

```

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_Data_Exploration.
py"
2 2022-04-25 00:13:45.430147: 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 2022-04-25 00:13:45.430470: 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

```

8	3	0.0	0.0	0.0			
		1.0	40.0	1.0	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
						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
						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	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	0.000000
		1.000000	1.000000
		1.000000	0.000000
		2.000000	3.000000
		1.000000	0.000000
	.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	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 (70692, 21)
307 (70692,)
308 0.0      35346
309 1.0      35346
310 Name: Diabetes, dtype: int64
311 2022-04-25 00:13:59.836854: 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 2022-04-25 00:13:59.837301: 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 2022-04-25 00:13:59.837733: 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 2022-04-25 00:13:59.838175: 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 2022-04-25 00:13:59.838599: 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 2022-04-25 00:13:59.839035: 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 2022-04-25 00:13:59.839476: 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 2022-04-25 00:13:59.839912: 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 2022-04-25 00:13:59.840217: 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 2022-04-25 00:13:59.879466: 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 1768/1768 [=====] - 3s
    806us/step - loss: 0.5361 - accuracy: 0.7291
325 Epoch 2/100
326 1768/1768 [=====] - 1s
    792us/step - loss: 0.5081 - accuracy: 0.7518
327 Epoch 3/100
328 1768/1768 [=====] - 1s
```

```
328 795us/step - loss: 0.5048 - accuracy: 0.7523
329 Epoch 4/100
330 1768/1768 [=====] - 1s
    791us/step - loss: 0.5031 - accuracy: 0.7538
331 Epoch 5/100
332 1768/1768 [=====] - 1s
    776us/step - loss: 0.5024 - accuracy: 0.7538
333 Epoch 6/100
334 1768/1768 [=====] - 1s
    744us/step - loss: 0.5018 - accuracy: 0.7545
335 Epoch 7/100
336 1768/1768 [=====] - 1s
    714us/step - loss: 0.5012 - accuracy: 0.7544
337 Epoch 8/100
338 1768/1768 [=====] - 1s
    745us/step - loss: 0.5008 - accuracy: 0.7544
339 Epoch 9/100
340 1768/1768 [=====] - 1s
    702us/step - loss: 0.5007 - accuracy: 0.7553
341 Epoch 10/100
342 1768/1768 [=====] - 1s
    715us/step - loss: 0.5004 - accuracy: 0.7550
343 Epoch 11/100
344 1768/1768 [=====] - 1s
    747us/step - loss: 0.5002 - accuracy: 0.7549
345 Epoch 12/100
346 1768/1768 [=====] - 1s
    726us/step - loss: 0.5000 - accuracy: 0.7550
347 Epoch 13/100
348 1768/1768 [=====] - 1s
    710us/step - loss: 0.4998 - accuracy: 0.7544
349 Epoch 14/100
350 1768/1768 [=====] - 1s
    705us/step - loss: 0.4999 - accuracy: 0.7547
351 Epoch 15/100
352 1768/1768 [=====] - 1s
    719us/step - loss: 0.4996 - accuracy: 0.7548
353 Epoch 16/100
354 1768/1768 [=====] - 1s
    719us/step - loss: 0.4997 - accuracy: 0.7552
355 Epoch 17/100
```

```
356 1768/1768 [=====] - 1s
    705us/step - loss: 0.4994 - accuracy: 0.7547
357 Epoch 18/100
358 1768/1768 [=====] - 1s
    715us/step - loss: 0.4996 - accuracy: 0.7544
359 Epoch 19/100
360 1768/1768 [=====] - 1s
    731us/step - loss: 0.4993 - accuracy: 0.7540
361 Epoch 20/100
362 1768/1768 [=====] - 1s
    739us/step - loss: 0.4991 - accuracy: 0.7543
363 Epoch 21/100
364 1768/1768 [=====] - 1s
    742us/step - loss: 0.4991 - accuracy: 0.7549
365 Epoch 22/100
366 1768/1768 [=====] - 1s
    737us/step - loss: 0.4992 - accuracy: 0.7542
367 Epoch 23/100
368 1768/1768 [=====] - 1s
    756us/step - loss: 0.4990 - accuracy: 0.7538
369 Epoch 24/100
370 1768/1768 [=====] - 1s
    768us/step - loss: 0.4988 - accuracy: 0.7550
371 Epoch 25/100
372 1768/1768 [=====] - 1s
    734us/step - loss: 0.4989 - accuracy: 0.7554
373 Epoch 26/100
374 1768/1768 [=====] - 1s
    742us/step - loss: 0.4988 - accuracy: 0.7539
375 Epoch 27/100
376 1768/1768 [=====] - 1s
    739us/step - loss: 0.4989 - accuracy: 0.7547
377 Epoch 28/100
378 1768/1768 [=====] - 1s
    737us/step - loss: 0.4988 - accuracy: 0.7554
379 Epoch 29/100
380 1768/1768 [=====] - 1s
    742us/step - loss: 0.4986 - accuracy: 0.7544
381 Epoch 30/100
382 1768/1768 [=====] - 1s
    738us/step - loss: 0.4987 - accuracy: 0.7551
```

```
383 Epoch 31/100
384 1768/1768 [=====] - 1s
    747us/step - loss: 0.4986 - accuracy: 0.7547
385 Epoch 32/100
386 1768/1768 [=====] - 1s
    745us/step - loss: 0.4986 - accuracy: 0.7545
387 Epoch 33/100
388 1768/1768 [=====] - 1s
    739us/step - loss: 0.4984 - accuracy: 0.7552
389 Epoch 34/100
390 1768/1768 [=====] - 1s
    726us/step - loss: 0.4987 - accuracy: 0.7546
391 Epoch 35/100
392 1768/1768 [=====] - 1s
    729us/step - loss: 0.4984 - accuracy: 0.7544
393 Epoch 36/100
394 1768/1768 [=====] - 1s
    746us/step - loss: 0.4984 - accuracy: 0.7547
395 Epoch 37/100
396 1768/1768 [=====] - 1s
    747us/step - loss: 0.4986 - accuracy: 0.7554
397 Epoch 38/100
398 1768/1768 [=====] - 1s
    745us/step - loss: 0.4988 - accuracy: 0.7550
399 Epoch 39/100
400 1768/1768 [=====] - 1s
    738us/step - loss: 0.4984 - accuracy: 0.7546
401 Epoch 40/100
402 1768/1768 [=====] - 1s
    737us/step - loss: 0.4984 - accuracy: 0.7548
403 Epoch 41/100
404 1768/1768 [=====] - 1s
    741us/step - loss: 0.4985 - accuracy: 0.7553
405 Epoch 42/100
406 1768/1768 [=====] - 1s
    742us/step - loss: 0.4984 - accuracy: 0.7552
407 Epoch 43/100
408 1768/1768 [=====] - 1s
    750us/step - loss: 0.4982 - accuracy: 0.7552
409 Epoch 44/100
410 1768/1768 [=====] - 1s
```

```
410 737us/step - loss: 0.4983 - accuracy: 0.7556
411 Epoch 45/100
412 1768/1768 [=====] - 1s
    744us/step - loss: 0.4982 - accuracy: 0.7552
413 Epoch 46/100
414 1768/1768 [=====] - 1s
    735us/step - loss: 0.4982 - accuracy: 0.7556
415 Epoch 47/100
416 1768/1768 [=====] - 1s
    742us/step - loss: 0.4983 - accuracy: 0.7548
417 Epoch 48/100
418 1768/1768 [=====] - 1s
    732us/step - loss: 0.4981 - accuracy: 0.7555
419 Epoch 49/100
420 1768/1768 [=====] - 1s
    750us/step - loss: 0.4980 - accuracy: 0.7558
421 Epoch 50/100
422 1768/1768 [=====] - 1s
    744us/step - loss: 0.4983 - accuracy: 0.7559
423 Epoch 51/100
424 1768/1768 [=====] - 1s
    737us/step - loss: 0.4981 - accuracy: 0.7555
425 Epoch 52/100
426 1768/1768 [=====] - 1s
    748us/step - loss: 0.4980 - accuracy: 0.7554
427 Epoch 53/100
428 1768/1768 [=====] - 1s
    744us/step - loss: 0.4982 - accuracy: 0.7545
429 Epoch 54/100
430 1768/1768 [=====] - 1s
    764us/step - loss: 0.4980 - accuracy: 0.7557
431 Epoch 55/100
432 1768/1768 [=====] - 1s
    735us/step - loss: 0.4982 - accuracy: 0.7551
433 Epoch 56/100
434 1768/1768 [=====] - 1s
    744us/step - loss: 0.4978 - accuracy: 0.7559
435 Epoch 57/100
436 1768/1768 [=====] - 1s
    733us/step - loss: 0.4980 - accuracy: 0.7556
437 Epoch 58/100
```

```
438 1768/1768 [=====] - 1s
    726us/step - loss: 0.4979 - accuracy: 0.7552
439 Epoch 59/100
440 1768/1768 [=====] - 1s
    743us/step - loss: 0.4980 - accuracy: 0.7553
441 Epoch 60/100
442 1768/1768 [=====] - 1s
    740us/step - loss: 0.4979 - accuracy: 0.7557
443 Epoch 61/100
444 1768/1768 [=====] - 1s
    725us/step - loss: 0.4978 - accuracy: 0.7551
445 Epoch 62/100
446 1768/1768 [=====] - 1s
    739us/step - loss: 0.4977 - accuracy: 0.7559
447 Epoch 63/100
448 1768/1768 [=====] - 1s
    739us/step - loss: 0.4976 - accuracy: 0.7557
449 Epoch 64/100
450 1768/1768 [=====] - 1s
    734us/step - loss: 0.4977 - accuracy: 0.7559
451 Epoch 65/100
452 1768/1768 [=====] - 1s
    748us/step - loss: 0.4978 - accuracy: 0.7552
453 Epoch 66/100
454 1768/1768 [=====] - 1s
    751us/step - loss: 0.4977 - accuracy: 0.7552
455 Epoch 67/100
456 1768/1768 [=====] - 1s
    745us/step - loss: 0.4975 - accuracy: 0.7561
457 Epoch 68/100
458 1768/1768 [=====] - 1s
    739us/step - loss: 0.4977 - accuracy: 0.7555
459 Epoch 69/100
460 1768/1768 [=====] - 1s
    747us/step - loss: 0.4975 - accuracy: 0.7554
461 Epoch 70/100
462 1768/1768 [=====] - 1s
    738us/step - loss: 0.4977 - accuracy: 0.7559
463 Epoch 71/100
464 1768/1768 [=====] - 1s
    742us/step - loss: 0.4976 - accuracy: 0.7562
```

```
465 Epoch 72/100
466 1768/1768 [=====] - 1s
    740us/step - loss: 0.4976 - accuracy: 0.7555
467 Epoch 73/100
468 1768/1768 [=====] - 1s
    739us/step - loss: 0.4978 - accuracy: 0.7561
469 Epoch 74/100
470 1768/1768 [=====] - 1s
    735us/step - loss: 0.4976 - accuracy: 0.7562
471 Epoch 75/100
472 1768/1768 [=====] - 1s
    742us/step - loss: 0.4975 - accuracy: 0.7555
473 Epoch 76/100
474 1768/1768 [=====] - 1s
    749us/step - loss: 0.4974 - accuracy: 0.7559
475 Epoch 77/100
476 1768/1768 [=====] - 1s
    730us/step - loss: 0.4975 - accuracy: 0.7553
477 Epoch 78/100
478 1768/1768 [=====] - 1s
    711us/step - loss: 0.4975 - accuracy: 0.7555
479 Epoch 79/100
480 1768/1768 [=====] - 1s
    712us/step - loss: 0.4975 - accuracy: 0.7557
481 Epoch 80/100
482 1768/1768 [=====] - 1s
    722us/step - loss: 0.4976 - accuracy: 0.7552
483 Epoch 81/100
484 1768/1768 [=====] - 1s
    733us/step - loss: 0.4975 - accuracy: 0.7556
485 Epoch 82/100
486 1768/1768 [=====] - 1s
    739us/step - loss: 0.4974 - accuracy: 0.7558
487 Epoch 83/100
488 1768/1768 [=====] - 1s
    743us/step - loss: 0.4975 - accuracy: 0.7557
489 Epoch 84/100
490 1768/1768 [=====] - 1s
    721us/step - loss: 0.4975 - accuracy: 0.7554
491 Epoch 85/100
492 1768/1768 [=====] - 1s
```

```
492 701us/step - loss: 0.4973 - accuracy: 0.7556
493 Epoch 86/100
494 1768/1768 [=====] - 1s
    695us/step - loss: 0.4975 - accuracy: 0.7553
495 Epoch 87/100
496 1768/1768 [=====] - 1s
    691us/step - loss: 0.4973 - accuracy: 0.7553
497 Epoch 88/100
498 1768/1768 [=====] - 1s
    687us/step - loss: 0.4973 - accuracy: 0.7556
499 Epoch 89/100
500 1768/1768 [=====] - 1s
    730us/step - loss: 0.4975 - accuracy: 0.7555
501 Epoch 90/100
502 1768/1768 [=====] - 1s
    726us/step - loss: 0.4974 - accuracy: 0.7555
503 Epoch 91/100
504 1768/1768 [=====] - 1s
    735us/step - loss: 0.4974 - accuracy: 0.7547
505 Epoch 92/100
506 1768/1768 [=====] - 1s
    750us/step - loss: 0.4973 - accuracy: 0.7554
507 Epoch 93/100
508 1768/1768 [=====] - 1s
    737us/step - loss: 0.4974 - accuracy: 0.7555
509 Epoch 94/100
510 1768/1768 [=====] - 1s
    734us/step - loss: 0.4974 - accuracy: 0.7556
511 Epoch 95/100
512 1768/1768 [=====] - 1s
    747us/step - loss: 0.4974 - accuracy: 0.7557
513 Epoch 96/100
514 1768/1768 [=====] - 1s
    727us/step - loss: 0.4974 - accuracy: 0.7562
515 Epoch 97/100
516 1768/1768 [=====] - 1s
    731us/step - loss: 0.4972 - accuracy: 0.7559
517 Epoch 98/100
518 1768/1768 [=====] - 1s
    741us/step - loss: 0.4973 - accuracy: 0.7565
519 Epoch 99/100
```

```
520 1768/1768 [=====] - 1s
    742us/step - loss: 0.4971 - accuracy: 0.7558
521 Epoch 100/100
522 1768/1768 [=====] - 1s
    769us/step - loss: 0.4972 - accuracy: 0.7559
523 442/442 [=====] - 0s 606us/
    step - loss: 0.5068 - accuracy: 0.7527
524 [0.5067573189735413, 0.7526699304580688]
525 1 0.3351722186859042
526 2 0.35483414668647006
527 3 0.3017893769007709
528 4 0.3158639224839097
529 5 0.29103897022420255
530 6 0.2960605417639154
531 7 0.2809251007850626
532 8 0.2851686823679185
533 9 0.2766815192022066
534 10 0.2790154890727774
535 11 0.27187212674163663
536 12 0.2768229719216352
537 13 0.2732159275762076
538 14 0.27081123134592266
539 15 0.2688308932739232
540 16 0.27088195770563694
541 17 0.26953815687106586
542 18 0.270386873187637
543 19 0.26861871419478034
544 20 0.27109413678477967
545 21 0.26762854515878065
546 22 0.26890161963363746
547 23 0.26670910248249524
548 24 0.2681236296767805
549 25 0.26769927151849493
550 26 0.26833580875592333
551 27 0.26727491336020937
552 28 0.2656482070867813
553 29 0.26437513261192447
554 30 0.2645873116910673
555 {1: 0.3351722186859042, 2: 0.35483414668647006, 3: 0.
    .3017893769007709, 4: 0.3158639224839097, 5: 0.
    29103897022420255, 6: 0.2960605417639154, 7: 0.
```

```

555 2809251007850626, 8: 0.2851686823679185, 9: 0.
     2766815192022066, 10: 0.2790154890727774, 11: 0.
     27187212674163663, 12: 0.2768229719216352, 13: 0.
     2732159275762076, 14: 0.27081123134592266, 15: 0.
     2688308932739232, 16: 0.27088195770563694, 17: 0.
     26953815687106586, 18: 0.270386873187637, 19: 0.
     26861871419478034, 20: 0.27109413678477967, 21: 0.
     26762854515878065, 22: 0.26890161963363746, 23: 0.
     26670910248249524, 24: 0.2681236296767805, 25: 0.
     26769927151849493, 26: 0.26833580875592333, 27: 0.
     26727491336020937, 28: 0.2656482070867813, 29: 0.
     26437513261192447, 30: 0.2645873116910673}

556 29

557 ***Classification Report For: KNeighborsClassifier(
n_neighbors=29)***

558 {'0.0': {'precision': 0.7611494974874372, 'recall': 0.6861551528878822, 'f1-score': 0.7217093508040501, 'support': 7064}, '1.0': {'precision': 0.7147085317204993, 'recall': 0.785017667844523, 'f1-score': 0.7482150074094033, 'support': 7075}, 'accuracy': 0.7356248673880755, 'macro avg': {'precision': 0.7379290146039683, 'recall': 0.7355864103662026, 'f1-score': 0.7349621791067267, 'support': 14139}, 'weighted avg': {'precision': 0.7379109493014916, 'recall': 0.7356248673880755, 'f1-score': 0.734972489674046, 'support': 14139}}

559 KNeighborsClassifier(n_neighbors=29) Accuracy
Standard Deviation = 0.0022899274902967344

560 KNeighborsClassifier(n_neighbors=29) Accuracy Mean
= 0.7408095813370651

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

562 {'0.0': {'precision': 0.7573608755973485, 'recall': 0.6954983012457531, 'f1-score': 0.725112537820087, 'support': 7064}, '1.0': {'precision': 0.718897020386827, 'recall': 0.7775265017667845, 'f1-score': 0.747063217220072, 'support': 7075}, 'accuracy': 0.7365443100643609, 'macro avg': {'precision': 0.7381289479920878, 'recall': 0.7365124015062687, 'f1-score': 0.7360878775200794, 'support': 14139}, 'weighted avg': {'precision': 0.7365124015062687, 'f1-score': 0.7360878775200794, 'support': 14139}}
```

```
562 7381139857455599, 'recall': 0.7365443100643609, 'f1-
    score': 0.7360964162241392, 'support': 14139}]}
563 RandomForestClassifier(random_state=0) Accuracy
    Standard Deviation = 0.0036883307803126262
564 RandomForestClassifier(random_state=0) Accuracy Mean
    = 0.7376621682630559
565 ***Classification Report For: GaussianNB()***
566 {'0.0': {'precision': 0.7040998217468806, 'recall':
    0.7269252548131371, 'f1-score': 0.7153305008010031
    , 'support': 7064}, '1.0': {'precision': 0.
    7182296231375986, 'recall': 0.694982332155477, 'f1-
    score': 0.7064147690539473, 'support': 7075}, 'accuracy':
    0.7109413678477968, 'macro avg': {'precision': 0.
    7111647224422396, 'recall': 0.
    7109537934843071, 'f1-score': 0.7108726349274752, 'support':
    14139}, 'weighted avg': {'precision': 0.
    7111702188640269, 'recall': 0.7109413678477968, 'f1-
    score': 0.7108691667525966, 'support': 14139}}
567 GaussianNB() Accuracy Standard Deviation = 0.
    005247643715299631
568 GaussianNB() Accuracy Mean = 0.717733811937465
569 ***Classification Report For: SVC(kernel='linear',
    random_state=0)***
570 {'0.0': {'precision': 0.7687888198757764, 'recall':
    0.7008776896942243, 'f1-score': 0.7332642180094787
    , 'support': 7064}, '1.0': {'precision': 0.
    725548772567866, 'recall': 0.7895406360424029, 'f1-
    score': 0.7561933125761473, 'support': 7075}, 'accuracy':
    0.7452436523092156, 'macro avg': {'precision': 0.
    7471687962218212, 'recall': 0.
    7452091628683135, 'f1-score': 0.744728765292813, 'support':
    14139}, 'weighted avg': {'precision': 0.
    7471519760605515, 'recall': 0.7452436523092156, 'f1-
    score': 0.7447376845954594, 'support': 14139}}
571 SVC(kernel='linear', random_state=0) Accuracy
    Standard Deviation = 0.0018852108183761197
572 SVC(kernel='linear', random_state=0) Accuracy Mean
    = 0.7485544735792261
573 ***Classification Report For: SVC(random_state=0)***
574 {'0.0': {'precision': 0.7779901258162127, 'recall':
    0.6915345413363534, 'f1-score': 0.732219141122686, '
```

```
574 support': 7064}, '1.0': {'precision': 0.  
    7227735368956743, 'recall': 0.8029681978798586, 'f1-  
    score': 0.760763307666555, 'support': 7075}, '  
    accuracy': 0.7472947167409294, 'macro avg': {'  
        precision': 0.7503818313559435, 'recall': 0.  
        747251369608106, 'f1-score': 0.7464912243946205, '  
        support': 14139}, 'weighted avg': {'precision': 0.  
        7503603523801275, 'recall': 0.7472947167409294, 'f1-  
        score': 0.7465023279320696, 'support': 14139}}}  
575 SVC(random_state=0) Accuracy Standard Deviation =  0  
.003293740028138264  
576 SVC(random_state=0) Accuracy Mean =  0.  
750517297656253  
577 --- 4332.627885818481 seconds ---  
578  
579 Process finished with exit code 0  
580
```