

```

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 20:26:12.254838: 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 20:26:12.255166: 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 1651087574.8893368
5 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
6 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
7 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
8 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					
8		0.0	0.0		0.0			
9	3		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					
10	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					
11		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					
12	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					
13	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					
14	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

14	30.0		1.0	0.0	9.0
	4.0	8.0			
15 3	0.0	1.0		0.0	
		1.0	27.0		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			
16 4	0.0	1.0		1.0	
		1.0	24.0		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			
17	*** Dataframe descriptive Statistics***				
18	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			
19 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		
	253680.000000	253680.000000	253680.000000		
20 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				

21	std	0.346294	0.494934	0.494210
		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
22	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
		.000000		1
23	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
		.000000		5
24	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
		.000000		7
25	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
		.000000		8
26	max	1.000000	1.000000	1.000000

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26      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

27 <class 'pandas.core.frame.DataFrame'>
28 RangeIndex: 253680 entries, 0 to 253679
29 Data columns (total 22 columns):
30 #   Column           Non-Null Count  Dtype  
31 ---  --  
32 0   Diabetes         253680 non-null   float64 
33 1   High_BP          253680 non-null   float64 
34 2   High_Cholesterol 253680 non-null   float64 
35 3   Cholesterol_Check 253680 non-null   float64 
36 4   BMI               253680 non-null   float64 
37 5   Ever_Smoked       253680 non-null   float64 
38 6   Had_Stroke        253680 non-null   float64 
39 7   MI_or_CHD         253680 non-null   float64 
40 8   Physical_Activity 253680 non-null   float64 
41 9   Eats_Fruit        253680 non-null   float64 
42 10  Eats_Vegetables   253680 non-null   float64 
43 11  Heavy_Drinker     253680 non-null   float64 
44 12  Has_Health_Care   253680 non-null   float64 
45 13  Couldnt_afford_doc 253680 non-null   float64 
46 14  General_Health     253680 non-null   float64 
47 15  Mental_Health      253680 non-null   float64 
48 16  Physical_Health    253680 non-null   float64 
49 17  Difficulty_Walking 253680 non-null   float64 
50 18  Sex                253680 non-null   float64 
51 19  Age                253680 non-null   float64 
52 20  Education          253680 non-null   float64 
53 21  Income              253680 non-null   float64 

54 dtypes: float64(22)
55 memory usage: 42.6 MB
56 *** Dataframe Info ***
57 None
58 *** Dataframe Shape ***
59 (253680, 22)
60 *** Dataframe descriptive Statistics***

```

61		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			
62	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
63	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		
64	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		
65	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		
66	25%	0.000000	0.000000	0.000000
		1.000000	25.000000	0.000000

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

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81   6   Had_Stroke          70692 non-null float64
82   7   MI_or_CHD           70692 non-null float64
83   8   Physical_Activity   70692 non-null float64
84   9   Eats_Fruit          70692 non-null float64
85  10   Eats_Vegetables     70692 non-null float64
86  11   Heavy_Drinker       70692 non-null float64
87  12   Has_Health_Care     70692 non-null float64
88  13   Couldnt_afford_doc 70692 non-null float64
89  14   General_Health      70692 non-null float64
90  15   Mental_Health       70692 non-null float64
91  16   Physical_Health     70692 non-null float64
92  17   Difficulty_Walking  70692 non-null float64
93  18   Sex                 70692 non-null float64
94  19   Age                 70692 non-null float64
95  20   Education           70692 non-null float64
96  21   Income               70692 non-null float64
97 dtypes: float64(22)
98 memory usage: 11.9 MB
99 *** Dataframe Info ***
100 None
101 *** Dataframe Shape ***
102 (70692, 22)
103
104 *** Diabetes ***
105 0.0    218334
106 1.0    35346
107 Name: Diabetes, dtype: int64
108
109 *** High_BP ***
110 0.0    144851
111 1.0    108829
112 Name: High_BP, dtype: int64
113
114 *** High_Cholesterol ***
115 0.0    146089
116 1.0    107591
117 Name: High_Cholesterol, dtype: int64
118
119 *** Cholesterol_Check ***
120 1.0    244210
121 0.0    9470

```

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

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

```
204 14.0      1167
205 6.0       988
206 8.0       639
207 12.0      398
208 28.0      327
209 21.0      227
210 29.0      158
211 18.0      97
212 9.0       91
213 16.0      88
214 27.0      79
215 22.0      63
216 17.0      54
217 26.0      45
218 11.0      41
219 13.0      41
220 23.0      38
221 24.0      33
222 19.0      16
223 Name: Mental_Health, dtype: int64
224
225 *** Physical_Health ***
226 0.0        160052
227 30.0       19400
228 2.0        14764
229 1.0        11388
230 3.0        8495
231 5.0        7622
232 10.0       5595
233 15.0       4916
234 4.0        4542
235 7.0        4538
236 20.0       3273
237 14.0       2587
238 25.0       1336
239 6.0        1330
240 8.0        809
241 21.0       663
242 12.0       578
243 28.0       522
244 29.0       215
```

```
245 9.0      179
246 18.0     152
247 16.0     112
248 27.0      99
249 17.0      96
250 24.0      72
251 22.0      70
252 26.0      69
253 13.0      68
254 11.0      60
255 23.0      56
256 19.0      22
257 Name: Physical_Health, dtype: int64
258
259 *** Difficulty_Walking ***
260 0.0      211005
261 1.0      42675
262 Name: Difficulty_Walking, dtype: int64
263
264 *** Sex ***
265 0.0      141974
266 1.0      111706
267 Name: Sex, dtype: int64
268
269 *** Age ***
270 9.0      33244
271 10.0     32194
272 8.0      30832
273 7.0      26314
274 11.0     23533
275 6.0      19819
276 13.0     17363
277 5.0      16157
278 12.0     15980
279 4.0      13823
280 3.0      11123
281 2.0      7598
282 1.0      5700
283 Name: Age, dtype: int64
284
285 *** Education ***
```

```
286 6.0    107325
287 5.0    69910
288 4.0    62750
289 3.0    9478
290 2.0    4043
291 1.0    174
292 Name: Education, dtype: int64
293
294 *** Income ***
295 8.0    90385
296 7.0    43219
297 6.0    36470
298 5.0    25883
299 4.0    20135
300 3.0    15994
301 2.0    11783
302 1.0    9811
303 Name: Income, dtype: int64
304 0.0    218334
305 1.0    35346
306 Name: Diabetes, dtype: int64
307 (106038, 21)
308 (106038,)
309 0.0    70692
310 1.0    35346
311 Name: Diabetes, dtype: int64
312 2022-04-27 20:26:21.837467: W tensorflow/
    stream_executor/platform/default/dso_loader.cc:64]
    Could not load dynamic library 'cudart64_110.dll';
    dlerror: cudart64_110.dll not found
313 2022-04-27 20:26:21.837958: W tensorflow/
    stream_executor/platform/default/dso_loader.cc:64]
    Could not load dynamic library 'cublas64_11.dll';
    dlerror: cublas64_11.dll not found
314 2022-04-27 20:26:21.838396: W tensorflow/
    stream_executor/platform/default/dso_loader.cc:64]
    Could not load dynamic library 'cublasLt64_11.dll';
    dlerror: cublasLt64_11.dll not found
315 2022-04-27 20:26:21.838840: W tensorflow/
    stream_executor/platform/default/dso_loader.cc:64]
    Could not load dynamic library 'cufft64_10.dll';
```

```
315 dlerror: cufft64_10.dll not found
316 2022-04-27 20:26:21.839266: W tensorflow/
    stream_executor/platform/default/dso_loader.cc:64]
    Could not load dynamic library 'curand64_10.dll';
    dlerror: curand64_10.dll not found
317 2022-04-27 20:26:21.839697: W tensorflow/
    stream_executor/platform/default/dso_loader.cc:64]
    Could not load dynamic library 'cusolver64_11.dll';
    dlerror: cusolver64_11.dll not found
318 2022-04-27 20:26:21.840132: W tensorflow/
    stream_executor/platform/default/dso_loader.cc:64]
    Could not load dynamic library 'cusparse64_11.dll';
    dlerror: cusparse64_11.dll not found
319 2022-04-27 20:26:21.840569: W tensorflow/
    stream_executor/platform/default/dso_loader.cc:64]
    Could not load dynamic library 'cudnn64_8.dll';
    dlerror: cudnn64_8.dll not found
320 2022-04-27 20:26:21.840881: 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.
321 Skipping registering GPU devices...
322 2022-04-27 20:26:21.841817: 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
323 To enable them in other operations, rebuild
    TensorFlow with the appropriate compiler flags.
324 Epoch 1/100
325 2651/2651 [=====] - 3s
    922us/step - loss: 0.4975 - accuracy: 0.7398
326 Epoch 2/100
327 2651/2651 [=====] - 2s
    762us/step - loss: 0.4762 - accuracy: 0.7589
328 Epoch 3/100
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```
329 2651/2651 [=====] - 2s
    739us/step - loss: 0.4731 - accuracy: 0.7626
330 Epoch 4/100
331 2651/2651 [=====] - 2s
    738us/step - loss: 0.4718 - accuracy: 0.7628
332 Epoch 5/100
333 2651/2651 [=====] - 2s
    723us/step - loss: 0.4712 - accuracy: 0.7642
334 Epoch 6/100
335 2651/2651 [=====] - 2s
    749us/step - loss: 0.4706 - accuracy: 0.7638
336 Epoch 7/100
337 2651/2651 [=====] - 2s
    712us/step - loss: 0.4703 - accuracy: 0.7648
338 Epoch 8/100
339 2651/2651 [=====] - 2s
    711us/step - loss: 0.4702 - accuracy: 0.7651
340 Epoch 9/100
341 2651/2651 [=====] - 2s
    700us/step - loss: 0.4698 - accuracy: 0.7648
342 Epoch 10/100
343 2651/2651 [=====] - 2s
    744us/step - loss: 0.4695 - accuracy: 0.7661
344 Epoch 11/100
345 2651/2651 [=====] - 2s
    689us/step - loss: 0.4694 - accuracy: 0.7657
346 Epoch 12/100
347 2651/2651 [=====] - 2s
    727us/step - loss: 0.4694 - accuracy: 0.7659
348 Epoch 13/100
349 2651/2651 [=====] - 2s
    693us/step - loss: 0.4694 - accuracy: 0.7668
350 Epoch 14/100
351 2651/2651 [=====] - 2s
    695us/step - loss: 0.4692 - accuracy: 0.7660
352 Epoch 15/100
353 2651/2651 [=====] - 2s
    695us/step - loss: 0.4691 - accuracy: 0.7657
354 Epoch 16/100
355 2651/2651 [=====] - 2s
    698us/step - loss: 0.4690 - accuracy: 0.7663
```

```
356 Epoch 17/100
357 2651/2651 [=====] - 2s
    713us/step - loss: 0.4690 - accuracy: 0.7657
358 Epoch 18/100
359 2651/2651 [=====] - 2s
    700us/step - loss: 0.4688 - accuracy: 0.7660
360 Epoch 19/100
361 2651/2651 [=====] - 2s
    710us/step - loss: 0.4688 - accuracy: 0.7657
362 Epoch 20/100
363 2651/2651 [=====] - 2s
    708us/step - loss: 0.4688 - accuracy: 0.7661
364 Epoch 21/100
365 2651/2651 [=====] - 2s
    696us/step - loss: 0.4687 - accuracy: 0.7667
366 Epoch 22/100
367 2651/2651 [=====] - 2s
    714us/step - loss: 0.4688 - accuracy: 0.7665
368 Epoch 23/100
369 2651/2651 [=====] - 2s
    715us/step - loss: 0.4687 - accuracy: 0.7664
370 Epoch 24/100
371 2651/2651 [=====] - 2s
    703us/step - loss: 0.4687 - accuracy: 0.7668
372 Epoch 25/100
373 2651/2651 [=====] - 2s
    703us/step - loss: 0.4686 - accuracy: 0.7669
374 Epoch 26/100
375 2651/2651 [=====] - 2s
    696us/step - loss: 0.4686 - accuracy: 0.7667
376 Epoch 27/100
377 2651/2651 [=====] - 2s
    699us/step - loss: 0.4685 - accuracy: 0.7668
378 Epoch 28/100
379 2651/2651 [=====] - 2s
    702us/step - loss: 0.4686 - accuracy: 0.7665
380 Epoch 29/100
381 2651/2651 [=====] - 2s
    713us/step - loss: 0.4684 - accuracy: 0.7667
382 Epoch 30/100
383 2651/2651 [=====] - 2s
```

```
383 722us/step - loss: 0.4684 - accuracy: 0.7664
384 Epoch 31/100
385 2651/2651 [=====] - 2s
    720us/step - loss: 0.4685 - accuracy: 0.7671
386 Epoch 32/100
387 2651/2651 [=====] - 2s
    713us/step - loss: 0.4685 - accuracy: 0.7663
388 Epoch 33/100
389 2651/2651 [=====] - 2s
    720us/step - loss: 0.4685 - accuracy: 0.7668
390 Epoch 34/100
391 2651/2651 [=====] - 2s
    716us/step - loss: 0.4684 - accuracy: 0.7667
392 Epoch 35/100
393 2651/2651 [=====] - 2s
    711us/step - loss: 0.4685 - accuracy: 0.7662
394 Epoch 36/100
395 2651/2651 [=====] - 2s
    720us/step - loss: 0.4684 - accuracy: 0.7667
396 Epoch 37/100
397 2651/2651 [=====] - 2s
    715us/step - loss: 0.4685 - accuracy: 0.7665
398 Epoch 38/100
399 2651/2651 [=====] - 2s
    710us/step - loss: 0.4684 - accuracy: 0.7667
400 Epoch 39/100
401 2651/2651 [=====] - 2s
    722us/step - loss: 0.4684 - accuracy: 0.7674
402 Epoch 40/100
403 2651/2651 [=====] - 2s
    723us/step - loss: 0.4683 - accuracy: 0.7664
404 Epoch 41/100
405 2651/2651 [=====] - 2s
    737us/step - loss: 0.4683 - accuracy: 0.7670
406 Epoch 42/100
407 2651/2651 [=====] - 2s
    733us/step - loss: 0.4683 - accuracy: 0.7666
408 Epoch 43/100
409 2651/2651 [=====] - 2s
    752us/step - loss: 0.4683 - accuracy: 0.7660
410 Epoch 44/100
```

```
411 2651/2651 [=====] - 2s
    840us/step - loss: 0.4683 - accuracy: 0.7666
412 Epoch 45/100
413 2651/2651 [=====] - 2s
    783us/step - loss: 0.4683 - accuracy: 0.7662
414 Epoch 46/100
415 2651/2651 [=====] - 2s
    702us/step - loss: 0.4682 - accuracy: 0.7673
416 Epoch 47/100
417 2651/2651 [=====] - 2s
    715us/step - loss: 0.4683 - accuracy: 0.7665
418 Epoch 48/100
419 2651/2651 [=====] - 2s
    695us/step - loss: 0.4683 - accuracy: 0.7671
420 Epoch 49/100
421 2651/2651 [=====] - 2s
    707us/step - loss: 0.4682 - accuracy: 0.7668
422 Epoch 50/100
423 2651/2651 [=====] - 2s
    696us/step - loss: 0.4682 - accuracy: 0.7667
424 Epoch 51/100
425 2651/2651 [=====] - 2s
    684us/step - loss: 0.4682 - accuracy: 0.7669
426 Epoch 52/100
427 2651/2651 [=====] - 2s
    696us/step - loss: 0.4682 - accuracy: 0.7667
428 Epoch 53/100
429 2651/2651 [=====] - 2s
    698us/step - loss: 0.4681 - accuracy: 0.7663
430 Epoch 54/100
431 2651/2651 [=====] - 2s
    701us/step - loss: 0.4682 - accuracy: 0.7669
432 Epoch 55/100
433 2651/2651 [=====] - 2s
    704us/step - loss: 0.4680 - accuracy: 0.7669
434 Epoch 56/100
435 2651/2651 [=====] - 2s
    708us/step - loss: 0.4682 - accuracy: 0.7665
436 Epoch 57/100
437 2651/2651 [=====] - 2s
    712us/step - loss: 0.4682 - accuracy: 0.7668
```

```
438 Epoch 58/100
439 2651/2651 [=====] - 2s
    713us/step - loss: 0.4681 - accuracy: 0.7669
440 Epoch 59/100
441 2651/2651 [=====] - 2s
    721us/step - loss: 0.4681 - accuracy: 0.7673
442 Epoch 60/100
443 2651/2651 [=====] - 2s
    727us/step - loss: 0.4681 - accuracy: 0.7668
444 Epoch 61/100
445 2651/2651 [=====] - 2s
    717us/step - loss: 0.4682 - accuracy: 0.7668
446 Epoch 62/100
447 2651/2651 [=====] - 2s
    706us/step - loss: 0.4681 - accuracy: 0.7675
448 Epoch 63/100
449 2651/2651 [=====] - 2s
    702us/step - loss: 0.4681 - accuracy: 0.7663
450 Epoch 64/100
451 2651/2651 [=====] - 2s
    710us/step - loss: 0.4681 - accuracy: 0.7670
452 Epoch 65/100
453 2651/2651 [=====] - 2s
    712us/step - loss: 0.4682 - accuracy: 0.7668
454 Epoch 66/100
455 2651/2651 [=====] - 2s
    709us/step - loss: 0.4680 - accuracy: 0.7673
456 Epoch 67/100
457 2651/2651 [=====] - 2s
    716us/step - loss: 0.4681 - accuracy: 0.7659
458 Epoch 68/100
459 2651/2651 [=====] - 2s
    728us/step - loss: 0.4681 - accuracy: 0.7671
460 Epoch 69/100
461 2651/2651 [=====] - 2s
    710us/step - loss: 0.4681 - accuracy: 0.7669
462 Epoch 70/100
463 2651/2651 [=====] - 2s
    697us/step - loss: 0.4681 - accuracy: 0.7660
464 Epoch 71/100
465 2651/2651 [=====] - 2s
```

```
465 708us/step - loss: 0.4681 - accuracy: 0.7669
466 Epoch 72/100
467 2651/2651 [=====] - 2s
    706us/step - loss: 0.4681 - accuracy: 0.7667
468 Epoch 73/100
469 2651/2651 [=====] - 2s
    709us/step - loss: 0.4680 - accuracy: 0.7672
470 Epoch 74/100
471 2651/2651 [=====] - 2s
    708us/step - loss: 0.4681 - accuracy: 0.7669
472 Epoch 75/100
473 2651/2651 [=====] - 2s
    743us/step - loss: 0.4679 - accuracy: 0.7672
474 Epoch 76/100
475 2651/2651 [=====] - 2s
    740us/step - loss: 0.4680 - accuracy: 0.7665
476 Epoch 77/100
477 2651/2651 [=====] - 2s
    772us/step - loss: 0.4680 - accuracy: 0.7664
478 Epoch 78/100
479 2651/2651 [=====] - 2s
    714us/step - loss: 0.4679 - accuracy: 0.7671
480 Epoch 79/100
481 2651/2651 [=====] - 2s
    733us/step - loss: 0.4680 - accuracy: 0.7668
482 Epoch 80/100
483 2651/2651 [=====] - 2s
    690us/step - loss: 0.4679 - accuracy: 0.7675
484 Epoch 81/100
485 2651/2651 [=====] - 2s
    693us/step - loss: 0.4679 - accuracy: 0.7667
486 Epoch 82/100
487 2651/2651 [=====] - 2s
    714us/step - loss: 0.4679 - accuracy: 0.7667
488 Epoch 83/100
489 2651/2651 [=====] - 2s
    693us/step - loss: 0.4679 - accuracy: 0.7672
490 Epoch 84/100
491 2651/2651 [=====] - 2s
    695us/step - loss: 0.4679 - accuracy: 0.7671
492 Epoch 85/100
```

```
493 2651/2651 [=====] - 2s
    706us/step - loss: 0.4680 - accuracy: 0.7663
494 Epoch 86/100
495 2651/2651 [=====] - 2s
    687us/step - loss: 0.4679 - accuracy: 0.7665
496 Epoch 87/100
497 2651/2651 [=====] - 2s
    684us/step - loss: 0.4679 - accuracy: 0.7668
498 Epoch 88/100
499 2651/2651 [=====] - 2s
    678us/step - loss: 0.4680 - accuracy: 0.7670
500 Epoch 89/100
501 2651/2651 [=====] - 2s
    725us/step - loss: 0.4679 - accuracy: 0.7666
502 Epoch 90/100
503 2651/2651 [=====] - 2s
    727us/step - loss: 0.4679 - accuracy: 0.7669
504 Epoch 91/100
505 2651/2651 [=====] - 2s
    696us/step - loss: 0.4680 - accuracy: 0.7666
506 Epoch 92/100
507 2651/2651 [=====] - 2s
    722us/step - loss: 0.4678 - accuracy: 0.7675
508 Epoch 93/100
509 2651/2651 [=====] - 2s
    720us/step - loss: 0.4679 - accuracy: 0.7669
510 Epoch 94/100
511 2651/2651 [=====] - 2s
    745us/step - loss: 0.4679 - accuracy: 0.7670
512 Epoch 95/100
513 2651/2651 [=====] - 2s
    703us/step - loss: 0.4678 - accuracy: 0.7677
514 Epoch 96/100
515 2651/2651 [=====] - 2s
    701us/step - loss: 0.4680 - accuracy: 0.7670
516 Epoch 97/100
517 2651/2651 [=====] - 2s
    708us/step - loss: 0.4679 - accuracy: 0.7667
518 Epoch 98/100
519 2651/2651 [=====] - 2s
    742us/step - loss: 0.4677 - accuracy: 0.7670
```

```
520 Epoch 99/100
521 2651/2651 [=====] - 2s
    697us/step - loss: 0.4679 - accuracy: 0.7666
522 Epoch 100/100
523 2651/2651 [=====] - 2s
    695us/step - loss: 0.4679 - accuracy: 0.7672
524 663/663 [=====] - 1s 614us/
    step - loss: 0.4736 - accuracy: 0.7630
525 [0.47363388538360596, 0.7629668116569519]
526 1 0.31483402489626555
527 2 0.30092417955488493
528 3 0.2909751037344398
529 4 0.2837136929460581
530 5 0.27772538664654844
531 6 0.2753677857412298
532 7 0.2713127121840815
533 8 0.2685307431158054
534 9 0.26622029422859295
535 10 0.2630139569973595
536 11 0.26065635609204074
537 12 0.2602319879290834
538 13 0.25641267446246696
539 14 0.2563655224443606
540 15 0.2561769143719351
541 16 0.25561109015465866
542 17 0.25660128253489245
543 18 0.25471520181063745
544 19 0.25410222557525464
545 20 0.2549509619011694
546 21 0.2550452659373821
547 22 0.2542908336476801
548 23 0.25311203319502074
549 24 0.254149377593361
550 25 0.25193323274236135
551 26 0.2534892493398717
552 27 0.25273481705016976
553 28 0.25311203319502074
554 29 0.2514617125612977
555 30 0.25254620897774427
556 {1: 0.31483402489626555, 2: 0.30092417955488493, 3:
    0.2909751037344398, 4: 0.2837136929460581, 5: 0.
```

```

556 27772538664654844, 6: 0.2753677857412298, 7: 0.
     2713127121840815, 8: 0.2685307431158054, 9: 0.
     26622029422859295, 10: 0.2630139569973595, 11: 0.
     26065635609204074, 12: 0.2602319879290834, 13: 0.
     25641267446246696, 14: 0.2563655224443606, 15: 0.
     2561769143719351, 16: 0.25561109015465866, 17: 0.
     25660128253489245, 18: 0.25471520181063745, 19: 0.
     25410222557525464, 20: 0.2549509619011694, 21: 0.
     2550452659373821, 22: 0.2542908336476801, 23: 0.
     25311203319502074, 24: 0.254149377593361, 25: 0.
     25193323274236135, 26: 0.2534892493398717, 27: 0.
     25273481705016976, 28: 0.25311203319502074, 29: 0.
     2514617125612977, 30: 0.25254620897774427}

557 Optimum K Value = 29
558 ***Classification Report For: KNeighborsClassifier(
n_neighbors=29)***

559 {'0.0': {'precision': 0.7896558610131132, 'recall': 0.8451838130521516, 'f1-score': 0.8164768230152449,
'support': 14036}, '1.0': {'precision': 0.6486661277283751, 'recall': 0.5593976575571667, 'f1-score': 0.6007336976866062, 'support': 7172}, 'accuracy': 0.7485382874387023, 'macro avg': {'precision': 0.7191609943707442, 'recall': 0.7022907353046592, 'f1-score': 0.7086052603509256, 'support': 21208}, 'weighted avg': {'precision': 0.7419767603379839, 'recall': 0.7485382874387023, 'f1-score': 0.7435180482671784, 'support': 21208}}

560 KNeighborsClassifier(n_neighbors=29) Accuracy
Standard Deviation = 0.004640093189053122
561 KNeighborsClassifier(n_neighbors=29) Accuracy Mean
= 0.7478722150182718
562 ***Classification Report For: RandomForestClassifier(
random_state=0)***

563 {'0.0': {'precision': 0.792146561594935, 'recall': 0.8379167854089484, 'f1-score': 0.8143890870061974, 'support': 14036}, '1.0': {'precision': 0.6423518314730389, 'recall': 0.5697155605131066, 'f1-score': 0.6038572378630016, 'support': 7172}, 'accuracy': 0.7472180309317239, 'macro avg': {'precision': 0.7172491965339869, 'recall': 0.7038161729610275, 'f1-score': 0.7091231624345995, 'support': 21208}}
```

```

563 support': 21208}, 'weighted avg': {'precision': 0.
7414898375080697, 'recall': 0.7472180309317239, 'f1-
score': 0.7431926317980212, 'support': 21208}}
564 RandomForestClassifier(random_state=0) Accuracy
Standard Deviation = 0.003670606911384755
565 RandomForestClassifier(random_state=0) Accuracy Mean
= 0.7491689260874691
566 ***Classification Report For: GaussianNB()***
567 {'0.0': {'precision': 0.8102062481043373, 'recall':
0.7612567683100598, 'f1-score': 0.7849691448721717
, 'support': 14036}, '1.0': {'precision': 0.
5821695760598504, 'recall': 0.6510039040713888, 'f1-
score': 0.6146656134807794, 'support': 7172}, 'accuracy':
0.7239720860052811, 'macro avg': {'precision': 0.
5961879120820939, 'recall': 0.
7061303361907243, 'f1-score': 0.6998173791764756, 'support':
21208}, 'weighted avg': {'precision': 0.
733090112122488, 'recall': 0.7239720860052811, 'f1-
score': 0.7273768718082776, 'support': 21208}}
568 GaussianNB() Accuracy Standard Deviation = 0.
0037036412210232736
569 GaussianNB() Accuracy Mean = 0.7269951668041965
570 ***Classification Report For: SVC(kernel='linear',
random_state=0)***
571 {'0.0': {'precision': 0.7878510777269758, 'recall':
0.859361641493303, 'f1-score': 0.8220541129966605, 'support':
14036}, '1.0': {'precision': 0.
6653102746693794, 'recall': 0.54712771890686, 'f1-
score': 0.6004590665646518, 'support': 7172}, 'accuracy':
0.75377216144851, 'macro avg': {'precision': 0.
7265806761981777, 'recall': 0.
7032446802000815, 'f1-score': 0.7112565897806562, 'support':
21208}, 'weighted avg': {'precision': 0.
7464109306348842, 'recall': 0.75377216144851, 'f1-
score': 0.7471163690787821, 'support': 21208}}
572 SVC(kernel='linear', random_state=0) Accuracy
Standard Deviation = 0.0029419736662222103
573 SVC(kernel='linear', random_state=0) Accuracy Mean
= 0.7579394082282211
574 ***Classification Report For: SVC(random_state=0)***
575 {'0.0': {'precision': 0.7884690299961044, 'recall':

```

```
575 0.8652037617554859, 'f1-score': 0.8250560500033969
    , 'support': 14036}, '1.0': {'precision': 0.
6741302101274543, 'recall': 0.5457334076965978, 'f1-
score': 0.6031746031746031, 'support': 7172}, 'accuracy': 0.757167106752169, 'macro avg': {'precision': 0.7312996200617794, 'recall': 0.
7054685847260418, 'f1-score': 0.714115326589, 'support': 21208}, 'weighted avg': {'precision': 0.
7498025826131376, 'recall': 0.757167106752169, 'f1-
score': 0.7500214528393028, 'support': 21208}}
576 SVC(random_state=0) Accuracy Standard Deviation =  0
    .0025046702170872306
577 SVC(random_state=0) Accuracy Mean =  0.
7627726040315925
578 --- 10437.980823755264 seconds ---
579
580 Process finished with exit code 0
581
```