```
 1 C:\Users\rachaellnihalaani\anaconda3\python.exe C:\Users\
   rachaellnihalaani\PycharmProjects\SVM\main.py
 2 Primal SVM
 3
 4 Schedule A of learning rate
 5 For C = 0.1145
 6 Training Error = 0.9174
 7 Testing Error = 0.8000
 8
 9 For C = 0.5727
10 Training Error = 0.9174
11 Testing Error = 1.0000
12
13 For C = 0.8018
14 Training Error = 1.0321
15 Testing Error = 1.0000
16
17
18
19 Schedule B of learning rate
20 For C = 0.1145
21 Training Error = 1.261467889908257
22 Test Error = 1.4000000000000001
23
24 For C = 0.5727
25 Training Error = 0.8027522935779817
26 Test Error = 0.8
27
28 For C = 0.8018
29 Training Error = 0.9174311926605505
30 Test Error = 0.8
31
32
33
34 Differences between Schedules A and B
35 For C = 0.1145,
36 Training Error :
37 Model A = 0.9174
38 Model B = 1.2615
39 Difference = -0.3440
40
41 Testing Error :
42 Model A = 0.8000
43 Model B = 1.4000
44 Difference = -0.6000
45
46 Weight Parameters :
47 Model A :
48 Size = (5,)
49 Weights : [-0.8761, -0.6137, -0.6768, -0.064, 1.1573]
50 Model B :
51 Size = (5,)
52 Weights : [-0.6409, -0.3857, -0.4213, -0.0859, 0.5716]
```

```
 53 Difference of Weights = [-0.2352, -0.228, -0.2555, 0.022, 0.5857]
 54
 55 For C = 0.5727,
 56 Training Error :
 57 Model A = 0.9174
 58 Model B = 0.8028
 59 Difference = 0.1147
 60
 61 Testing Error :
 62 Model A = 1.0000
 63 Model B = 0.8000
 64 Difference = 0.2000
 65
 66 Weight Parameters :
 67 Model A :
 68 Size = (5,)
 69 Weights : [-1.585, -1.0694, -1.1725, -0.1984, 1.7547]
 70 Model B :
 71 Size = (5,)
 72 Weights : [-0.8396, -0.584, -0.6457, -0.0639, 1.1325]
 73 Difference of Weights = [-0.7454, -0.4854, -0.5268, -0.1346, 0.6223]
 74
 75 For C = 0.8018,
 76 Training Error :
 77 Model A = 1.0321
 78 Model B = 0.9174
 79 Difference = 0.1147
 80
 81 Testing Error :
 82 Model A = 1.0000
 83 Model B = 0.8000
 84 Difference = 0.2000
 85
 86 Weight Parameters :
 87 Model A :
 88 Size = (5,)
 89 Weights : [-1.9481, -1.2239, -1.4204, -0.2524, 1.9748]
 90 Model B :
 91 Size = (5,)
 92 Weights : [-0.9461, -0.6525, -0.7244, -0.0708, 1.2184]
 93 Difference of Weights = [-1.002, -0.5714, -0.696, -0.1816, 0.7563]
 94
 95
 96
 97 Dual SVM
 98 Without Kernel
 99
100 For C = 0.1145 :
101 Training Error = 0.0115
102 Testing Error = 0.0120
103 Weight Vector w = [-0.9431, -0.6515, -0.7337, -0.041]
104 Bias b = 1.4041727093419532
105
```

```
106 For C = 0.5727 :
107 Training Error = 0.2752
108 Testing Error = 0.2800
109 Weight Vector w = [-904.8049, -1238.472, 163.4838, 60.1634]
110 Bias b = 2435.398530566211
111
112 For C = 0.8018 :
113 Training Error = 0.0092
114 Testing Error = 0.0100
115 Weight Vector w = [-2.0428, -1.28, -1.5134, -0.2484]
116 Bias b = 2.0448625988075655
117
118
119 With Gaussian Kernel
120
121 For C = 0.1145 and Gamma = 0.1 :
122 Training Error = 0.4461
123 Testing Error = 0.4420
124 Weight Vector w = [-176.1339, -239.8513, 47.9038, -0.6833]
125 Bias b = -0.8832198684356563
126
127 For C = 0.1145 and Gamma = 0.5 :
128 Training Error = 0.4071
129 Testing Error = 0.4260
130 Weight Vector w = [-170.6865, -235.3885, 44.979, 1.4784]
131 Bias b = -0.6767729206095492
132
133 For C = 0.1145 and Gamma = 1 :
134 Training Error = 0.0952
135 Testing Error = 0.1920
136 Weight Vector w = [-168.0445, -229.8367, 42.455, 1.3753]
137 Bias b = -0.42994253379840464
138
139 For C = 0.1145 and Gamma = 5 :
140 Training Error = 0.0034
141 Testing Error = 0.0040
142 Weight Vector w = [-86.5061, -123.9202, 39.0322, -0.9058]
143 Bias b = -0.13500712965552178
144
145 For C = 0.1145 and Gamma = 100 :
146 Training Error = 0.0161
147 Testing Error = 0.0140
148 Weight Vector w = [-39.3386, -35.1779, -8.5255, 1.2192]
149 Bias b = 0.18796469100931745
150
151 For C = 0.5727 and Gamma = 0.1 :
152 Training Error = 0.0000
153 Testing Error = 0.3480
154 Weight Vector w = [-877.2043, -1196.9523, 243.6137, -1.4867]
155 Bias b = -0.4205489287304752
156
157 For C = 0.5727 and Gamma = 0.5 :
158 Training Error = 0.0000
```

```
159 Testing Error = 0.0180
160 Weight Vector w = [-576.5161, -852.3815, 234.7379, 14.1672]
161 Bias b = -0.20436849720278036
162
163 For C = 0.5727 and Gamma = 1 :
164 Training Error = 0.0000
165 Testing Error = 0.0040
166 Weight Vector w = [-384.2615, -577.3295, 183.416, 5.4187]
167 Bias b = -0.17719993471361994
168
169 For C = 0.5727 and Gamma = 5 :
170 Training Error = 0.0000
171 Testing Error = 0.0000
172 Weight Vector w = [-107.3785, -163.1966, 60.5348, -2.1431]
173 Bias b = -0.12528915808115593
174
175 For C = 0.5727 and Gamma = 100 :
176 Training Error = 0.0080
177 Testing Error = 0.0060
178 Weight Vector w = [-48.9205, -37.9655, -18.7725, 7.38]
179 Bias b = 0.3755352197233631
180
181 For C = 0.8018 and Gamma = 0.1 :
182 Training Error = 0.0000
183 Testing Error = 0.2320
184 Weight Vector w = [-1146.5897, -1595.0181, 368.1003, 9.5079]
185 Bias b = -0.25050362837776585
186
187 For C = 0.8018 and Gamma = 0.5 :
188 Training Error = 0.0000
189 Testing Error = 0.0100
190 Weight Vector w = [-625.7872, -936.6135, 272.945, 14.808]
191 Bias b = -0.1769745225965584
192
193 For C = 0.8018 and Gamma = 1 :
194 Training Error = 0.0000
195 Testing Error = 0.0040
196 Weight Vector w = [-398.563, -594.9612, 190.2922, 3.8873]
197 Bias b = -0.1655852831204197
198
199 For C = 0.8018 and Gamma = 5 :
200 Training Error = 0.0000
201 Testing Error = 0.0000
202 Weight Vector w = [-108.9582, -163.4372, 60.5587, -2.5479]
203 Bias b = -0.11937488370527297
204
205 For C = 0.8018 and Gamma = 100 :
206 Training Error = 0.0034
207 Testing Error = 0.0040
208 Weight Vector w = [-50.0653, -41.1677, -21.2722, 11.6861]
209 Bias b = 0.3845830265600772
210
211
```

```
212 Number of Support Vectors
213 For C = 0.1145475372279496 and
214 Gamma = 0.1, Number of Support vectors = 869
215 Gamma = 0.5, Number of Support vectors = 825
216 Gamma = 1, Number of Support vectors = 805
217 Gamma = 5, Number of Support vectors = 442
218 Gamma = 100, Number of Support vectors = 290
219
220
221 For C = 0.572737686139748 and
222 Gamma = 0.1, Number of Support vectors = 869
223 Gamma = 0.5, Number of Support vectors = 731
224 Gamma = 1, Number of Support vectors = 556
225 Gamma = 5, Number of Support vectors = 208
226 Gamma = 100, Number of Support vectors = 117
227
228
229 For C = 0.8018327605956472 and
230 Gamma = 0.1, Number of Support vectors = 868
231 Gamma = 0.5, Number of Support vectors = 694
232 Gamma = 1, Number of Support vectors = 528
233 Gamma = 5, Number of Support vectors = 193
234 Gamma = 100, Number of Support vectors = 99
235
236
237
238
239 Number of Overlapped Support Vectors between consecutive gamma values
      for C = 500/873
240 For Gamma = 0.1 and 0.5, Number of Overlapped Support Vectors = 731
241 For Gamma = 0.5 and 1, Number of Overlapped Support Vectors = 554
242 For Gamma = 1 and 5, Number of Overlapped Support Vectors = 198
243 For Gamma = 5 and 100, Number of Overlapped Support Vectors = 74
244
245
246 Dual Kernel Perceptron
247 For Gamma=  0.1, Training Error=0.0000 and Testing Error=0.0040
248 For Gamma=  0.5, Training Error=0.0000 and Testing Error=0.0040
249 For Gamma=  1, Training Error=0.0000 and Testing Error=0.0040
250 For Gamma=  5, Training Error=0.0000 and Testing Error=0.0040
251 For Gamma=  100, Training Error=0.0000 and Testing Error=0.0000
252
253 Process finished with exit code 0
254
```