

```

1 "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"
2 2022-04-27 23:28:58.694235: W tensorflow/
  stream_executor/platform/default/dso_loader.cc:64]
  Could not load dynamic library 'cudart64_110.dll';
  dlerror: cudart64_110.dll not found
3 2022-04-27 23:28:58.694566: 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.
4   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
5 0      0.0      0.0          0.0
          1.0  23.0          1.0          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  2.0
          6.0      7.0
6 1      0.0      0.0          0.0
          1.0  26.0          0.0          0.0
          0.0          1.0          0.0
          1.0          0.0          1.0
          0.0          2.0          1.0
          2.0          0.0  1.0  1.0
          3.0      8.0
7 2      0.0      0.0          0.0
          1.0  30.0          0.0          0.0
          0.0          1.0          0.0
          0.0          0.0          1.0
          0.0          2.0          0.0
          0.0          0.0  1.0  7.0
          6.0      8.0

```

		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	2.0
		4.0	2.0			
8	3	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	7.0
		6.0	8.0			
9	4	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			
10	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
		4.0	3.0		9.0	
11	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	7.0
		6.0	1.0			
12	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	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
	.071148		2
21	min	0.000000	0.000000
		0.000000	12.000000
		0.000000	0.000000
		0.000000	0.000000
		0.000000	0.000000
		0.000000	1.000000
		0.000000	0.000000
		0.000000	1.000000
	.000000		1
22	25%	0.000000	0.000000
		1.000000	24.000000
		0.000000	0.000000
		0.000000	1.000000
		1.000000	0.000000
		0.000000	2.000000
		0.000000	0.000000
		0.000000	4.000000
	.000000		5
23	50%	0.000000	0.000000
		1.000000	27.000000
		0.000000	0.000000
		1.000000	1.000000
		1.000000	0.000000
		0.000000	2.000000
		0.000000	0.000000
		0.000000	5.000000
	.000000		7
24	75%	0.000000	1.000000
		1.000000	31.000000
		0.000000	1.000000
		1.000000	0.000000
		1.000000	3.000000
		2.000000	0.000000
		1.000000	6.000000
	.000000		8
25	max	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

```

	Cholesterol_Check	BMI	Ever_Smoked
60	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
62	mean	0.500000	0.564859
		0.975117	29.884612
		0.061973	0.148659
		0.613436	0.786383
		0.954450	0.093235
			2.
	837506	3.721284	5.771855
	253013	0.457958	8.593589
		5.698580	4.921151
63	std	0.500004	0.495779
		0.155768	7.157158
		0.241108	0.355755
		0.486966	0.409862
		0.208508	0.290764
	112432	8.120994	10.028243
	434741	0.498233	2.846638
		2.169845	1.028972
64	min	0.000000	0.000000
		0.000000	12.000000
		0.000000	0.000000
		0.000000	0.000000
		0.000000	0.000000
	000000	0.000000	0.000000
	000000	0.000000	1.000000
		1.000000	1.000000
65	25%	0.000000	0.000000
		1.000000	25.000000
		0.000000	0.000000

65		0.000000	1.000000	0.000000	
		1.000000	0.000000	2.	
		0.000000	0.000000	0.000000	0.
		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.	
		0.000000	0.000000	0.000000	0.
		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.	
		0.000000	5.000000		1.
		0.000000	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.	
		0.000000	30.000000	30.000000	1.
		0.000000	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 (176730, 21)
307 (176730,)
308 0.0      141384
309 1.0      35346
310 Name: Diabetes, dtype: int64
311 2022-04-27 23:29:07.366401: 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 23:29:07.366848: 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 23:29:07.367286: 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 23:29:07.367726: 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 23:29:07.368153: 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 23:29:07.368581: 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 23:29:07.369012: W tensorflow/
    stream_executor/platform/default/dso_loader.cc:64]
    Could not load dynamic library 'cusparsse64_11.dll';
    dlerror: cusparsse64_11.dll not found
318 2022-04-27 23:29:07.369443: 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 23:29:07.369747: 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 23:29:07.370669: 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 4419/4419 [=====] - 4s
    747us/step - loss: 0.3975 - accuracy: 0.8088
325 Epoch 2/100
326 4419/4419 [=====] - 3s
    709us/step - loss: 0.3842 - accuracy: 0.8191
327 Epoch 3/100
328 4419/4419 [=====] - 3s
```

```
328 699us/step - loss: 0.3817 - accuracy: 0.8208
329 Epoch 4/100
330 4419/4419 [=====] - 3s
    701us/step - loss: 0.3805 - accuracy: 0.8219
331 Epoch 5/100
332 4419/4419 [=====] - 3s
    695us/step - loss: 0.3800 - accuracy: 0.8225
333 Epoch 6/100
334 4419/4419 [=====] - 3s
    729us/step - loss: 0.3797 - accuracy: 0.8224
335 Epoch 7/100
336 4419/4419 [=====] - 3s
    742us/step - loss: 0.3794 - accuracy: 0.8227
337 Epoch 8/100
338 4419/4419 [=====] - 3s
    702us/step - loss: 0.3793 - accuracy: 0.8227
339 Epoch 9/100
340 4419/4419 [=====] - 3s
    705us/step - loss: 0.3792 - accuracy: 0.8225
341 Epoch 10/100
342 4419/4419 [=====] - 3s
    699us/step - loss: 0.3791 - accuracy: 0.8225
343 Epoch 11/100
344 4419/4419 [=====] - 3s
    697us/step - loss: 0.3790 - accuracy: 0.8227
345 Epoch 12/100
346 4419/4419 [=====] - 3s
    698us/step - loss: 0.3790 - accuracy: 0.8224
347 Epoch 13/100
348 4419/4419 [=====] - 3s
    691us/step - loss: 0.3790 - accuracy: 0.8231
349 Epoch 14/100
350 4419/4419 [=====] - 3s
    697us/step - loss: 0.3790 - accuracy: 0.8230
351 Epoch 15/100
352 4419/4419 [=====] - 3s
    709us/step - loss: 0.3788 - accuracy: 0.8228
353 Epoch 16/100
354 4419/4419 [=====] - 3s
    717us/step - loss: 0.3789 - accuracy: 0.8231
355 Epoch 17/100
```

```
356 4419/4419 [=====] - 3s
    710us/step - loss: 0.3788 - accuracy: 0.8228
357 Epoch 18/100
358 4419/4419 [=====] - 3s
    701us/step - loss: 0.3788 - accuracy: 0.8230
359 Epoch 19/100
360 4419/4419 [=====] - 3s
    699us/step - loss: 0.3788 - accuracy: 0.8231
361 Epoch 20/100
362 4419/4419 [=====] - 3s
    716us/step - loss: 0.3788 - accuracy: 0.8230
363 Epoch 21/100
364 4419/4419 [=====] - 3s
    710us/step - loss: 0.3786 - accuracy: 0.8232
365 Epoch 22/100
366 4419/4419 [=====] - 3s
    703us/step - loss: 0.3786 - accuracy: 0.8234
367 Epoch 23/100
368 4419/4419 [=====] - 3s
    695us/step - loss: 0.3786 - accuracy: 0.8231
369 Epoch 24/100
370 4419/4419 [=====] - 3s
    699us/step - loss: 0.3787 - accuracy: 0.8233
371 Epoch 25/100
372 4419/4419 [=====] - 3s
    705us/step - loss: 0.3787 - accuracy: 0.8235
373 Epoch 26/100
374 4419/4419 [=====] - 3s
    692us/step - loss: 0.3786 - accuracy: 0.8231
375 Epoch 27/100
376 4419/4419 [=====] - 3s
    746us/step - loss: 0.3786 - accuracy: 0.8234
377 Epoch 28/100
378 4419/4419 [=====] - 3s
    699us/step - loss: 0.3786 - accuracy: 0.8229
379 Epoch 29/100
380 4419/4419 [=====] - 3s
    696us/step - loss: 0.3786 - accuracy: 0.8230
381 Epoch 30/100
382 4419/4419 [=====] - 3s
    699us/step - loss: 0.3786 - accuracy: 0.8229
```

```
383 Epoch 31/100
384 4419/4419 [=====] - 3s
    697us/step - loss: 0.3786 - accuracy: 0.8233
385 Epoch 32/100
386 4419/4419 [=====] - 3s
    701us/step - loss: 0.3785 - accuracy: 0.8235
387 Epoch 33/100
388 4419/4419 [=====] - 3s
    699us/step - loss: 0.3785 - accuracy: 0.8230
389 Epoch 34/100
390 4419/4419 [=====] - 3s
    714us/step - loss: 0.3785 - accuracy: 0.8234
391 Epoch 35/100
392 4419/4419 [=====] - 3s
    693us/step - loss: 0.3785 - accuracy: 0.8229
393 Epoch 36/100
394 4419/4419 [=====] - 3s
    701us/step - loss: 0.3785 - accuracy: 0.8232
395 Epoch 37/100
396 4419/4419 [=====] - 3s
    699us/step - loss: 0.3784 - accuracy: 0.8230
397 Epoch 38/100
398 4419/4419 [=====] - 3s
    699us/step - loss: 0.3785 - accuracy: 0.8230
399 Epoch 39/100
400 4419/4419 [=====] - 3s
    709us/step - loss: 0.3784 - accuracy: 0.8235
401 Epoch 40/100
402 4419/4419 [=====] - 3s
    714us/step - loss: 0.3784 - accuracy: 0.8232
403 Epoch 41/100
404 4419/4419 [=====] - 3s
    699us/step - loss: 0.3784 - accuracy: 0.8234
405 Epoch 42/100
406 4419/4419 [=====] - 3s
    708us/step - loss: 0.3785 - accuracy: 0.8230
407 Epoch 43/100
408 4419/4419 [=====] - 3s
    700us/step - loss: 0.3783 - accuracy: 0.8230
409 Epoch 44/100
410 4419/4419 [=====] - 3s
```

```
410 699us/step - loss: 0.3784 - accuracy: 0.8232
411 Epoch 45/100
412 4419/4419 [=====] - 3s
    697us/step - loss: 0.3783 - accuracy: 0.8237
413 Epoch 46/100
414 4419/4419 [=====] - 3s
    713us/step - loss: 0.3783 - accuracy: 0.8235
415 Epoch 47/100
416 4419/4419 [=====] - 3s
    700us/step - loss: 0.3785 - accuracy: 0.8237
417 Epoch 48/100
418 4419/4419 [=====] - 3s
    698us/step - loss: 0.3784 - accuracy: 0.8231
419 Epoch 49/100
420 4419/4419 [=====] - 3s
    695us/step - loss: 0.3784 - accuracy: 0.8237
421 Epoch 50/100
422 4419/4419 [=====] - 3s
    702us/step - loss: 0.3784 - accuracy: 0.8237
423 Epoch 51/100
424 4419/4419 [=====] - 3s
    713us/step - loss: 0.3784 - accuracy: 0.8232
425 Epoch 52/100
426 4419/4419 [=====] - 3s
    719us/step - loss: 0.3783 - accuracy: 0.8229
427 Epoch 53/100
428 4419/4419 [=====] - 3s
    715us/step - loss: 0.3783 - accuracy: 0.8232
429 Epoch 54/100
430 4419/4419 [=====] - 3s
    716us/step - loss: 0.3784 - accuracy: 0.8238
431 Epoch 55/100
432 4419/4419 [=====] - 3s
    723us/step - loss: 0.3783 - accuracy: 0.8235
433 Epoch 56/100
434 4419/4419 [=====] - 3s
    724us/step - loss: 0.3783 - accuracy: 0.8236
435 Epoch 57/100
436 4419/4419 [=====] - 3s
    695us/step - loss: 0.3783 - accuracy: 0.8232
437 Epoch 58/100
```

```
438 4419/4419 [=====] - 3s
    705us/step - loss: 0.3783 - accuracy: 0.8234
439 Epoch 59/100
440 4419/4419 [=====] - 3s
    723us/step - loss: 0.3783 - accuracy: 0.8232
441 Epoch 60/100
442 4419/4419 [=====] - 3s
    720us/step - loss: 0.3783 - accuracy: 0.8233
443 Epoch 61/100
444 4419/4419 [=====] - 3s
    721us/step - loss: 0.3783 - accuracy: 0.8233
445 Epoch 62/100
446 4419/4419 [=====] - 3s
    723us/step - loss: 0.3783 - accuracy: 0.8232
447 Epoch 63/100
448 4419/4419 [=====] - 3s
    717us/step - loss: 0.3783 - accuracy: 0.8229
449 Epoch 64/100
450 4419/4419 [=====] - 3s
    717us/step - loss: 0.3782 - accuracy: 0.8234
451 Epoch 65/100
452 4419/4419 [=====] - 3s
    722us/step - loss: 0.3783 - accuracy: 0.8235
453 Epoch 66/100
454 4419/4419 [=====] - 3s
    705us/step - loss: 0.3784 - accuracy: 0.8237
455 Epoch 67/100
456 4419/4419 [=====] - 3s
    695us/step - loss: 0.3782 - accuracy: 0.8233
457 Epoch 68/100
458 4419/4419 [=====] - 3s
    698us/step - loss: 0.3783 - accuracy: 0.8231
459 Epoch 69/100
460 4419/4419 [=====] - 3s
    711us/step - loss: 0.3782 - accuracy: 0.8233
461 Epoch 70/100
462 4419/4419 [=====] - 3s
    716us/step - loss: 0.3782 - accuracy: 0.8232
463 Epoch 71/100
464 4419/4419 [=====] - 3s
    712us/step - loss: 0.3782 - accuracy: 0.8229
```

```
465 Epoch 72/100
466 4419/4419 [=====] - 3s
    711us/step - loss: 0.3782 - accuracy: 0.8233
467 Epoch 73/100
468 4419/4419 [=====] - 3s
    706us/step - loss: 0.3783 - accuracy: 0.8230
469 Epoch 74/100
470 4419/4419 [=====] - 3s
    710us/step - loss: 0.3782 - accuracy: 0.8239
471 Epoch 75/100
472 4419/4419 [=====] - 3s
    707us/step - loss: 0.3782 - accuracy: 0.8237
473 Epoch 76/100
474 4419/4419 [=====] - 3s
    704us/step - loss: 0.3782 - accuracy: 0.8233
475 Epoch 77/100
476 4419/4419 [=====] - 3s
    696us/step - loss: 0.3783 - accuracy: 0.8228
477 Epoch 78/100
478 4419/4419 [=====] - 3s
    698us/step - loss: 0.3783 - accuracy: 0.8234
479 Epoch 79/100
480 4419/4419 [=====] - 3s
    701us/step - loss: 0.3782 - accuracy: 0.8232
481 Epoch 80/100
482 4419/4419 [=====] - 3s
    693us/step - loss: 0.3783 - accuracy: 0.8230
483 Epoch 81/100
484 4419/4419 [=====] - 3s
    695us/step - loss: 0.3782 - accuracy: 0.8233
485 Epoch 82/100
486 4419/4419 [=====] - 3s
    699us/step - loss: 0.3782 - accuracy: 0.8231
487 Epoch 83/100
488 4419/4419 [=====] - 3s
    700us/step - loss: 0.3782 - accuracy: 0.8231
489 Epoch 84/100
490 4419/4419 [=====] - 3s
    710us/step - loss: 0.3781 - accuracy: 0.8231
491 Epoch 85/100
492 4419/4419 [=====] - 3s
```

```
492 714us/step - loss: 0.3783 - accuracy: 0.8232
493 Epoch 86/100
494 4419/4419 [=====] - 3s
    685us/step - loss: 0.3781 - accuracy: 0.8233
495 Epoch 87/100
496 4419/4419 [=====] - 3s
    716us/step - loss: 0.3782 - accuracy: 0.8232
497 Epoch 88/100
498 4419/4419 [=====] - 3s
    721us/step - loss: 0.3782 - accuracy: 0.8237
499 Epoch 89/100
500 4419/4419 [=====] - 3s
    715us/step - loss: 0.3782 - accuracy: 0.8235
501 Epoch 90/100
502 4419/4419 [=====] - 3s
    717us/step - loss: 0.3781 - accuracy: 0.8234
503 Epoch 91/100
504 4419/4419 [=====] - 3s
    717us/step - loss: 0.3781 - accuracy: 0.8233
505 Epoch 92/100
506 4419/4419 [=====] - 3s
    711us/step - loss: 0.3781 - accuracy: 0.8234
507 Epoch 93/100
508 4419/4419 [=====] - 3s
    707us/step - loss: 0.3781 - accuracy: 0.8234
509 Epoch 94/100
510 4419/4419 [=====] - 3s
    716us/step - loss: 0.3782 - accuracy: 0.8231
511 Epoch 95/100
512 4419/4419 [=====] - 3s
    716us/step - loss: 0.3781 - accuracy: 0.8232
513 Epoch 96/100
514 4419/4419 [=====] - 3s
    721us/step - loss: 0.3782 - accuracy: 0.8232
515 Epoch 97/100
516 4419/4419 [=====] - 3s
    716us/step - loss: 0.3781 - accuracy: 0.8230
517 Epoch 98/100
518 4419/4419 [=====] - 3s
    721us/step - loss: 0.3781 - accuracy: 0.8235
519 Epoch 99/100
```

```
520 4419/4419 [=====] - 3s
    716us/step - loss: 0.3782 - accuracy: 0.8234
521 Epoch 100/100
522 4419/4419 [=====] - 3s
    711us/step - loss: 0.3781 - accuracy: 0.8230
523 1105/1105 [=====] - 1s
    597us/step - loss: 0.3834 - accuracy: 0.8190
524 [0.38343706727027893, 0.8190460205078125]
525 1 0.24919368528263453
526 2 0.20641656764556104
527 3 0.21733718101058108
528 4 0.20123917840774064
529 5 0.20729361172409888
530 6 0.19832512872743735
531 7 0.20299326656481642
532 8 0.1962881231256719
533 9 0.19863633791659596
534 10 0.19498670288009956
535 11 0.19481695241328578
536 12 0.19402478356815478
537 13 0.1939682000792169
538 14 0.1933740734453686
539 15 0.19294969727833422
540 16 0.19218582017767216
541 17 0.19331748995643072
542 18 0.19224240366661005
543 19 0.19303457251174105
544 20 0.19204436145532733
545 21 0.19328919821196178
546 22 0.19096927516550666
547 23 0.1922141119221411
548 24 0.19161998528829283
549 25 0.19091269167656877
550 26 0.19198777796638944
551 27 0.19130877609913433
552 28 0.19173315226616872
553 29 0.19096927516550666
554 30 0.19085610818763088
555 {1: 0.24919368528263453, 2: 0.20641656764556104, 3:
    0.21733718101058108, 4: 0.20123917840774064, 5: 0.
    20729361172409888, 6: 0.19832512872743735, 7: 0.
```

```

555 20299326656481642, 8: 0.1962881231256719, 9: 0.
     19863633791659596, 10: 0.19498670288009956, 11: 0.
     19481695241328578, 12: 0.19402478356815478, 13: 0.
     1939682000792169, 14: 0.1933740734453686, 15: 0.
     19294969727833422, 16: 0.19218582017767216, 17: 0.
     19331748995643072, 18: 0.19224240366661005, 19: 0.
     19303457251174105, 20: 0.19204436145532733, 21: 0.
     19328919821196178, 22: 0.19096927516550666, 23: 0.
     1922141119221411, 24: 0.19161998528829283, 25: 0.
     19091269167656877, 26: 0.19198777796638944, 27: 0.
     19130877609913433, 28: 0.19173315226616872, 29: 0.
     19096927516550666, 30: 0.19085610818763088}

556 Optimum K Value = 30

557 ***Classification Report For: KNeighborsClassifier(
n_neighbors=30)***

558 {'0.0': {'precision': 0.8297063691534359, 'recall': 0.9578910120311395, 'f1-score': 0.8892027723943107, 'support': 28260}, '1.0': {'precision': 0.5625, 'recall': 0.21591871295512277, 'f1-score': 0.312053844584948, 'support': 7086}, 'accuracy': 0.8091438918123691, 'macro avg': {'precision': 0.6961031845767179, 'recall': 0.5869048624931311, 'f1-score': 0.6006283084896293, 'support': 35346}, 'weighted avg': {'precision': 0.7761380917862304, 'recall': 0.8091438918123691, 'f1-score': 0.7734986671926714, 'support': 35346}}

559 KNeighborsClassifier(n_neighbors=30) Accuracy
Standard Deviation = 0.001433872433016367

560 KNeighborsClassifier(n_neighbors=30) Accuracy Mean
= 0.8130835226081377

561 ***Classification Report For: RandomForestClassifier(
random_state=0)***

562 {'0.0': {'precision': 0.8441285222491394, 'recall': 0.9370842179759378, 'f1-score': 0.8881808425006708, 'support': 28260}, '1.0': {'precision': 0.552591847005536, 'recall': 0.3099068585944115, 'f1-score': 0.3971066907775768, 'support': 7086}, 'accuracy': 0.8113506478809484, 'macro avg': {'precision': 0.6983601846273377, 'recall': 0.6234955382851747, 'f1-score': 0.6426437666391238, 'support': 35346}, 'weighted avg': {'precision': 0.705050505050505, 'recall': 0.705050505050505, 'f1-score': 0.705050505050505, 'support': 35346}}

```

```

562 7856826194376141, 'recall': 0.8113506478809484, 'f1-
    score': 0.7897326039698654, 'support': 35346}]}
563 RandomForestClassifier(random_state=0) Accuracy
    Standard Deviation = 0.0018698131662462847
564 RandomForestClassifier(random_state=0) Accuracy Mean
    = 0.8132390945861359
565 ***Classification Report For: GaussianNB()***
566 {'0.0': {'precision': 0.8856293359762141, 'recall':
    0.7905166312809625, 'f1-score': 0.8353744040385155
    , 'support': 28260}, '1.0': {'precision': 0.
    41507756150578007, 'recall': 0.5928591589048828, 'f1-
    score': 0.4882896495612251, 'support': 7086}, 'accuracy':
    0.7508911899507724, 'macro avg': {'precision': 0.
    6503534487409971, 'recall': 0.
    6916878950929226, 'f1-score': 0.6618320267998703, 'support':
    35346}, 'weighted avg': {'precision': 0.
    7912953272086733, 'recall': 0.7508911899507724, 'f1-
    score': 0.7657924833055872, 'support': 35346}}
567 GaussianNB() Accuracy Standard Deviation = 0.
    003665266039550076
568 GaussianNB() Accuracy Mean = 0.753670852148381
569 ***Classification Report For: SVC(kernel='linear',
    random_state=0) ***
570 A:\College\Portfolio\Data Mining and Machine
    Learning 1\Final Project\Code\venv\lib\site-packages
    \sklearn\metrics\_classification.py:1318:
    UndefinedMetricWarning: Precision and F-score are
    ill-defined and being set to 0.0 in labels with no
    predicted samples. Use `zero_division` parameter to
    control this behavior.
571     _warn_prf(average, modifier, msg_start, len(result
    )))
572 A:\College\Portfolio\Data Mining and Machine
    Learning 1\Final Project\Code\venv\lib\site-packages
    \sklearn\metrics\_classification.py:1318:
    UndefinedMetricWarning: Precision and F-score are
    ill-defined and being set to 0.0 in labels with no
    predicted samples. Use `zero_division` parameter to
    control this behavior.
573     _warn_prf(average, modifier, msg_start, len(result
    )))

```

```

574 A:\College\Portfolio\Data Mining and Machine
    Learning 1\Final Project\Code\venv\lib\site-packages
    \sklearn\metrics\_classification.py:1318:
    UndefinedMetricWarning: Precision and F-score are
    ill-defined and being set to 0.0 in labels with no
    predicted samples. Use `zero_division` parameter to
    control this behavior.
575     _warn_prf(average, modifier, msg_start, len(result
        ))
576 {'0.0': {'precision': 0.7995246986929214, 'recall':
        1.0, 'f1-score': 0.8885954155268371, 'support':
        28260}, '1.0': {'precision': 0.0, 'recall': 0.0, 'f1
        -score': 0.0, 'support': 7086}, 'accuracy': 0.
        7995246986929214, 'macro avg': {'precision': 0.
        3997623493464607, 'recall': 0.5, 'f1-score': 0.
        44429770776341854, 'support': 35346}, 'weighted avg
        ': {'precision': 0.6392397438200068, 'recall': 0.
        7995246986929214, 'f1-score': 0.7104539818590057, '
        support': 35346}}
577 SVC(kernel='linear', random_state=0) Accuracy
    Standard Deviation = 6.9258185071636325e-06
578 SVC(kernel='linear', random_state=0) Accuracy Mean
    = 0.8001188250867889
579 ***Classification Report For: SVC(random_state=0) ***
580 {'0.0': {'precision': 0.8301795245026686, 'recall':
        0.9687190375088465, 'f1-score': 0.894114573126919, 'support':
        28260}, '1.0': {'precision': 0.
        6270042194092827, 'recall': 0.2097092859158905, 'f1-
        score': 0.3142978003384095, 'support': 7086}, 'accuracy':
        0.8165563288632377, 'macro avg': {'precision': 0.
        7285918719559756, 'recall': 0.
        5892141617123685, 'f1-score': 0.6042061867326642, 'support':
        35346}, 'weighted avg': {'precision': 0.
        7894478939959144, 'recall': 0.8165563288632377, 'f1-
        score': 0.7778756308992446, 'support': 35346}}
581 SVC(random_state=0) Accuracy Standard Deviation = 0
    .002111345658126113
582 SVC(random_state=0) Accuracy Mean = 0.
    8198169627023557
583 --- 34052.38494467735 seconds ---
584

```

585 Process finished with exit code 0

586