      1.028972
         2.169845
64 min         0.000000      0.000000          0.000000
               0.000000     12.000000      0.000000
         0.000000      0.000000           0.000000
         0.000000         0.000000       0.000000
            0.000000            0.000000        1.
   000000       0.000000         0.000000            0.
   000000      0.000000      1.000000      1.000000
         1.000000
65 25%         0.000000      0.000000          0.000000
               1.000000     25.000000      0.000000
         0.000000      0.000000           0.000000
```

```
65        0.000000          1.000000        0.000000
             1.000000             0.000000         2.
   000000        0.000000          0.000000             0.
   000000       0.000000       7.000000       4.000000
          4.000000
66 50%         0.500000       1.000000          1.000000
             1.000000     29.000000       0.000000
          0.000000       0.000000           1.000000
          1.000000          1.000000        0.000000
             1.000000             0.000000         3.
   000000        0.000000          0.000000             0.
   000000       0.000000       9.000000       5.000000
          6.000000
67 75%         1.000000       1.000000          1.000000
             1.000000     33.000000       1.000000
          0.000000       0.000000           1.000000
          1.000000          1.000000        0.000000
             1.000000             0.000000         4.
   000000        2.000000          5.000000             1.
   000000       1.000000     11.000000       6.000000
          8.000000
68 max         1.000000       1.000000          1.000000
             1.000000     98.000000       1.000000
          1.000000       1.000000           1.000000
          1.000000          1.000000        1.000000
             1.000000             1.000000         5.
   000000       30.000000         30.000000             1.
   000000       1.000000     13.000000       6.000000
          8.000000
69 <class 'pandas.core.frame.DataFrame'>
70 RangeIndex: 70692 entries, 0 to 70691
71 Data columns (total 22 columns):
72  #   Column               Non-Null Count  Dtype
73 ---  ------               --------------  -----
74  0   Diabetes             70692 non-null  float64
75  1   High_BP              70692 non-null  float64
76  2   High_Cholesterol     70692 non-null  float64
77  3   Cholesterol_Check    70692 non-null  float64
78  4   BMI                  70692 non-null  float64
79  5   Ever_Smoked          70692 non-null  float64
80  6   Had_Stroke           70692 non-null  float64
```

```
 81  7   MI_or_CHD            70692 non-null  float64
 82  8   Physical_Activity    70692 non-null  float64
 83  9   Eats_Fruit           70692 non-null  float64
 84  10  Eats_Vegetables      70692 non-null  float64
 85  11  Heavy_Drinker        70692 non-null  float64
 86  12  Has_Health_Care      70692 non-null  float64
 87  13  Couldnt_afford_doc   70692 non-null  float64
 88  14  General_Health       70692 non-null  float64
 89  15  Mental_Health        70692 non-null  float64
 90  16  Physical_Health      70692 non-null  float64
 91  17  Difficulty_Walking   70692 non-null  float64
 92  18  Sex                  70692 non-null  float64
 93  19  Age                  70692 non-null  float64
 94  20  Education            70692 non-null  float64
 95  21  Income               70692 non-null  float64
 96 dtypes: float64(22)
 97 memory usage: 11.9 MB
 98 *** Dataframe Info ***
 99  None
100 *** Dataframe Shape ***
101   (70692, 22)
102
103 *** Diabetes ***
104  0.0    218334
105 1.0     35346
106 Name: Diabetes, dtype: int64
107
108 *** High_BP ***
109  0.0    144851
110 1.0    108829
111 Name: High_BP, dtype: int64
112
113 *** High_Cholesterol ***
114  0.0    146089
115 1.0    107591
116 Name: High_Cholesterol, dtype: int64
117
118 *** Cholesterol_Check ***
119  1.0    244210
120 0.0      9470
121 Name: Cholesterol_Check, dtype: int64
```

```
122
123 *** BMI ***
124  27.0    24606
125 26.0    20562
126 24.0    19550
127 25.0    17146
128 28.0    16545
129         ...
130 85.0        1
131 91.0        1
132 86.0        1
133 90.0        1
134 78.0        1
135 Name: BMI, Length: 84, dtype: int64
136
137 *** Ever_Smoked ***
138  0.0    141257
139 1.0    112423
140 Name: Ever_Smoked, dtype: int64
141
142 *** Had_Stroke ***
143  0.0    243388
144 1.0     10292
145 Name: Had_Stroke, dtype: int64
146
147 *** MI_or_CHD ***
148  0.0    229787
149 1.0     23893
150 Name: MI_or_CHD, dtype: int64
151
152 *** Physical_Activity ***
153  1.0    191920
154 0.0     61760
155 Name: Physical_Activity, dtype: int64
156
157 *** Eats_Fruit ***
158  1.0    160898
159 0.0     92782
160 Name: Eats_Fruit, dtype: int64
161
162 *** Eats_Vegetables ***
```

```
163  1.0    205841
164 0.0     47839
165 Name: Eats_Vegetables, dtype: int64
166
167 *** Heavy_Drinker ***
168  0.0    239424
169 1.0     14256
170 Name: Heavy_Drinker, dtype: int64
171
172 *** Has_Health_Care ***
173  1.0    241263
174 0.0     12417
175 Name: Has_Health_Care, dtype: int64
176
177 *** Couldnt_afford_doc ***
178  0.0    232326
179 1.0     21354
180 Name: Couldnt_afford_doc, dtype: int64
181
182 *** General_Health ***
183  2.0    89084
184 3.0    75646
185 1.0    45299
186 4.0    31570
187 5.0    12081
188 Name: General_Health, dtype: int64
189
190 *** Mental_Health ***
191  0.0     175680
192 2.0      13054
193 30.0     12088
194 5.0       9030
195 1.0       8538
196 3.0       7381
197 10.0      6373
198 15.0      5505
199 4.0       3789
200 20.0      3364
201 7.0       3100
202 25.0      1188
203 14.0      1167
```

```
204 6.0         988
205 8.0         639
206 12.0        398
207 28.0        327
208 21.0        227
209 29.0        158
210 18.0         97
211 9.0          91
212 16.0         88
213 27.0         79
214 22.0         63
215 17.0         54
216 26.0         45
217 11.0         41
218 13.0         41
219 23.0         38
220 24.0         33
221 19.0         16
222 Name: Mental_Health, dtype: int64
223
224 *** Physical_Health ***
225  0.0     160052
226 30.0     19400
227 2.0      14764
228 1.0      11388
229 3.0       8495
230 5.0       7622
231 10.0      5595
232 15.0      4916
233 4.0       4542
234 7.0       4538
235 20.0      3273
236 14.0      2587
237 25.0      1336
238 6.0       1330
239 8.0        809
240 21.0       663
241 12.0       578
242 28.0       522
243 29.0       215
244 9.0        179
```

```
245 18.0       152
246 16.0       112
247 27.0        99
248 17.0        96
249 24.0        72
250 22.0        70
251 26.0        69
252 13.0        68
253 11.0        60
254 23.0        56
255 19.0        22
256 Name: Physical_Health, dtype: int64
257
258 *** Difficulty_Walking ***
259  0.0    211005
260 1.0     42675
261 Name: Difficulty_Walking, dtype: int64
262
263 *** Sex ***
264  0.0    141974
265 1.0    111706
266 Name: Sex, dtype: int64
267
268 *** Age ***
269  9.0     33244
270 10.0    32194
271 8.0     30832
272 7.0     26314
273 11.0    23533
274 6.0     19819
275 13.0    17363
276 5.0     16157
277 12.0    15980
278 4.0     13823
279 3.0     11123
280 2.0      7598
281 1.0      5700
282 Name: Age, dtype: int64
283
284 *** Education ***
285  6.0    107325
```

```
286 5.0     69910
287 4.0     62750
288 3.0      9478
289 2.0      4043
290 1.0       174
291 Name: Education, dtype: int64
292
293 *** Income ***
294  8.0    90385
295 7.0    43219
296 6.0    36470
297 5.0    25883
298 4.0    20135
299 3.0    15994
300 2.0    11783
301 1.0     9811
302 Name: Income, dtype: int64
303 0.0    218334
304 1.0     35346
305 Name: Diabetes, dtype: int64
306 (82474, 21)
307 (82474,)
308 0.0    47128
309 1.0    35346
310 Name: Diabetes, dtype: int64
311 2022-04-27 18:35:01.043201: W tensorflow/
    stream_executor/platform/default/dso_loader.cc:64]
    Could not load dynamic library 'cudart64_110.dll';
    dlerror: cudart64_110.dll not found
312 2022-04-27 18:35:01.043657: W tensorflow/
    stream_executor/platform/default/dso_loader.cc:64]
    Could not load dynamic library 'cublas64_11.dll';
    dlerror: cublas64_11.dll not found
313 2022-04-27 18:35:01.044096: W tensorflow/
    stream_executor/platform/default/dso_loader.cc:64]
    Could not load dynamic library 'cublasLt64_11.dll';
    dlerror: cublasLt64_11.dll not found
314 2022-04-27 18:35:01.044537: W tensorflow/
    stream_executor/platform/default/dso_loader.cc:64]
    Could not load dynamic library 'cufft64_10.dll';
    dlerror: cufft64_10.dll not found
```

```
315 2022-04-27 18:35:01.044969: W tensorflow/
    stream_executor/platform/default/dso_loader.cc:64]
    Could not load dynamic library 'curand64_10.dll';
    dlerror: curand64_10.dll not found
316 2022-04-27 18:35:01.045401: W tensorflow/
    stream_executor/platform/default/dso_loader.cc:64]
    Could not load dynamic library 'cusolver64_11.dll';
    dlerror: cusolver64_11.dll not found
317 2022-04-27 18:35:01.045840: W tensorflow/
    stream_executor/platform/default/dso_loader.cc:64]
    Could not load dynamic library 'cusparse64_11.dll';
    dlerror: cusparse64_11.dll not found
318 2022-04-27 18:35:01.046275: W tensorflow/
    stream_executor/platform/default/dso_loader.cc:64]
    Could not load dynamic library 'cudnn64_8.dll';
    dlerror: cudnn64_8.dll not found
319 2022-04-27 18:35:01.046580: W tensorflow/core/
    common_runtime/gpu/gpu_device.cc:1850] Cannot dlopen
     some GPU libraries. Please make sure the missing
    libraries mentioned above are installed properly if
    you would like to use GPU. Follow the guide at https
    ://www.tensorflow.org/install/gpu for how to
    download and setup the required libraries for your
    platform.
320 Skipping registering GPU devices...
321 2022-04-27 18:35:01.047502: I tensorflow/core/
    platform/cpu_feature_guard.cc:151] This TensorFlow
    binary is optimized with oneAPI Deep Neural Network
    Library (oneDNN) to use the following CPU
    instructions in performance-critical operations:
    AVX AVX2
322 To enable them in other operations, rebuild
    TensorFlow with the appropriate compiler flags.
323 Epoch 1/100
324 2062/2062 [==============================] - 2s
    748us/step - loss: 0.5312 - accuracy: 0.7229
325 Epoch 2/100
326 2062/2062 [==============================] - 1s
    725us/step - loss: 0.5071 - accuracy: 0.7442
327 Epoch 3/100
328 2062/2062 [==============================] - 1s
```

```
328 685us/step - loss: 0.5038 - accuracy: 0.7467
329 Epoch 4/100
330 2062/2062 [==============================] - 1s
    696us/step - loss: 0.5024 - accuracy: 0.7470
331 Epoch 5/100
332 2062/2062 [==============================] - 1s
    695us/step - loss: 0.5015 - accuracy: 0.7476
333 Epoch 6/100
334 2062/2062 [==============================] - 1s
    710us/step - loss: 0.5009 - accuracy: 0.7488
335 Epoch 7/100
336 2062/2062 [==============================] - 1s
    695us/step - loss: 0.5004 - accuracy: 0.7493
337 Epoch 8/100
338 2062/2062 [==============================] - 1s
    693us/step - loss: 0.5000 - accuracy: 0.7491
339 Epoch 9/100
340 2062/2062 [==============================] - 1s
    691us/step - loss: 0.4998 - accuracy: 0.7504
341 Epoch 10/100
342 2062/2062 [==============================] - 1s
    695us/step - loss: 0.4997 - accuracy: 0.7499
343 Epoch 11/100
344 2062/2062 [==============================] - 1s
    701us/step - loss: 0.4995 - accuracy: 0.7493
345 Epoch 12/100
346 2062/2062 [==============================] - 1s
    697us/step - loss: 0.4993 - accuracy: 0.7499
347 Epoch 13/100
348 2062/2062 [==============================] - 1s
    712us/step - loss: 0.4993 - accuracy: 0.7495
349 Epoch 14/100
350 2062/2062 [==============================] - 1s
    710us/step - loss: 0.4992 - accuracy: 0.7498
351 Epoch 15/100
352 2062/2062 [==============================] - 1s
    691us/step - loss: 0.4991 - accuracy: 0.7501
353 Epoch 16/100
354 2062/2062 [==============================] - 1s
    702us/step - loss: 0.4990 - accuracy: 0.7500
355 Epoch 17/100
```

```
356 2062/2062 [==============================] - 1s
    706us/step - loss: 0.4991 - accuracy: 0.7496
357 Epoch 18/100
358 2062/2062 [==============================] - 1s
    697us/step - loss: 0.4989 - accuracy: 0.7498
359 Epoch 19/100
360 2062/2062 [==============================] - 1s
    696us/step - loss: 0.4989 - accuracy: 0.7491
361 Epoch 20/100
362 2062/2062 [==============================] - 1s
    692us/step - loss: 0.4989 - accuracy: 0.7493
363 Epoch 21/100
364 2062/2062 [==============================] - 1s
    699us/step - loss: 0.4989 - accuracy: 0.7499
365 Epoch 22/100
366 2062/2062 [==============================] - 1s
    715us/step - loss: 0.4989 - accuracy: 0.7492
367 Epoch 23/100
368 2062/2062 [==============================] - 1s
    705us/step - loss: 0.4988 - accuracy: 0.7497
369 Epoch 24/100
370 2062/2062 [==============================] - 2s
    729us/step - loss: 0.4989 - accuracy: 0.7492
371 Epoch 25/100
372 2062/2062 [==============================] - 2s
    739us/step - loss: 0.4987 - accuracy: 0.7497
373 Epoch 26/100
374 2062/2062 [==============================] - 1s
    723us/step - loss: 0.4986 - accuracy: 0.7500
375 Epoch 27/100
376 2062/2062 [==============================] - 1s
    711us/step - loss: 0.4985 - accuracy: 0.7499
377 Epoch 28/100
378 2062/2062 [==============================] - 1s
    716us/step - loss: 0.4986 - accuracy: 0.7497
379 Epoch 29/100
380 2062/2062 [==============================] - 1s
    708us/step - loss: 0.4987 - accuracy: 0.7496
381 Epoch 30/100
382 2062/2062 [==============================] - 1s
    713us/step - loss: 0.4985 - accuracy: 0.7499
```

```
383 Epoch 31/100
384 2062/2062 [==============================] - 1s
    710us/step - loss: 0.4985 - accuracy: 0.7504
385 Epoch 32/100
386 2062/2062 [==============================] - 1s
    718us/step - loss: 0.4985 - accuracy: 0.7500
387 Epoch 33/100
388 2062/2062 [==============================] - 2s
    735us/step - loss: 0.4986 - accuracy: 0.7505
389 Epoch 34/100
390 2062/2062 [==============================] - 2s
    735us/step - loss: 0.4985 - accuracy: 0.7499
391 Epoch 35/100
392 2062/2062 [==============================] - 1s
    724us/step - loss: 0.4985 - accuracy: 0.7496
393 Epoch 36/100
394 2062/2062 [==============================] - 1s
    721us/step - loss: 0.4985 - accuracy: 0.7503
395 Epoch 37/100
396 2062/2062 [==============================] - 1s
    721us/step - loss: 0.4984 - accuracy: 0.7501
397 Epoch 38/100
398 2062/2062 [==============================] - 1s
    722us/step - loss: 0.4985 - accuracy: 0.7503
399 Epoch 39/100
400 2062/2062 [==============================] - 1s
    714us/step - loss: 0.4984 - accuracy: 0.7496
401 Epoch 40/100
402 2062/2062 [==============================] - 1s
    727us/step - loss: 0.4984 - accuracy: 0.7501
403 Epoch 41/100
404 2062/2062 [==============================] - 1s
    713us/step - loss: 0.4983 - accuracy: 0.7504
405 Epoch 42/100
406 2062/2062 [==============================] - 1s
    722us/step - loss: 0.4985 - accuracy: 0.7502
407 Epoch 43/100
408 2062/2062 [==============================] - 1s
    723us/step - loss: 0.4982 - accuracy: 0.7506
409 Epoch 44/100
410 2062/2062 [==============================] - 1s
```

```
410 720us/step - loss: 0.4983 - accuracy: 0.7494
411 Epoch 45/100
412 2062/2062 [==============================] - 1s
    716us/step - loss: 0.4982 - accuracy: 0.7501
413 Epoch 46/100
414 2062/2062 [==============================] - 2s
    728us/step - loss: 0.4983 - accuracy: 0.7505
415 Epoch 47/100
416 2062/2062 [==============================] - 1s
    700us/step - loss: 0.4982 - accuracy: 0.7504
417 Epoch 48/100
418 2062/2062 [==============================] - 1s
    699us/step - loss: 0.4982 - accuracy: 0.7500
419 Epoch 49/100
420 2062/2062 [==============================] - 1s
    692us/step - loss: 0.4981 - accuracy: 0.7503
421 Epoch 50/100
422 2062/2062 [==============================] - 1s
    689us/step - loss: 0.4982 - accuracy: 0.7503
423 Epoch 51/100
424 2062/2062 [==============================] - 1s
    693us/step - loss: 0.4980 - accuracy: 0.7501
425 Epoch 52/100
426 2062/2062 [==============================] - 1s
    719us/step - loss: 0.4982 - accuracy: 0.7510
427 Epoch 53/100
428 2062/2062 [==============================] - 1s
    717us/step - loss: 0.4981 - accuracy: 0.7507
429 Epoch 54/100
430 2062/2062 [==============================] - 1s
    721us/step - loss: 0.4980 - accuracy: 0.7496
431 Epoch 55/100
432 2062/2062 [==============================] - 1s
    726us/step - loss: 0.4982 - accuracy: 0.7506
433 Epoch 56/100
434 2062/2062 [==============================] - 2s
    744us/step - loss: 0.4980 - accuracy: 0.7497
435 Epoch 57/100
436 2062/2062 [==============================] - 2s
    742us/step - loss: 0.4982 - accuracy: 0.7502
437 Epoch 58/100
```

```
438 2062/2062 [==============================] - 2s
    741us/step - loss: 0.4981 - accuracy: 0.7513
439 Epoch 59/100
440 2062/2062 [==============================] - 2s
    735us/step - loss: 0.4980 - accuracy: 0.7503
441 Epoch 60/100
442 2062/2062 [==============================] - 2s
    749us/step - loss: 0.4982 - accuracy: 0.7500
443 Epoch 61/100
444 2062/2062 [==============================] - 1s
    701us/step - loss: 0.4980 - accuracy: 0.7505
445 Epoch 62/100
446 2062/2062 [==============================] - 1s
    723us/step - loss: 0.4979 - accuracy: 0.7500
447 Epoch 63/100
448 2062/2062 [==============================] - 1s
    719us/step - loss: 0.4980 - accuracy: 0.7497
449 Epoch 64/100
450 2062/2062 [==============================] - 2s
    766us/step - loss: 0.4981 - accuracy: 0.7509
451 Epoch 65/100
452 2062/2062 [==============================] - 1s
    706us/step - loss: 0.4980 - accuracy: 0.7509
453 Epoch 66/100
454 2062/2062 [==============================] - 1s
    698us/step - loss: 0.4980 - accuracy: 0.7505
455 Epoch 67/100
456 2062/2062 [==============================] - 1s
    711us/step - loss: 0.4980 - accuracy: 0.7508
457 Epoch 68/100
458 2062/2062 [==============================] - 2s
    730us/step - loss: 0.4980 - accuracy: 0.7507
459 Epoch 69/100
460 2062/2062 [==============================] - 2s
    742us/step - loss: 0.4979 - accuracy: 0.7513
461 Epoch 70/100
462 2062/2062 [==============================] - 2s
    747us/step - loss: 0.4979 - accuracy: 0.7500
463 Epoch 71/100
464 2062/2062 [==============================] - 2s
    747us/step - loss: 0.4979 - accuracy: 0.7507
```

```
Epoch 72/100
2062/2062 [==============================] - 2s
    741us/step - loss: 0.4978 - accuracy: 0.7510
Epoch 73/100
2062/2062 [==============================] - 2s
    743us/step - loss: 0.4978 - accuracy: 0.7507
Epoch 74/100
2062/2062 [==============================] - 2s
    744us/step - loss: 0.4978 - accuracy: 0.7504
Epoch 75/100
2062/2062 [==============================] - 2s
    748us/step - loss: 0.4979 - accuracy: 0.7505
Epoch 76/100
2062/2062 [==============================] - 2s
    729us/step - loss: 0.4978 - accuracy: 0.7505
Epoch 77/100
2062/2062 [==============================] - 2s
    748us/step - loss: 0.4978 - accuracy: 0.7511
Epoch 78/100
2062/2062 [==============================] - 2s
    733us/step - loss: 0.4979 - accuracy: 0.7504
Epoch 79/100
2062/2062 [==============================] - 2s
    751us/step - loss: 0.4976 - accuracy: 0.7502
Epoch 80/100
2062/2062 [==============================] - 1s
    719us/step - loss: 0.4978 - accuracy: 0.7504
Epoch 81/100
2062/2062 [==============================] - 1s
    711us/step - loss: 0.4978 - accuracy: 0.7504
Epoch 82/100
2062/2062 [==============================] - 1s
    710us/step - loss: 0.4977 - accuracy: 0.7506
Epoch 83/100
2062/2062 [==============================] - 1s
    707us/step - loss: 0.4977 - accuracy: 0.7510
Epoch 84/100
2062/2062 [==============================] - 1s
    723us/step - loss: 0.4977 - accuracy: 0.7505
Epoch 85/100
2062/2062 [==============================] - 2s
```

```
492 742us/step - loss: 0.4977 - accuracy: 0.7505
493 Epoch 86/100
494 2062/2062 [==============================] - 2s
    738us/step - loss: 0.4976 - accuracy: 0.7501
495 Epoch 87/100
496 2062/2062 [==============================] - 2s
    754us/step - loss: 0.4977 - accuracy: 0.7507
497 Epoch 88/100
498 2062/2062 [==============================] - 2s
    734us/step - loss: 0.4977 - accuracy: 0.7506
499 Epoch 89/100
500 2062/2062 [==============================] - 2s
    743us/step - loss: 0.4976 - accuracy: 0.7507
501 Epoch 90/100
502 2062/2062 [==============================] - 2s
    740us/step - loss: 0.4977 - accuracy: 0.7516
503 Epoch 91/100
504 2062/2062 [==============================] - 2s
    732us/step - loss: 0.4976 - accuracy: 0.7504
505 Epoch 92/100
506 2062/2062 [==============================] - 2s
    743us/step - loss: 0.4976 - accuracy: 0.7513
507 Epoch 93/100
508 2062/2062 [==============================] - 2s
    744us/step - loss: 0.4976 - accuracy: 0.7516
509 Epoch 94/100
510 2062/2062 [==============================] - 2s
    734us/step - loss: 0.4976 - accuracy: 0.7509
511 Epoch 95/100
512 2062/2062 [==============================] - 2s
    741us/step - loss: 0.4976 - accuracy: 0.7518
513 Epoch 96/100
514 2062/2062 [==============================] - 2s
    740us/step - loss: 0.4977 - accuracy: 0.7513
515 Epoch 97/100
516 2062/2062 [==============================] - 2s
    752us/step - loss: 0.4975 - accuracy: 0.7508
517 Epoch 98/100
518 2062/2062 [==============================] - 2s
    735us/step - loss: 0.4977 - accuracy: 0.7505
519 Epoch 99/100
```

```
520 2062/2062 [==============================] - 2s
    743us/step - loss: 0.4975 - accuracy: 0.7510
521 Epoch 100/100
522 2062/2062 [==============================] - 2s
    741us/step - loss: 0.4977 - accuracy: 0.7509
523 516/516 [==============================] - 0s 650us/
    step - loss: 0.5026 - accuracy: 0.7463
524 [0.5026231408119202, 0.7462867498397827]
525 1 0.3379205819945438
526 2 0.3425280387996362
527 3 0.3091846013943619
528 4 0.31464080024249774
529 5 0.2991815701727796
530 6 0.2997271900575932
531 7 0.28754167929675656
532 8 0.289663534404365
533 9 0.2814186117005153
534 10 0.284328584419521
535 11 0.27790239466505007
536 12 0.2801454986359503
537 13 0.27565929069414974
538 14 0.27832676568657166
539 15 0.2739011821764171
540 16 0.27559866626250384
541 17 0.2743861776295847
542 18 0.27675053046377696
543 19 0.2732343134283116
544 20 0.2731736889966656
545 21 0.2703849651409518
546 22 0.2728099424067899
547 23 0.2702637162776599
548 24 0.2708699605941194
549 25 0.270142467414368
550 26 0.2698393452561382
551 27 0.26880872991815696
552 28 0.26880872991815696
553 29 0.26850560775992727
554 30 0.2694755986662625
555 {1: 0.3379205819945438, 2: 0.3425280387996362, 3: 0.
    3091846013943619, 4: 0.31464080024249774, 5: 0.
    2991815701727796, 6: 0.2997271900575932, 7: 0.
```

```
555 28754167929675656, 8: 0.289663534404365, 9: 0.
    2814186117005153, 10: 0.284328584419521, 11: 0.
    27790239466505007, 12: 0.2801454986359503, 13: 0.
    27565929069414974, 14: 0.27832676568657166, 15: 0.
    27390118217641 71, 16: 0.27559866626250384, 17: 0.
    2743861776295847, 18: 0.27675053046377696, 19: 0.
    2732343134283116, 20: 0.2731736889966656, 21: 0.
    2703849651409518, 22: 0.2728099424067899, 23: 0.
    2702637162776599, 24: 0.2708699605941194, 25: 0.
    270142467414368, 26: 0.2698393452561382, 27: 0.
    26880872991815696, 28: 0.26880872991815696, 29: 0.
    26850560775992727, 30: 0.2694755986662625}
556 29
557 ***Classification Report For: KNeighborsClassifier(
    n_neighbors=29)***
558 {'0.0': {'precision': 0.7712794869007501, 'recall':
    0.7531847133757962, 'f1-score': 0.7621247113163971
    , 'support': 9420}, '1.0': {'precision': 0.
    6813322368421053, 'recall': 0.7026148409893993, 'f1-
    score': 0.6918098949272842, 'support': 7075}, '
    accuracy': 0.7314943922400727, 'macro avg': {'
    precision': 0.7263058618714278, 'recall': 0.
    7278997771825977, 'f1-score': 0.7269673031218407, '
    support': 16495}, 'weighted avg': {'precision': 0.
    7326995054418285, 'recall': 0.7314943922400727, 'f1-
    score': 0.7319654311737495, 'support': 16495}}
559 KNeighborsClassifier(n_neighbors=29) Accuracy
    Standard Deviation =  0.0052668153716531165
560 KNeighborsClassifier(n_neighbors=29) Accuracy Mean
     =  0.7341275850675325
561 ***Classification Report For: RandomForestClassifier
    (random_state=0)***
562 {'0.0': {'precision': 0.7687412361126092, 'recall':
    0.7565817409766454, 'f1-score': 0.7626130223102028
    , 'support': 9420}, '1.0': {'precision': 0.
    6825858250276855, 'recall': 0.6969611307420495, 'f1-
    score': 0.6896985803203022, 'support': 7075}, '
    accuracy': 0.7310093967869051, 'macro avg': {'
    precision': 0.7256635305701473, 'recall': 0.
    7267714358593474, 'f1-score': 0.7261558013152525, '
    support': 16495}, 'weighted avg': {'precision': 0.
```

```
562 731787642088612, 'recall': 0.7310093967869051, 'f1-
    score': 0.7313387163339344, 'support': 16495}}
563 RandomForestClassifier(random_state=0) Accuracy
    Standard Deviation =  0.00561799781095341
564 RandomForestClassifier(random_state=0) Accuracy Mean
     =  0.7342336043053364
565 ***Classification Report For: GaussianNB()***
566 {'0.0': {'precision': 0.7565931690445309, 'recall':
    0.7430997876857749, 'f1-score': 0.7497857754927163
    , 'support': 9420}, '1.0': {'precision': 0.
    6658843020847715, 'recall': 0.681696113074205, 'f1-
    score': 0.6736974437770639, 'support': 7075}, '
    accuracy': 0.7167626553501061, 'macro avg': {'
    precision': 0.7112387355646512, 'recall': 0.
    71239795037999, 'f1-score': 0.7117416096348901, '
    support': 16495}, 'weighted avg': {'precision': 0.
    717686516498893, 'recall': 0.7167626553501061, 'f1-
    score': 0.7171501315467786, 'support': 16495}}
567 GaussianNB() Accuracy Standard Deviation =  0.
    006222067642071669
568 GaussianNB() Accuracy Mean =  0.7168189744086694
569 ***Classification Report For: SVC(kernel='linear',
    random_state=0)***
570 {'0.0': {'precision': 0.7798857389242212, 'recall':
    0.7680467091295117, 'f1-score': 0.7739209498850083
    , 'support': 9420}, '1.0': {'precision': 0.
    6972845663618731, 'recall': 0.7113780918727916, 'f1-
    score': 0.7042608269782411, 'support': 7075}, '
    accuracy': 0.7437405274325554, 'macro avg': {'
    precision': 0.7385851526430471, 'recall': 0.
    7397124005011516, 'f1-score': 0.7390908884316247, '
    support': 16495}, 'weighted avg': {'precision': 0.
    7444566212595584, 'recall': 0.7437405274325554, 'f1-
    score': 0.7440424794657674, 'support': 16495}}
571 SVC(kernel='linear', random_state=0) Accuracy
    Standard Deviation =  0.003383206060228931
572 SVC(kernel='linear', random_state=0) Accuracy Mean
     =  0.7441155934318111
573 ***Classification Report For: SVC(random_state=0)***
574 {'0.0': {'precision': 0.780466724286949, 'recall': 0
    .766879808917198, 'f1-score': 0.7736131934032984, '
```

```
574 support': 9420}, '1.0': {'precision': 0.
    6966431827600498, 'recall': 0.7127915194346289, 'f1-
    score': 0.7046248428112337, 'support': 7075}, '
    accuracy': 0.7436799030009094, 'macro avg': {'
    precision': 0.7385549535234994, 'recall': 0.
    7398352501631744, 'f1-score': 0.739119018107266, '
    support': 16495}, 'weighted avg': {'precision': 0.
    744513310749343, 'recall': 0.7436799030009094, 'f1-
    score': 0.7440228581235859, 'support': 16495}}
575 SVC(random_state=0) Accuracy Standard Deviation =  0
    .004949871240830811
576 SVC(random_state=0) Accuracy Mean =  0.
    7460252951925984
577 --- 6395.657623767853 seconds ---
578
579 Process finished with exit code 0
580
```