```
 1 C:\ProgramData\Anaconda3\python.exe Z:/Documentos/GitHub/
   Projeto_Final_Udacity/Main.py
 2 Found Numpy. WIll be used for storing data
 3
 4 C:\ProgramData\Anaconda3\lib\site-packages\sklearn\
   cross_validation.py:41: DeprecationWarning: This module
   was deprecated in version 0.18 in favor of the
   model_selection module into which all the refactored
   classes and functions are moved. Also note that the
   interface of the new CV iterators are different from that
   of this module. This module will be removed in 0.20.
 5
 6   "This module will be removed in 0.20.",
   DeprecationWarning)
 7 Circuito: Biquad Highpass Filter mc + 4bitPRBS [FALHA].raw
 8 C:\ProgramData\Anaconda3\lib\site-packages\sklearn\
   grid_search.py:42: DeprecationWarning: This module was
   deprecated in version 0.18 in favor of the model_selection
    module into which all the refactored classes and
   functions are moved. This module will be removed in 0.20.
 9 Obtendo dados do arquivo 'Biquad Highpass Filter mc +
   4bitPRBS [FALHA]raw.csv' .
10   DeprecationWarning)
11 Leitura do arquivo csv executada em:  3.2157249450683594
   segundos
12 Salvando características do circuito...
13
14 Iniciando a aplicação do PAA
15 Quantidade de segmentos de PAA: 100
16 Aplicação do Paa executada em:  3.5147998332977295
17
18 Iniciando a aplicação dos métodos de aprendizagem
   supervisionados
19 Elementos de treino: 2925
20 Elementos de teste: 975
21
22 Classificador: DecisionTreeClassifier
23 Score de teste: 0.9898816582258024
24 Confusion Matrix:
25        0      1      2      3       4      5      6      7
         8      9   \
26 0   100.0   0.00    0.0   0.00    0.00    0.0    0.0   0.
   00    0.0   0.00
27 1     0.0  98.94    0.0   0.00    1.06    0.0    0.0   0.
   00    0.0   0.00
```

```
28 2      0.0    0.00  100.0    0.00     0.00     0.0     0.0    0.
   00     0.0    0.00
29 3      0.0    0.00    0.0   97.53     0.00     0.0     0.0    2.
   47     0.0    0.00
30 4      0.0    0.00    0.0    0.00   100.00     0.0     0.0    0.
   00     0.0    0.00
31 5      0.0    0.00    0.0    0.00     0.00   100.0     0.0    0.
   00     0.0    0.00
32 6      0.0    0.00    0.0    0.00     0.00     0.0   100.0    0.
   00     0.0    0.00
33 7      0.0    0.00    0.0    0.00     0.00     0.0     0.0   98.
   33     0.0    0.00
34 8      0.0    0.00    0.0    0.00     0.00     0.0     0.0    0.
   00   100.0    0.00
35 9      0.0    0.00    0.0    1.28     0.00     0.0     0.0    0.
   00     0.0   98.72
36 10     0.0    0.00    0.0    0.00     0.00     0.0     0.0    0.
   00     0.0    0.00
37 11     0.0    0.00    0.0    0.00     0.00     0.0     0.0    5.
   88     0.0    0.00
38 12     0.0    0.00    0.0    0.00     0.00     0.0     0.0    0.
   00     0.0    0.00
39
40          10      11      12
41 0      0.0    0.00     0.0
42 1      0.0    0.00     0.0
43 2      0.0    0.00     0.0
44 3      0.0    0.00     0.0
45 4      0.0    0.00     0.0
46 5      0.0    0.00     0.0
47 6      0.0    0.00     0.0
48 7      0.0    1.67     0.0
49 8      0.0    0.00     0.0
50 9      0.0    0.00     0.0
51 10   100.0    0.00     0.0
52 11     0.0   94.12     0.0
53 12     0.0    0.00   100.0
54
55 Treino, teste e predições do [0]_DecisionTreeClassifier
   executados em: 5.969344615936279 segundos
56
57
58 Elementos de treino: 2925
59 Elementos de teste: 975
60
```

```
Classificador: AdaBoostClassifier
Score de teste: 0.6881081680012195
Confusion Matrix:
        0      1      2      3      4      5      6      7      8      9   \
0   100.0   0.00    0.0    0.0    0.0    0.0    0.0    0.0   0.00    0.0
1     0.0  98.94    0.0    0.0    0.0    0.0    0.0    0.0   1.06    0.0
2     0.0   0.00  100.0    0.0    0.0    0.0    0.0    0.0   0.00    0.0
3     0.0   0.00    0.0  100.0    0.0    0.0    0.0    0.0   0.00    0.0
4     0.0   0.00    0.0    0.0  100.0    0.0    0.0    0.0   0.00    0.0
5     0.0   0.00    0.0    0.0    0.0  100.0    0.0    0.0   0.00    0.0
6     0.0   0.00    0.0    0.0    0.0    0.0  100.0    0.0   0.00    0.0
7     0.0   0.00    0.0    0.0    0.0    0.0    0.0  100.0   0.00    0.0
8     0.0   0.00    0.0    0.0    0.0    0.0    0.0    0.0  100.00    0.0
9     0.0   0.00    0.0    0.0    0.0    0.0    0.0    0.0   0.00  100.0
10    0.0   0.00    0.0    0.0    0.0    0.0  100.0    0.0   0.00    0.0
11    0.0   0.00    0.0    0.0    0.0    0.0    0.0   88.24   0.00    0.0
12    0.0   0.00    0.0    0.0    0.0    0.0    0.0    0.0   0.00    0.0
   100.00    0.0

      10     11   12
0    0.0   0.00  0.0
1    0.0   0.00  0.0
2    0.0   0.00  0.0
3    0.0   0.00  0.0
4    0.0   0.00  0.0
5    0.0   0.00  0.0
6    0.0   0.00  0.0
7    0.0   0.00  0.0
8    0.0   0.00  0.0
9    0.0   0.00  0.0
10   0.0   0.00  0.0
11   0.0  11.76  0.0
```

```
 92 12  0.0   0.00  0.0
 93
 94 Treino, teste e predições do [1]_AdaBoostClassifier
    executados em: 54.131516218185425 segundos
 95
 96
 97 Elementos de treino: 2925
 98 Elementos de teste: 975
 99
100 Classificador: SVC
101 Score de teste: 0.9811783953590658
102 Confusion Matrix:
103         0      1      2      3      4      5      6      7
          8      9   \
104 0   100.0   0.00    0.0    0.0    0.0    0.0   0.00   0.
    00    0.0    0.0
105 1     0.0  98.94    0.0    0.0    0.0    0.0   0.00   0.
    00    0.0    0.0
106 2     0.0   0.00  100.0    0.0    0.0    0.0   0.00   0.
    00    0.0    0.0
107 3     0.0   0.00    0.0  100.0    0.0    0.0   0.00   0.
    00    0.0    0.0
108 4     0.0   0.00    0.0    0.0  100.0    0.0   0.00   0.
    00    0.0    0.0
109 5     0.0   0.00    0.0    0.0    0.0  100.0   0.00   0.
    00    0.0    0.0
110 6     0.0   0.00    0.0    0.0    0.0    0.0  98.33   0.
    00    0.0    0.0
111 7     0.0   0.00    0.0    0.0    0.0    0.0   0.00  90.
    00    0.0    0.0
112 8     0.0   0.00    0.0    0.0    0.0    0.0   0.00   0.
    00  100.0    0.0
113 9     0.0   0.00    0.0    0.0    0.0    0.0   0.00   0.
    00    0.0  100.0
114 10    0.0   0.00    0.0    0.0    0.0    0.0   0.00   0.
    00    0.0    0.0
115 11    0.0   0.00    0.0    0.0    0.0    0.0   0.00  11.
    76    0.0    0.0
116 12    0.0   0.00    0.0    0.0    0.0    0.0   0.00   0.
    00    0.0    0.0
117
118         10     11      12
119 0     0.00   0.00    0.00
120 1     0.00   0.00    1.06
121 2     0.00   0.00    0.00
```

```
122 3      0.00    0.00     0.00
123 4      0.00    0.00     0.00
124 5      0.00    0.00     0.00
125 6      1.67    0.00     0.00
126 7      0.00   10.00     0.00
127 8      0.00    0.00     0.00
128 9      0.00    0.00     0.00
129 10   100.00    0.00     0.00
130 11     0.00   88.24     0.00
131 12     0.00    0.00   100.00
132
133 Treino, teste e predições do [2]_SVC executados em: 10.
    71542239189148 segundos
134
135
136 Elementos de treino: 2925
137 Elementos de teste: 975
138
139 Classificador: RandomForestClassifier
140 Score de teste: 0.9952869973343887
141 Confusion Matrix:
142         0      1      2      3      4      5      6
    7      8      9   \
143 0   100.0    0.0    0.0    0.0    0.0    0.0   0.00    0.
    00    0.0    0.0
144 1     0.0  100.0    0.0    0.0    0.0    0.0   0.00    0.
    00    0.0    0.0
145 2     0.0    0.0  100.0    0.0    0.0    0.0   0.00    0.
    00    0.0    0.0
146 3     0.0    0.0    0.0  100.0    0.0    0.0   0.00    0.
    00    0.0    0.0
147 4     0.0    0.0    0.0    0.0  100.0    0.0   0.00    0.
    00    0.0    0.0
148 5     0.0    0.0    0.0    0.0    0.0  100.0   0.00    0.
    00    0.0    0.0
149 6     0.0    0.0    0.0    0.0    0.0    0.0  98.33    0.
    00    0.0    0.0
150 7     0.0    0.0    0.0    0.0    0.0    0.0   0.00  100.
    00    0.0    0.0
151 8     0.0    0.0    0.0    0.0    0.0    0.0   0.00    0.
    00  100.0    0.0
152 9     0.0    0.0    0.0    0.0    0.0    0.0   0.00    0.
    00    0.0  100.0
153 10    0.0    0.0    0.0    0.0    0.0    0.0   0.00    0.
    00    0.0    0.0
```

```
154 11    0.0    0.0    0.0    0.0    0.0    0.0   0.00    4.
    41    0.0    0.0
155 12    0.0    0.0    0.0    0.0    0.0    0.0   0.00    0.
    00    0.0    0.0
156
157          10     11     12
158 0     0.00   0.00    0.0
159 1     0.00   0.00    0.0
160 2     0.00   0.00    0.0
161 3     0.00   0.00    0.0
162 4     0.00   0.00    0.0
163 5     0.00   0.00    0.0
164 6     1.67   0.00    0.0
165 7     0.00   0.00    0.0
166 8     0.00   0.00    0.0
167 9     0.00   0.00    0.0
168 10  100.00   0.00    0.0
169 11    0.00  95.59    0.0
170 12    0.00   0.00  100.0
171
172 Treino, teste e predições do [3]_RandomForestClassifier
    executados em: 4.2499470710754395 segundos
173
174
175 Elementos de treino: 2925
176 Elementos de teste: 975
177
178 Classificador: GaussianNB
179 Score de teste: 0.9799553274446233
180 Confusion Matrix:
181        0      1      2       3      4      5      6
    7      8      9   \
182 0   100.0   0.00    0.0    0.00    0.0    0.0   0.00   0.
    00    0.0    0.0
183 1     0.0  98.94    0.0    1.06    0.0    0.0   0.00   0.
    00    0.0    0.0
184 2     0.0   0.00  100.0    0.00    0.0    0.0   0.00   0.
    00    0.0    0.0
185 3     0.0   0.00    0.0  100.00    0.0    0.0   0.00   0.
    00    0.0    0.0
186 4     0.0   0.00    0.0    0.00  100.0    0.0   0.00   0.
    00    0.0    0.0
187 5     0.0   0.00    0.0    0.00    0.0  100.0   0.00   0.
    00    0.0    0.0
188 6     0.0   0.00    0.0    0.00    0.0    0.0  98.33   0.
```

```
188 00    0.0    0.0
189 7     0.0   0.00    0.0    0.00    0.0    0.0   0.00  86.
    67    0.0    0.0
190 8     0.0   0.00    0.0    0.00    0.0    0.0   0.00   0.
    00  100.0    0.0
191 9     0.0   0.00    0.0    0.00    0.0    0.0   0.00   0.
    00    0.0  100.0
192 10    0.0   0.00    0.0    0.00    0.0    0.0   0.00   0.
    00    0.0    0.0
193 11    0.0   0.00    0.0    0.00    0.0    0.0   0.00  10.
    29    0.0    0.0
194 12    0.0   0.00    0.0    0.00    0.0    0.0   0.00   0.
    00    0.0    0.0
195
196         10     11     12
197 0     0.00   0.00    0.0
198 1     0.00   0.00    0.0
199 2     0.00   0.00    0.0
200 3     0.00   0.00    0.0
201 4     0.00   0.00    0.0
202 5     0.00   0.00    0.0
203 6     1.67   0.00    0.0
204 7     0.00  13.33    0.0
205 8     0.00   0.00    0.0
206 9     0.00   0.00    0.0
207 10  100.00   0.00    0.0
208 11    0.00  89.71    0.0
209 12    0.00   0.00  100.0
210
211 Treino, teste e predições do [4]_GaussianNB executados em
    : 5.53725528717041 segundos
212
213
214 Elementos de treino: 2925
215 Elementos de teste: 975
216
217 Classificador: KNeighborsClassifier
218 Score de teste: 0.9767018493708555
219 Confusion Matrix:
220        0      1      2      3      4      5      6      7
           8      9   \
221 0   100.0   0.00    0.0    0.0    0.0    0.0   0.00   0.
    00    0.0    0.0
222 1     0.0  98.94    0.0    0.0    0.0    0.0   0.00   0.
    00    0.0    0.0
```

```
223 2      0.0    0.00  100.0     0.0     0.0     0.0    0.00    0.
    00     0.0     0.0
224 3      0.0    0.00    0.0   100.0     0.0     0.0    0.00    0.
    00     0.0     0.0
225 4      0.0    0.00    0.0     0.0   100.0     0.0    0.00    0.
    00     0.0     0.0
226 5      0.0    0.00    0.0     0.0     0.0   100.0    0.00    0.
    00     0.0     0.0
227 6      0.0    0.00    0.0     0.0     0.0     0.0   98.33    0.
    00     0.0     0.0
228 7      0.0    0.00    0.0     0.0     0.0     0.0    0.00   86.
    67     0.0     0.0
229 8      0.0    0.00    0.0     0.0     0.0     0.0    0.00    0.
    00   100.0     0.0
230 9      0.0    0.00    0.0     0.0     0.0     0.0    0.00    0.
    00     0.0   100.0
231 10     0.0    1.30    0.0     0.0     0.0     0.0    0.00    0.
    00     0.0     0.0
232 11     0.0    0.00    0.0     0.0     0.0     0.0    0.00   13.
    24     0.0     0.0
233 12     0.0    0.00    0.0     0.0     0.0     0.0    0.00    0.
    00     0.0     0.0
234
235          10      11      12
236 0     0.00    0.00    0.00
237 1     0.00    0.00    1.06
238 2     0.00    0.00    0.00
239 3     0.00    0.00    0.00
240 4     0.00    0.00    0.00
241 5     0.00    0.00    0.00
242 6     1.67    0.00    0.00
243 7     0.00   13.33    0.00
244 8     0.00    0.00    0.00
245 9     0.00    0.00    0.00
246 10   98.70    0.00    0.00
247 11    0.00   86.76    0.00
248 12    0.00    0.00  100.00
249
250 Treino, teste e predições do [5]_KNeighborsClassifier
    executados em: 9.10404086112976 segundos
251
252
253 Elementos de treino: 2925
254 Elementos de teste: 975
255
```

```
Classificador: SGDClassifier
Score de teste: 0.9776050597749968
Confusion Matrix:
        0      1      2      3      4       5      6
    7      8      9   \
0   98.63   0.00    0.0    0.0    0.0    1.37   0.00   0.
    00    0.0    0.0
1    0.00  98.94    0.0    0.0    0.0    0.00   0.00   0.
    00    0.0    0.0
2    0.00   0.00  100.0    0.0    0.0    0.00   0.00   0.
    00    0.0    0.0
3    0.00   0.00    0.0  100.0    0.0    0.00   0.00   0.
    00    0.0    0.0
4    0.00   0.00    0.0    0.0  100.0    0.00   0.00   0.
    00    0.0    0.0
5    0.00   0.00    0.0    0.0    0.0  100.00   0.00   0.
    00    0.0    0.0
6    0.00   0.00    0.0    0.0    0.0    0.00  98.33   0.
    00    0.0    0.0
7    0.00   0.00    0.0    0.0    0.0    0.00   0.00  98.
    33    0.0    0.0
8    0.00   0.00    0.0    0.0    0.0    0.00   0.00   0.
    00  100.0    0.0
9    0.00   0.00    0.0    0.0    0.0    0.00   0.00   0.
    00    0.0  100.0
10   0.00   0.00    0.0    0.0    0.0    0.00   0.00   0.
    00    0.0    0.0
11   0.00   0.00    0.0    0.0    0.0    0.00   0.00  23.
    53    0.0    0.0
12   0.00   0.00    0.0    0.0    0.0    0.00   0.00   0.
    00    0.0    0.0

         10     11      12
0     0.00   0.00    0.00
1     0.00   0.00    1.06
2     0.00   0.00    0.00
3     0.00   0.00    0.00
4     0.00   0.00    0.00
5     0.00   0.00    0.00
6     1.67   0.00    0.00
7     0.00   1.67    0.00
8     0.00   0.00    0.00
9     0.00   0.00    0.00
10  100.00   0.00    0.00
11    0.00  76.47    0.00
```

```
287 12    0.00   0.00  100.00
288
289 Treino, teste e predições do [6]_SGDClassifier executados
     em: 2.279522180557251 segundos
290
291
292 Elementos de treino: 2925
293 Elementos de teste: 975
294
295 Classificador: AdaBoostClassifier
296 Score de teste: 0.9930579241591462
297 Confusion Matrix:
298         0      1      2      3      4       5      6
            7      8      9   \
299 0   100.0   0.00    0.0    0.0    0.0    0.00   0.00    0
    .00    0.0    0.0
300 1     0.0  98.94    0.0    0.0    0.0    1.06   0.00    0
    .00    0.0    0.0
301 2     0.0   0.00  100.0    0.0    0.0    0.00   0.00    0
    .00    0.0    0.0
302 3     0.0   0.00    0.0  100.0    0.0    0.00   0.00    0
    .00    0.0    0.0
303 4     0.0   0.00    0.0    0.0  100.0    0.00   0.00    0
    .00    0.0    0.0
304 5     0.0   0.00    0.0    0.0    0.0  100.00   0.00    0
    .00    0.0    0.0
305 6     0.0   0.00    0.0    0.0    0.0    0.00  98.33    0
    .00    0.0    0.0
306 7     0.0   0.00    0.0    0.0    0.0    0.00   0.00  100
    .00    0.0    0.0
307 8     0.0   0.00    0.0    0.0    0.0    0.00   0.00    0
    .00  100.0    0.0
308 9     0.0   0.00    0.0    0.0    0.0    0.00   0.00    0
    .00    0.0  100.0
309 10    0.0   0.00    0.0    0.0    0.0    0.00   0.00    0
    .00    0.0    0.0
310 11    0.0   0.00    0.0    0.0    0.0    0.00   0.00    5
    .88    0.0    0.0
311 12    0.0   0.00    0.0    0.0    0.0    0.00   0.00    0
    .00    0.0    0.0
312
313         10     11     12
314 0     0.00   0.00    0.0
315 1     0.00   0.00    0.0
316 2     0.00   0.00    0.0
```

```
317 3     0.00   0.00    0.0
318 4     0.00   0.00    0.0
319 5     0.00   0.00    0.0
320 6     1.67   0.00    0.0
321 7     0.00   0.00    0.0
322 8     0.00   0.00    0.0
323 9     0.00   0.00    0.0
324 10  100.00   0.00    0.0
325 11    0.00  94.12    0.0
326 12    0.00   0.00  100.0
327
328 Treino, teste e predições do [7]_AdaBoostClassifier
    executados em: 4.486009359359741 segundos
329
330
331 Elementos de treino: 2925
332 Elementos de teste: 975
333
334 Classificador: LogisticRegression
335 Score de teste: 0.9933374998495421
336 Confusion Matrix:
337         0      1      2      3      4       5      6
    7      8      9   \
338 0   98.63   0.00    0.0    0.0    0.0    1.37   0.00   0.
    00    0.0    0.0
339 1    0.00  98.94    0.0    0.0    0.0    0.00   0.00   0.
    00    0.0    0.0
340 2    0.00   0.00  100.0    0.0    0.0    0.00   0.00   0.
    00    0.0    0.0
341 3    0.00   0.00    0.0  100.0    0.0    0.00   0.00   0.
    00    0.0    0.0
342 4    0.00   0.00    0.0    0.0  100.0    0.00   0.00   0.
    00    0.0    0.0
343 5    0.00   0.00    0.0    0.0    0.0  100.00   0.00   0.
    00    0.0    0.0
344 6    0.00   0.00    0.0    0.0    0.0    0.00  98.33   0.
    00    0.0    0.0
345 7    0.00   0.00    0.0    0.0    0.0    0.00   0.00  98.
    33    0.0    0.0
346 8    0.00   0.00    0.0    0.0    0.0    0.00   0.00   0.
    00  100.0    0.0
347 9    0.00   0.00    0.0    0.0    0.0    0.00   0.00   0.
    00    0.0  100.0
348 10   0.00   0.00    0.0    0.0    0.0    0.00   0.00   0.
    00    0.0    0.0
```

```
349 11   0.00   0.00    0.0    0.0    0.0    0.00   0.00   2.
    94    0.0    0.0
350 12   0.00   0.00    0.0    0.0    0.0    0.00   0.00   0.
    00    0.0    0.0
351
352          10     11      12
353 0      0.00   0.00    0.00
354 1      0.00   0.00    1.06
355 2      0.00   0.00    0.00
356 3      0.00   0.00    0.00
357 4      0.00   0.00    0.00
358 5      0.00   0.00    0.00
359 6      1.67   0.00    0.00
360 7      0.00   1.67    0.00
361 8      0.00   0.00    0.00
362 9      0.00   0.00    0.00
363 10   100.00   0.00    0.00
364 11     0.00  97.06    0.00
365 12     0.00   0.00  100.00
366
367 Treino, teste e predições do [8]_LogisticRegression
    executados em: 31.323044300079346 segundos
368
369
370 Elementos de treino: 2925
371 Elementos de teste: 975
372
373 Classificador: BaggingClassifier
374 Score de teste: 0.9939903846153846
375 Confusion Matrix:
376         0      1      2      3      4      5      6
    7      8      9   \
377 0   100.0    0.0    0.0    0.0    0.0    0.0    0.0    0.
    00    0.0    0.0
378 1     0.0  100.0    0.0    0.0    0.0    0.0    0.0    0.
    00    0.0    0.0
379 2     0.0    0.0  100.0    0.0    0.0    0.0    0.0    0.
    00    0.0    0.0
380 3     0.0    0.0    0.0  100.0    0.0    0.0    0.0    0.
    00    0.0    0.0
381 4     0.0    0.0    0.0    0.0  100.0    0.0    0.0    0.
    00    0.0    0.0
382 5     0.0    0.0    0.0    0.0    0.0  100.0    0.0    0.
    00    0.0    0.0
383 6     0.0    0.0    0.0    0.0    0.0    0.0  100.0    0.
```

```
383 00    0.0    0.0
384 7     0.0    0.0    0.0    0.0    0.0    0.0    0.0  100.
    00    0.0    0.0
385 8     0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.
    00  100.0    0.0
386 9     0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.
    00    0.0  100.0
387 10    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.
    00    0.0    0.0
388 11    0.0    0.0    0.0    0.0    0.0    0.0    0.0    7.
    35    0.0    0.0
389 12    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.
    00    0.0    0.0
390
391        10     11     12
392 0     0.0   0.00    0.0
393 1     0.0   0.00    0.0
394 2     0.0   0.00    0.0
395 3     0.0   0.00    0.0
396 4     0.0   0.00    0.0
397 5     0.0   0.00    0.0
398 6     0.0   0.00    0.0
399 7     0.0   0.00    0.0
400 8     0.0   0.00    0.0
401 9     0.0   0.00    0.0
402 10  100.0   0.00    0.0
403 11    0.0  92.65    0.0
404 12    0.0   0.00  100.0
405
406 Treino, teste e predições do [9]_BaggingClassifier
    executados em: 36.70264434814453 segundos
407
408
409 Aplicando tuning do modelo...
410 Elementos de treino: 2925
411 Elementos de teste: 975
412 Otimização de parâmetros executada em:  1055.967073917389
      segundos
413 Melhor Score:  0.894844496823169
414 Melhores Parâmetros:  {'learning_rate': 0.5, '
    random_state': 40}
415
416 ------
417 Modelo não-otimizado
418 ------
```

```
F-score dos dados de teste: 0.6881

------
Modelo otimizado
------
F-score dos dados de teste: 0.9374


Confusion Matrix:
[[73  0  0  0  0  0  0  0  0  0  0  0  0]
 [ 0 93  0  0  0  0  0  0  0  0  0  0  1]
 [ 0  0 73  0  0  0  0  0  0  0  0  0  0]
 [ 0  0  0 79  0  0  0  2  0  0  0  0  0]
 [ 0  0  0  0 85  0  0  0  0  0  0  0  0]
 [ 0  0  0  0  0 69  0  0  0  0  0  0  0]
 [ 0  0  0  0  0  0 59  1  0  0  0  0  0]
 [ 0  0  0  0  0  0  0 59  0  0  0  1  0]
 [ 0  0  0  0  0  1  0  0 69  0  0  0  0]
 [ 0  0  0  0  0  0  0  0  0 78  0  0  0]
 [ 0  0  0  0  0  0  0  0  0  0 77  0  0]
 [ 0  0  0  0  0  0  0 49  0  0  0 19  0]
 [ 0  0  0  0  0  0  0  1  0  0  0  0 86]]

Plotando gráficos de  Dados_Originais ...
Plotando gráficos de  PAA ...
Plotando gráficos de  [0]_DecisionTreeClassifier ...
Plotando gráficos de  [1]_AdaBoostClassifier ...
Plotando gráficos de  [2]_SVC ...
Plotando gráficos de  [3]_RandomForestClassifier ...
Plotando gráficos de  [4]_GaussianNB ...
Plotando gráficos de  [5]_KNeighborsClassifier ...
Plotando gráficos de  [6]_SGDClassifier ...
Plotando gráficos de  [7]_AdaBoostClassifier ...
Plotando gráficos de  [8]_LogisticRegression ...
Plotando gráficos de  [9]_BaggingClassifier ...
Plotando gráficos de  PREDICOES_FINAIS ...
Score do [0]_DecisionTreeClassifier: 0.9898816582258024
Score do [1]_AdaBoostClassifier: 0.6881081680012195
Score do [2]_SVC: 0.9811783953590658
Score do [3]_RandomForestClassifier: 0.9952869973343887
Score do [4]_GaussianNB: 0.9799553274446233
Score do [5]_KNeighborsClassifier: 0.9767018493708555
Score do [6]_SGDClassifier: 0.9776050597749968
Score do [7]_AdaBoostClassifier: 0.9930579241591462
Score do [8]_LogisticRegression: 0.9933374998495421
```

```
Score do [9]_BaggingClassifier: 0.9939903846153846


Circuito: Sallen Key mc + 4bitPRBS [FALHA].raw
Obtendo dados do arquivo 'Sallen Key mc + 4bitPRBS [FALHA]raw.csv' .
Leitura do arquivo csv executada em:  1.2002787590026855 segundos
Salvando características do circuito...

Iniciando a aplicação do PAA
Quantidade de segmentos de PAA: 100
Aplicação do Paa executada em:  1.3773102760314941

Iniciando a aplicação dos métodos de aprendizagem supervisionados
Elementos de treino: 2475
Elementos de teste: 825

Classificador: DecisionTreeClassifier
Score de teste: 0.9974657523059964
Confusion Matrix:
         0      1      2       3      4      5      6      7      8      9   \
0   100.00    0.0   0.00    0.00    0.0    0.0    0.0   0.00    0.0    0.0
1     0.00  100.0   0.00    0.00    0.0    0.0    0.0   0.00    0.0    0.0
2     1.28    0.0  98.72    0.00    0.0    0.0    0.0   0.00    0.0    0.0
3     0.00    0.0   0.00  100.00    0.0    0.0    0.0   0.00    0.0    0.0
4     0.00    0.0   0.00    0.00  100.0    0.0    0.0   0.00    0.0    0.0
5     0.00    0.0   0.00    0.00    0.0  100.0    0.0   0.00    0.0    0.0
6     0.00    0.0   0.00    0.00    0.0    0.0  100.0   0.00    0.0    0.0
7     0.00    0.0   0.00    1.45    0.0    0.0    0.0  98.55    0.0    0.0
8     0.00    0.0   0.00    0.00    0.0    0.0    0.0   0.00  100.0    0.0
9     0.00    0.0   0.00    0.00    0.0    0.0    0.0   0.00    0.0  100.0
10    0.00    0.0   0.00    0.00    0.0    0.0    0.0   0.00    0.0    0.0
```

```
494 .00    0.0    0.0
495
496         10
497 0      0.0
498 1      0.0
499 2      0.0
500 3      0.0
501 4      0.0
502 5      0.0
503 6      0.0
504 7      0.0
505 8      0.0
506 9      0.0
507 10   100.0
508
509 Treino, teste e predições do [0]_DecisionTreeClassifier
    executados em: 2.6915972232818604 segundos
510
511
512 Elementos de treino: 2475
513 Elementos de teste: 825
514
515 Classificador: AdaBoostClassifier
516 Score de teste: 0.2394620066091568
517 Confusion Matrix:
518         0    1    2    3      4    5      6    7    8
           9    10
519 0   100.0  0.0  0.0  0.0    0.0  0.0    0.0  0.0  0.0
    0.0  0.0
520 1     0.0  0.0  0.0  0.0    0.0  0.0    0.0  0.0  0.0
    100.0  0.0
521 2   100.0  0.0  0.0  0.0    0.0  0.0    0.0  0.0  0.0
    0.0  0.0
522 3   100.0  0.0  0.0  0.0    0.0  0.0    0.0  0.0  0.0
    0.0  0.0
523 4     0.0  0.0  0.0  0.0  100.0  0.0    0.0  0.0  0.0
    0.0  0.0
524 5   100.0  0.0  0.0  0.0    0.0  0.0    0.0  0.0  0.0
    0.0  0.0
525 6     0.0  0.0  0.0  0.0    0.0  0.0  100.0  0.0  0.0
    0.0  0.0
526 7   100.0  0.0  0.0  0.0    0.0  0.0    0.0  0.0  0.0
    0.0  0.0
527 8   100.0  0.0  0.0  0.0    0.0  0.0    0.0  0.0  0.0
    0.0  0.0
```

```
528 9     0.0  0.0  0.0  0.0    0.0  0.0    0.0  0.0  0.0
    100.0  0.0
529 10  100.0  0.0  0.0  0.0    0.0  0.0    0.0  0.0  0.0
    0.0  0.0
530
531 Treino, teste e predições do [1]_AdaBoostClassifier
    executados em: 25.740804433822632 segundos
532
533
534 Elementos de treino: 2475
535 Elementos de teste: 825
536
537 Classificador: SVC
538 Score de teste: 1.0
539 Confusion Matrix:
540        0      1      2      3      4      5      6      7
          8      9   \
541 0   100.0    0.0    0.0    0.0    0.0    0.0    0.0    0.
    0    0.0    0.0
542 1     0.0  100.0    0.0    0.0    0.0    0.0    0.0    0.
    0    0.0    0.0
543 2     0.0    0.0  100.0    0.0    0.0    0.0    0.0    0.
    0    0.0    0.0
544 3     0.0    0.0    0.0  100.0    0.0    0.0    0.0    0.
    0    0.0    0.0
545 4     0.0    0.0    0.0    0.0  100.0    0.0    0.0    0.
    0    0.0    0.0
546 5     0.0    0.0    0.0    0.0    0.0  100.0    0.0    0.
    0    0.0    0.0
547 6     0.0    0.0    0.0    0.0    0.0    0.0  100.0    0.
    0    0.0    0.0
548 7     0.0    0.0    0.0    0.0    0.0    0.0    0.0  100.
    0    0.0    0.0
549 8     0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.
    0  100.0    0.0
550 9     0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.
    0    0.0  100.0
551 10    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.
    0    0.0    0.0
552
553        10
554 0     0.0
555 1     0.0
556 2     0.0
557 3     0.0
```

```
558 4     0.0
559 5     0.0
560 6     0.0
561 7     0.0
562 8     0.0
563 9     0.0
564 10  100.0
565
566 Treino, teste e predições do [2]_SVC executados em: 3.
    1236937046051025 segundos
567
568
569 Elementos de treino: 2475
570 Elementos de teste: 825
571
572 Classificador: RandomForestClassifier
573 Score de teste: 1.0
574 Confusion Matrix:
575        0      1      2      3      4      5      6      7
           8      9   \
576 0   100.0    0.0    0.0    0.0    0.0    0.0    0.0    0.
    0    0.0    0.0
577 1     0.0  100.0    0.0    0.0    0.0    0.0    0.0    0.
    0    0.0    0.0
578 2     0.0    0.0  100.0    0.0    0.0    0.0    0.0    0.
    0    0.0    0.0
579 3     0.0    0.0    0.0  100.0    0.0    0.0    0.0    0.
    0    0.0    0.0
580 4     0.0    0.0    0.0    0.0  100.0    0.0    0.0    0.
    0    0.0    0.0
581 5     0.0    0.0    0.0    0.0    0.0  100.0    0.0    0.
    0    0.0    0.0
582 6     0.0    0.0    0.0    0.0    0.0    0.0  100.0    0.
    0    0.0    0.0
583 7     0.0    0.0    0.0    0.0    0.0    0.0    0.0  100.
    0    0.0    0.0
584 8     0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.
    0  100.0    0.0
585 9     0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.
    0    0.0  100.0
586 10    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.
    0    0.0    0.0
587
588        10
589 0     0.0
```

```
590 1     0.0
591 2     0.0
592 3     0.0
593 4     0.0
594 5     0.0
595 6     0.0
596 7     0.0
597 8     0.0
598 9     0.0
599 10  100.0
600
601 Treino, teste e predições do [3]_RandomForestClassifier
    executados em: 3.188727617263794 segundos
602
603
604 Elementos de treino: 2475
605 Elementos de teste: 825
606
607 Classificador: GaussianNB
608 Score de teste: 0.9742935263534872
609 Confusion Matrix:
610         0      1      2      3      4      5      6      7
          8      9   \
611 0   100.0    0.0    0.0    0.0    0.0   0.00    0.0   0.
    00    0.0    0.0
612 1     0.0  100.0    0.0    0.0    0.0   0.00    0.0   0.
    00    0.0    0.0
613 2     0.0    0.0  100.0    0.0    0.0   0.00    0.0   0.
    00    0.0    0.0
614 3     0.0    0.0    0.0  100.0    0.0   0.00    0.0   0.
    00    0.0    0.0
615 4     0.0    0.0    0.0    0.0  100.0   0.00    0.0   0.
    00    0.0    0.0
616 5     0.0    0.0    0.0    0.0    0.0  84.81    0.0  15.
    19    0.0    0.0
617 6     0.0    0.0    0.0    0.0    0.0   0.00  100.0   0.
    00    0.0    0.0
618 7     0.0    0.0    0.0    0.0    0.0  11.59    0.0  88.
    41    0.0    0.0
619 8     0.0    0.0    0.0    0.0    0.0   0.00    0.0   0.
    00  100.0    0.0
620 9     0.0    0.0    0.0    0.0    0.0   0.00    0.0   0.
    00    0.0  100.0
621 10    0.0    0.0    0.0    0.0    0.0   1.15    0.0   0.
    00    0.0    0.0
```

```
622
623         10
624 0     0.00
625 1     0.00
626 2     0.00
627 3     0.00
628 4     0.00
629 5     0.00
630 6     0.00
631 7     0.00
632 8     0.00
633 9     0.00
634 10   98.85
635
636 Treino, teste e predições do [4]_GaussianNB executados em
    : 3.514782190322876 segundos
637
638
639 Elementos de treino: 2475
640 Elementos de teste: 825
641
642 Classificador: KNeighborsClassifier
643 Score de teste: 1.0
644 Confusion Matrix:
645         0      1      2      3      4      5      6      7
          8      9   \
646 0   100.0    0.0    0.0    0.0    0.0    0.0    0.0    0.
    0    0.0    0.0
647 1     0.0  100.0    0.0    0.0    0.0    0.0    0.0    0.
    0    0.0    0.0
648 2     0.0    0.0  100.0    0.0    0.0    0.0    0.0    0.
    0    0.0    0.0
649 3     0.0    0.0    0.0  100.0    0.0    0.0    0.0    0.
    0    0.0    0.0
650 4     0.0    0.0    0.0    0.0  100.0    0.0    0.0    0.
    0    0.0    0.0
651 5     0.0    0.0    0.0    0.0    0.0  100.0    0.0    0.
    0    0.0    0.0
652 6     0.0    0.0    0.0    0.0    0.0    0.0  100.0    0.
    0    0.0    0.0
653 7     0.0    0.0    0.0    0.0    0.0    0.0    0.0  100.
    0    0.0    0.0
654 8     0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.
    0  100.0    0.0
655 9     0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.
```

```
655 0    0.0  100.0
656 10    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.
    0    0.0    0.0
657
658        10
659 0     0.0
660 1     0.0
661 2     0.0
662 3     0.0
663 4     0.0
664 5     0.0
665 6     0.0
666 7     0.0
667 8     0.0
668 9     0.0
669 10  100.0
670
671 Treino, teste e predições do [5]_KNeighborsClassifier
    executados em: 4.262986183166504 segundos
672
673
674 Elementos de treino: 2475
675 Elementos de teste: 825
676
677 Classificador: SGDClassifier
678 Score de teste: 0.9962247337292486
679 Confusion Matrix:
680        0      1      2       3      4      5      6
    7      8       9   \
681 0   100.0   0.00    0.0    0.00    0.0    0.0    0.0    0
    .0    0.0    0.00
682 1     0.0  97.73    0.0    0.00    0.0    0.0    0.0    0
    .0    0.0    2.27
683 2     0.0   0.00  100.0    0.00    0.0    0.0    0.0    0
    .0    0.0    0.00
684 3     0.0   0.00    0.0  100.00    0.0    0.0    0.0    0
    .0    0.0    0.00
685 4     0.0   0.00    0.0    0.00  100.0    0.0    0.0    0
    .0    0.0    0.00
686 5     0.0   0.00    0.0    0.00    0.0  100.0    0.0    0
    .0    0.0    0.00
687 6     0.0   0.00    0.0    0.00    0.0    0.0  100.0    0
    .0    0.0    0.00
688 7     0.0   0.00    0.0    0.00    0.0    0.0    0.0  100
    .0    0.0    0.00
```

```
689 8      0.0    0.00     0.0     0.00     0.0     0.0     0.0     0
    .0   100.0     0.00
690 9      0.0    0.00     0.0     0.00     0.0     0.0     0.0     0
    .0     0.0   100.00
691 10     0.0    0.00     0.0     1.15     0.0     0.0     0.0     0
    .0     0.0     0.00
692
693         10
694 0     0.00
695 1     0.00
696 2     0.00
697 3     0.00
698 4     0.00
699 5     0.00
700 6     0.00
701 7     0.00
702 8     0.00
703 9     0.00
704 10   98.85
705
706 Treino, teste e predições do [6]_SGDClassifier executados
     em: 1.4393360614776611 segundos
707
708
709 Elementos de treino: 2475
710 Elementos de teste: 825
711
712 Classificador: AdaBoostClassifier
713 Score de teste: 1.0
714 Confusion Matrix:
715         0      1      2      3      4      5      6      7
           8      9   \
716 0   100.0    0.0    0.0    0.0    0.0    0.0    0.0    0.
    0    0.0    0.0
717 1     0.0  100.0    0.0    0.0    0.0    0.0    0.0    0.
    0    0.0    0.0
718 2     0.0    0.0  100.0    0.0    0.0    0.0    0.0    0.
    0    0.0    0.0
719 3     0.0    0.0    0.0  100.0    0.0    0.0    0.0    0.
    0    0.0    0.0
720 4     0.0    0.0    0.0    0.0  100.0    0.0    0.0    0.
    0    0.0    0.0
721 5     0.0    0.0    0.0    0.0    0.0  100.0    0.0    0.
    0    0.0    0.0
722 6     0.0    0.0    0.0    0.0    0.0    0.0  100.0    0.
```

```
722 0    0.0    0.0
723 7     0.0    0.0    0.0    0.0    0.0    0.0    0.0  100.
    0    0.0    0.0
724 8     0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.
    0  100.0    0.0
725 9     0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.
    0    0.0  100.0
726 10    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.
    0    0.0    0.0
727
728        10
729 0     0.0
730 1     0.0
731 2     0.0
732 3     0.0
733 4     0.0
734 5     0.0
735 6     0.0
736 7     0.0
737 8     0.0
738 9     0.0
739 10  100.0
740
741 Treino, teste e predições do [7]_AdaBoostClassifier
    executados em: 3.485837459564209 segundos
742
743
744 Elementos de treino: 2475
745 Elementos de teste: 825
746
747 Classificador: LogisticRegression
748 Score de teste: 1.0
749 Confusion Matrix:
750        0      1      2      3      4      5      6      7
           8      9   \
751 0   100.0    0.0    0.0    0.0    0.0    0.0    0.0    0.
    0    0.0    0.0
752 1     0.0  100.0    0.0    0.0    0.0    0.0    0.0    0.
    0    0.0    0.0
753 2     0.0    0.0  100.0    0.0    0.0    0.0    0.0    0.
    0    0.0    0.0
754 3     0.0    0.0    0.0  100.0    0.0    0.0    0.0    0.
    0    0.0    0.0
755 4     0.0    0.0    0.0    0.0  100.0    0.0    0.0    0.
    0    0.0    0.0
```

```
756 5      0.0    0.0    0.0    0.0    0.0  100.0    0.0    0.
    0    0.0    0.0
757 6      0.0    0.0    0.0    0.0    0.0    0.0  100.0    0.
    0    0.0    0.0
758 7      0.0    0.0    0.0    0.0    0.0    0.0    0.0  100.
    0    0.0    0.0
759 8      0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.
    0  100.0    0.0
760 9      0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.
    0    0.0  100.0
761 10     0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.
    0    0.0    0.0
762
763         10
764 0      0.0
765 1      0.0
766 2      0.0
767 3      0.0
768 4      0.0
769 5      0.0
770 6      0.0
771 7      0.0
772 8      0.0
773 9      0.0
774 10   100.0
775
776 Treino, teste e predições do [8]_LogisticRegression
    executados em: 10.855444192886353 segundos
777
778
779 Elementos de treino: 2475
780 Elementos de teste: 825
781
782 Classificador: BaggingClassifier
783 Score de teste: 0.9988296113341263
784 Confusion Matrix:
785         0      1      2       3      4      5      6
    7      8      9   \
786 0   100.0    0.0    0.0    0.00    0.0    0.0    0.0    0
    .0    0.0    0.0
787 1     0.0  100.0    0.0    0.00    0.0    0.0    0.0    0
    .0    0.0    0.0
788 2     0.0    0.0  100.0    0.00    0.0    0.0    0.0    0
    .0    0.0    0.0
789 3     0.0    0.0    0.0  100.00    0.0    0.0    0.0    0
```

```
789 .0    0.0    0.0
790 4     0.0    0.0    0.0    0.00  100.0    0.0    0.0    0
    .0    0.0    0.0
791 5     0.0    0.0    0.0    0.00    0.0  100.0    0.0    0
    .0    0.0    0.0
792 6     0.0    0.0    0.0    0.00    0.0    0.0  100.0    0
    .0    0.0    0.0
793 7     0.0    0.0    0.0    0.00    0.0    0.0    0.0  100
    .0    0.0    0.0
794 8     0.0    0.0    0.0    0.00    0.0    0.0    0.0    0
    .0  100.0    0.0
795 9     0.0    0.0    0.0    0.00    0.0    0.0    0.0    0
    .0    0.0  100.0
796 10    0.0    0.0    0.0    1.15    0.0    0.0    0.0    0
    .0    0.0    0.0
797
798        10
799 0    0.00
800 1    0.00
801 2    0.00
802 3    0.00
803 4    0.00
804 5    0.00
805 6    0.00
806 7    0.00
807 8    0.00
808 9    0.00
809 10  98.85
810
811 Treino, teste e predições do [9]_BaggingClassifier
    executados em: 12.634844064712524 segundos
812
813
814 Aplicando tuning do modelo...
815 Elementos de treino: 2475
816 Elementos de teste: 825
817 Otimização de parâmetros executada em:  389.5542607307434
      segundos
818 Melhor Score:  0.9927139275484952
819 Melhores Parâmetros:  {'learning_rate': 0.5, '
    random_state': 20}
820
821 ------
822 Modelo não-otimizado
823 ------
```

```
824 F-score dos dados de teste: 0.2395
825
826 ------
827 Modelo otimizado
828 ------
829 F-score dos dados de teste: 0.8556
830
831
832 Confusion Matrix:
833 [[67  0  0  0  0  0  0  0  0  0  0]
834  [ 0 88  0  0  0  0  0  0  0  0  0]
835  [ 0  0 78  0  0  0  0  0  0  0  0]
836  [ 1  0  0 74  0  0  0  0  0  0  0]
837  [ 0  0  0  0 81  0  0  0  0  0  0]
838  [ 0  0  0  0  0 77  0  1  1  0  0]
839  [ 0  0  0  0  0  0 64  0  0  0  0]
840  [ 0  0  0  0  0  9  0 60  0  0  0]
841  [ 0  0  0  0  0  0  0  0 72  0  0]
842  [ 0  0  0  0  0  0  0  0  1 64  0]
843  [ 0  0  0  0  0  0  0  0 86  0  1]]
844
845 Plotando gráficos de  Dados_Originais ...
846 Plotando gráficos de  PAA ...
847 Plotando gráficos de  [0]_DecisionTreeClassifier ...
848 Plotando gráficos de  [1]_AdaBoostClassifier ...
849 Plotando gráficos de  [2]_SVC ...
850 Plotando gráficos de  [3]_RandomForestClassifier ...
851 Plotando gráficos de  [4]_GaussianNB ...
852 Plotando gráficos de  [5]_KNeighborsClassifier ...
853 Plotando gráficos de  [6]_SGDClassifier ...
854 Plotando gráficos de  [7]_AdaBoostClassifier ...
855 Plotando gráficos de  [8]_LogisticRegression ...
856 Plotando gráficos de  [9]_BaggingClassifier ...
857 Plotando gráficos de  PREDICOES_FINAIS ...
858 Score do [0]_DecisionTreeClassifier: 0.9974657523059964
859 Score do [1]_AdaBoostClassifier: 0.2394620066091568
860 Score do [2]_SVC: 1.0
861 Score do [3]_RandomForestClassifier: 1.0
862 Score do [4]_GaussianNB: 0.9742935263534872
863 Score do [5]_KNeighborsClassifier: 1.0
864 Score do [6]_SGDClassifier: 0.9962247337292486
865 Score do [7]_AdaBoostClassifier: 1.0
866 Score do [8]_LogisticRegression: 1.0
867 Score do [9]_BaggingClassifier: 0.9988296113341263
868
```

```
869
870 Circuito: Nonlinear Rectfier + 4bit PRBS [FALHA] - 300 -
    0.2s.raw
871 Obtendo dados do arquivo 'Nonlinear Rectfier + 4bit PRBS
     [FALHA] - 300 - 0.2s.raw'...
872
873 Lendo grandeza: time
874 "time" lido.
875
876 Lendo grandeza: V(vout)
877 "V(vout)" lido.
878 Grandezas lidas.
879 Leitura do arquivo raw executada em:  75.29294157028198
    segundos
880 Salvando características do circuito...
881
882 Iniciando a aplicação do PAA
883 Quantidade de segmentos de PAA: 100
884 Aplicação do Paa executada em:  1.4733405113220215
885
886 Iniciando a aplicação dos métodos de aprendizagem
    supervisionados
887 Elementos de treino: 2475
888 Elementos de teste: 825
889
890 Classificador: DecisionTreeClassifier
891 Score de teste: 0.9898366164870879
892 Confusion Matrix:
893         0      1      2      3      4      5      6
    7      8      9   \
894 0   100.0   0.00   0.00   0.00   0.00   0.00    0.0    0.
    00    0.0    0.0
895 1     0.0  98.86   0.00   0.00   0.00   0.00    0.0    1.
    14    0.0    0.0
896 2     0.0   0.00  98.72   0.00   1.28   0.00    0.0    0.
    00    0.0    0.0
897 3     0.0   0.00   0.00  98.67   0.00   0.00    0.0    1.
    33    0.0    0.0
898 4     0.0   0.00   0.00   0.00  96.30   1.23    0.0    0.
    00    0.0    0.0
899 5     0.0   2.53   0.00   0.00   1.27  96.20    0.0    0.
    00    0.0    0.0
900 6     0.0   0.00   0.00   0.00   0.00   0.00  100.0    0.
    00    0.0    0.0
901 7     0.0   0.00   0.00   0.00   0.00   0.00    0.0  100.
```

```
901 00    0.0    0.0
902 8     0.0   0.00   0.00   0.00   0.00   0.00    0.0    0.
    00  100.0    0.0
903 9     0.0   0.00   0.00   0.00   0.00   0.00    0.0    0.
    00    0.0  100.0
904 10    0.0   0.00   0.00   0.00   0.00   0.00    0.0    0.
    00    0.0    0.0
905
906         10
907 0     0.00
908 1     0.00
909 2     0.00
910 3     0.00
911 4     2.47
912 5     0.00
913 6     0.00
914 7     0.00
915 8     0.00
916 9     0.00
917 10  100.00
918
919 Treino, teste e predições do [0]_DecisionTreeClassifier
    executados em: 2.899644613265991 segundos
920
921
922 Elementos de treino: 2475
923 Elementos de teste: 825
924
925 Classificador: AdaBoostClassifier
926 Score de teste: 0.18983668452165567
927 Confusion Matrix:
928      0    1       2    3    4    5      6    7    8
    9    10
929 0   0.0  0.0    0.00  0.0  0.0  0.0  100.0  0.0  0.0   0.
    00  0.0
930 1   0.0  0.0    0.00  0.0  0.0  0.0  100.0  0.0  0.0   0.
    00  0.0
931 2   0.0  0.0  100.00  0.0  0.0  0.0    0.0  0.0  0.0   0.
    00  0.0
932 3   0.0  0.0    0.00  0.0  0.0  0.0  100.0  0.0  0.0   0.
    00  0.0
933 4   0.0  0.0    0.00  0.0  0.0  0.0  100.0  0.0  0.0   0.
    00  0.0
934 5   0.0  0.0    0.00  0.0  0.0  0.0  100.0  0.0  0.0   0.
    00  0.0
```

```
935 6    0.0   0.0     0.00   0.0   0.0   0.0   100.0   0.0   0.0    0.
    00   0.0
936 7    0.0   0.0     0.00   0.0   0.0   0.0   100.0   0.0   0.0    0.
    00   0.0
937 8    0.0   0.0     0.00   0.0   0.0   0.0   100.0   0.0   0.0    0.
    00   0.0
938 9    0.0   0.0     3.08   0.0   0.0   0.0     0.0   0.0   0.0   96.
    92   0.0
939 10   0.0   0.0     0.00   0.0   0.0   0.0   100.0   0.0   0.0    0.
    00   0.0
940
941 Treino, teste e predições do [1]_AdaBoostClassifier
    executados em: 27.0380961894989 segundos
942
943
944 Elementos de treino: 2475
945 Elementos de teste: 825
946
947 Classificador: SVC
948 Score de teste: 0.9659446007182815
949 Confusion Matrix:
950         0      1      2      3      4      5      6      7
          8      9   \
951 0    92.54   0.00    0.0   0.00   4.48   1.49    0.0    0.
    00    0.0    0.0
952 1     0.00  95.45    0.0   0.00   3.41   0.00    0.0    0.
    00    0.0    0.0
953 2     0.00   0.00  100.0   0.00   0.00   0.00    0.0    0.
    00    0.0    0.0
954 3     0.00   0.00    0.0  98.67   0.00   0.00    0.0    1.
    33    0.0    0.0
955 4     0.00   3.70    0.0   0.00  92.59   3.70    0.0    0.
    00    0.0    0.0
956 5     0.00   0.00    0.0   0.00   1.27  92.41    0.0    0.
    00    0.0    0.0
957 6     0.00   0.00    0.0   0.00   0.00   0.00  100.0    0.
    00    0.0    0.0
958 7     0.00   2.90    0.0   0.00   0.00   0.00    0.0   97.
    10    0.0    0.0
959 8     0.00   0.00    0.0   0.00   0.00   0.00    0.0    0.
    00  100.0    0.0
960 9     0.00   0.00    0.0   0.00   0.00   0.00    0.0    0.
    00    0.0  100.0
961 10    0.00   0.00    0.0   0.00   1.15   6.90    0.0    0.
    00    0.0    0.0
```

```
962
963         10
964 0    1.49
965 1    1.14
966 2    0.00
967 3    0.00
968 4    0.00
969 5    6.33
970 6    0.00
971 7    0.00
972 8    0.00
973 9    0.00
974 10  91.95
975
976 Treino, teste e predições do [2]_SVC executados em: 9.
    744194746017456 segundos
977
978
979 Elementos de treino: 2475
980 Elementos de teste: 825
981
982 Classificador: RandomForestClassifier
983 Score de teste: 0.9902099999508708
984 Confusion Matrix:
985         0      1      2      3      4      5      6
            7      8      9   \
986 0   100.0   0.00    0.0    0.0   0.00   0.00    0.0    0
    .00    0.0    0.0
987 1     0.0  97.73    0.0    0.0   1.14   0.00    0.0    1
    .14    0.0    0.0
988 2     0.0   0.00  100.0    0.0   0.00   0.00    0.0    0
    .00    0.0    0.0
989 3     0.0   0.00    0.0  100.0   0.00   0.00    0.0    0
    .00    0.0    0.0
990 4     0.0   0.00    0.0    0.0  97.53   0.00    0.0    0
    .00    0.0    0.0
991 5     0.0   2.53    0.0    0.0   1.27  93.67    0.0    0
    .00    0.0    0.0
992 6     0.0   0.00    0.0    0.0   0.00   0.00  100.0    0
    .00    0.0    0.0
993 7     0.0   0.00    0.0    0.0   0.00   0.00    0.0  100
    .00    0.0    0.0
994 8     0.0   0.00    0.0    0.0   0.00   0.00    0.0    0
    .00  100.0    0.0
995 9     0.0   0.00    0.0    0.0   0.00   0.00    0.0    0
```

```
 995 .00    0.0  100.0
 996 10    0.0   0.00    0.0    0.0   0.00   0.00    0.0    0
     .00    0.0    0.0
 997
 998          10
 999 0     0.00
1000 1     0.00
1001 2     0.00
1002 3     0.00
1003 4     2.47
1004 5     2.53
1005 6     0.00
1006 7     0.00
1007 8     0.00
1008 9     0.00
1009 10  100.00
1010
1011 Treino, teste e predições do [3]_RandomForestClassifier
     executados em: 3.209721088409424 segundos
1012
1013
1014 Elementos de treino: 2475
1015 Elementos de teste: 825
1016
1017 Classificador: GaussianNB
1018 Score de teste: 0.9698879875402622
1019 Confusion Matrix:
1020        0      1      2      3      4      5      6
     7      8       9   \
1021 0   95.52   0.00   0.00    0.0   4.48   0.00    0.0    0
     .0    0.0    0.00
1022 1    0.00  94.32   0.00    0.0   5.68   0.00    0.0    0
     .0    0.0    0.00
1023 2    0.00   0.00  98.72    0.0   0.00   0.00    0.0    0
     .0    0.0    1.28
1024 3    0.00   0.00   0.00  100.0   0.00   0.00    0.0    0
     .0    0.0    0.00
1025 4    0.00   0.00   0.00    0.0  88.89   2.47    0.0    0
     .0    0.0    0.00
1026 5    0.00   0.00   0.00    0.0   3.80  94.94    0.0    0
     .0    0.0    0.00
1027 6    0.00   0.00   0.00    0.0   0.00   0.00  100.0    0
     .0    0.0    0.00
1028 7    0.00   0.00   0.00    0.0   0.00   0.00    0.0  100
     .0    0.0    0.00
```

```
1029 8    0.00   0.00   0.00    0.0   0.00   0.00    0.0    0
     .0  100.0    0.00
1030 9    0.00   0.00   0.00    0.0   0.00   0.00    0.0    0
     .0    0.0  100.00
1031 10   0.00   0.00   0.00    0.0   5.75   1.15    0.0    0
     .0    0.0    0.00
1032
1033        10
1034 0    0.00
1035 1    0.00
1036 2    0.00
1037 3    0.00
1038 4    8.64
1039 5    1.27
1040 6    0.00
1041 7    0.00
1042 8    0.00
1043 9    0.00
1044 10  93.10
1045
1046 Treino, teste e predições do [4]_GaussianNB executados
     em: 2.954665184020996 segundos
1047
1048
1049 Elementos de treino: 2475
1050 Elementos de teste: 825
1051
1052 Classificador: KNeighborsClassifier
1053 Score de teste: 0.9779132598184436
1054 Confusion Matrix:
1055        0      1      2      3      4      5      6     7
            8      9   \
1056 0   97.01   0.00    0.0    0.0   1.49   0.00    0.0   0.
     0    0.00    0.0
1057 1    0.00  97.73    0.0    0.0   1.14   0.00    0.0   0.
     0    0.00    0.0
1058 2    0.00   0.00  100.0    0.0   0.00   0.00    0.0   0.
     0    0.00    0.0
1059 3    0.00   0.00    0.0  100.0   0.00   0.00    0.0   0.
     0    0.00    0.0
1060 4    1.23   6.17    0.0    0.0  92.59   0.00    0.0   0.
     0    0.00    0.0
1061 5    0.00   1.27    0.0    0.0   1.27  96.20    0.0   0.
     0    0.00    0.0
1062 6    0.00   0.00    0.0    0.0   0.00   0.00  100.0   0.
```

```
1062 0    0.00    0.0
1063 7    0.00   1.45    0.0    0.0   0.00   0.00    0.0  97.
     1    1.45    0.0
1064 8    0.00   0.00    0.0    0.0   0.00   0.00    0.0   0.
     0  100.00    0.0
1065 9    0.00   0.00    0.0    0.0   0.00   0.00    0.0   0.
     0    0.00  100.0
1066 10   0.00   0.00    0.0    0.0   0.00   5.75    0.0   0.
     0    0.00    0.0
1067
1068        10
1069 0    1.49
1070 1    1.14
1071 2    0.00
1072 3    0.00
1073 4    0.00
1074 5    1.27
1075 6    0.00
1076 7    0.00
1077 8    0.00
1078 9    0.00
1079 10  94.25
1080
1081 Treino, teste e predições do [5]_KNeighborsClassifier
     executados em: 8.320873498916626 segundos
1082
1083
1084 Elementos de treino: 2475
1085 Elementos de teste: 825
1086
1087 Classificador: SGDClassifier
1088 Score de teste: 0.9108702792953363
1089 Confusion Matrix:
1090        0      1      2      3      4      5      6
     7      8       9   \
1091 0   94.03   0.00   0.00    0.0   5.97   0.00    0.0    0
     .0    0.0    0.00
1092 1    0.00  93.18   0.00    0.0   6.82   0.00    0.0    0
     .0    0.0    0.00
1093 2    0.00   0.00  98.72    0.0   0.00   0.00    0.0    0
     .0    0.0    1.28
1094 3    0.00   0.00   0.00  100.0   0.00   0.00    0.0    0
     .0    0.0    0.00
1095 4    0.00   3.70   0.00    0.0  96.30   0.00    0.0    0
     .0    0.0    0.00
```

```
1096 5    0.00   5.06   0.00    0.0   5.06  89.87    0.0    0
     .0    0.0    0.00
1097 6    0.00   0.00   0.00    0.0   0.00   0.00  100.0    0
     .0    0.0    0.00
1098 7    0.00   0.00   0.00    0.0   0.00   0.00    0.0  100
     .0    0.0    0.00
1099 8    0.00   0.00   0.00    0.0   0.00   0.00    0.0    0
     .0  100.0    0.00
1100 9    0.00   0.00   0.00    0.0   0.00   0.00    0.0    0
     .0    0.0  100.00
1101 10   0.00  22.99   0.00    0.0   4.60  39.08    0.0    0
     .0    0.0    0.00
1102
1103        10
1104 0    0.00
1105 1    0.00
1106 2    0.00
1107 3    0.00
1108 4    0.00
1109 5    0.00
1110 6    0.00
1111 7    0.00
1112 8    0.00
1113 9    0.00
1114 10  33.33
1115
1116 Treino, teste e predições do [6]_SGDClassifier
     executados em: 1.452327013015747 segundos
1117
1118
1119 Elementos de treino: 2475
1120 Elementos de teste: 825
1121
1122 Classificador: AdaBoostClassifier
1123 Score de teste: 0.9946963794436301
1124 Confusion Matrix:
1125        0      1      2      3      4      5      6
     7      8      9   \
1126 0   100.0   0.00    0.0    0.0   0.00   0.00    0.0    0
     .0    0.0    0.0
1127 1     0.0  98.86    0.0    0.0   1.14   0.00    0.0    0
     .0    0.0    0.0
1128 2     0.0   0.00  100.0    0.0   0.00   0.00    0.0    0
     .0    0.0    0.0
1129 3     0.0   0.00    0.0  100.0   0.00   0.00    0.0    0
```

```
1129 .0    0.0    0.0
1130 4     0.0   0.00    0.0    0.0  97.53   0.00    0.0    0
     .0    0.0    0.0
1131 5     0.0   1.27    0.0    0.0   0.00  97.47    0.0    0
     .0    0.0    0.0
1132 6     0.0   0.00    0.0    0.0   0.00   0.00  100.0    0
     .0    0.0    0.0
1133 7     0.0   0.00    0.0    0.0   0.00   0.00    0.0  100
     .0    0.0    0.0
1134 8     0.0   0.00    0.0    0.0   0.00   0.00    0.0    0
     .0  100.0    0.0
1135 9     0.0   0.00    0.0    0.0   0.00   0.00    0.0    0
     .0    0.0  100.0
1136 10    0.0   0.00    0.0    0.0   0.00   0.00    0.0    0
     .0    0.0    0.0
1137
1138         10
1139 0     0.00
1140 1     0.00
1141 2     0.00
1142 3     0.00
1143 4     2.47
1144 5     1.27
1145 6     0.00
1146 7     0.00
1147 8     0.00
1148 9     0.00
1149 10  100.00
1150
1151 Treino, teste e predições do [7]_AdaBoostClassifier
     executados em: 3.4407742023468018 segundos
1152
1153
1154 Elementos de treino: 2475
1155 Elementos de teste: 825
1156
1157 Classificador: LogisticRegression
1158 Score de teste: 0.9954703647646823
1159 Confusion Matrix:
1160        0      1      2      3       4      5      6
            7      8      9   \
1161 0   100.0   0.00    0.0   0.00    0.00   0.00    0.0
     0.00    0.0    0.0
1162 1     0.0  97.73    0.0   0.00    2.27   0.00    0.0
     0.00    0.0    0.0
```

```
1163 2     0.0   0.00  100.0   0.00    0.00   0.00    0.0
     0.00    0.0    0.0
1164 3     0.0   0.00    0.0  98.67    0.00   0.00    0.0
     1.33    0.0    0.0
1165 4     0.0   0.00    0.0   0.00  100.00   0.00    0.0
     0.00    0.0    0.0
1166 5     0.0   0.00    0.0   0.00    0.00  98.73    0.0
     0.00    0.0    0.0
1167 6     0.0   0.00    0.0   0.00    0.00   0.00  100.0
     0.00    0.0    0.0
1168 7     0.0   0.00    0.0   0.00    0.00   0.00    0.0
     100.00    0.0    0.0
1169 8     0.0   0.00    0.0   0.00    0.00   0.00    0.0
     0.00  100.0    0.0
1170 9     0.0   0.00    0.0   0.00    0.00   0.00    0.0
     0.00    0.0  100.0
1171 10    0.0   0.00    0.0   0.00    0.00   0.00    0.0
     0.00    0.0    0.0
1172
1173         10
1174 0     0.00
1175 1     0.00
1176 2     0.00
1177 3     0.00
1178 4     0.00
1179 5     1.27
1180 6     0.00
1181 7     0.00
1182 8     0.00
1183 9     0.00
1184 10  100.00
1185
1186 Treino, teste e predições do [8]_LogisticRegression
     executados em: 10.868446826934814 segundos
1187
1188
1189 Elementos de treino: 2475
1190 Elementos de teste: 825
1191
1192 Classificador: BaggingClassifier
1193 Score de teste: 0.9892654027233071
1194 Confusion Matrix:
1195        0      1      2      3      4      5      6
     7      8      9   \
1196 0   100.0   0.00    0.0    0.0   0.00   0.00    0.0   0.
```

```
1196 00    0.0    0.0
1197 1     0.0  98.86    0.0    0.0   1.14   0.00    0.0   0.
     00    0.0    0.0
1198 2     0.0   0.00  100.0    0.0   0.00   0.00    0.0   0.
     00    0.0    0.0
1199 3     0.0   0.00    0.0  100.0   0.00   0.00    0.0   0.
     00    0.0    0.0
1200 4     0.0   0.00    0.0    0.0  95.06   0.00    0.0   0.
     00    0.0    0.0
1201 5     0.0   2.53    0.0    0.0   0.00  96.20    0.0   0.
     00    0.0    0.0
1202 6     0.0   0.00    0.0    0.0   0.00   0.00  100.0   0.
     00    0.0    0.0
1203 7     0.0   0.00    0.0    0.0   0.00   1.45    0.0  98.
     55    0.0    0.0
1204 8     0.0   0.00    0.0    0.0   0.00   0.00    0.0   0.
     00  100.0    0.0
1205 9     0.0   0.00    0.0    0.0   0.00   0.00    0.0   0.
     00    0.0  100.0
1206 10    0.0   0.00    0.0    0.0   1.15   0.00    0.0   0.
     00    0.0    0.0
1207
1208        10
1209 0    0.00
1210 1    0.00
1211 2    0.00
1212 3    0.00
1213 4    4.94
1214 5    1.27
1215 6    0.00
1216 7    0.00
1217 8    0.00
1218 9    0.00
1219 10  98.85
1220
1221 Treino, teste e predições do [9]_BaggingClassifier
     executados em: 13.45002818107605 segundos
1222
1223
1224 Aplicando tuning do modelo...
1225 Elementos de treino: 2475
1226 Elementos de teste: 825
1227 Otimização de parâmetros executada em:  419.
     72529697418213  segundos
1228 Melhor Score:  0.9477650009592821
```

```
1229 Melhores Parâmetros:  {'learning_rate': 0.5, '
     random_state': 20}
1230
1231 ------
1232 Modelo não-otimizado
1233 ------
1234 F-score dos dados de teste: 0.1898
1235
1236 ------
1237 Modelo otimizado
1238 ------
1239 F-score dos dados de teste: 0.8653
1240
1241
1242 Confusion Matrix:
1243 [[67  0  0  0  0  0  0  0  0  0  0]
1244  [ 0 87  0  0  1  0  0  0  0  0  0]
1245  [ 0  0 77  0  1  0  0  0  0  0  0]
1246  [ 0  0  0 72  0  0  0  3  0  0  0]
1247  [ 0  0  0  0 81  0  0  0  0  0  0]
1248  [ 0  2  0  0  2 74  0  0  0  0  1]
1249  [ 1  0  0  0  0  0 63  0  0  0  0]
1250  [ 0  0  0  1  0  0  0 68  0  0  0]
1251  [ 0  0  0  0  0  0  0  0 72  0  0]
1252  [ 0  0  0  0  0  0  0  0  0 65  0]
1253  [ 0  0  0  0 84  1  0  0  0  0  2]]
1254
1255 Plotando gráficos de  Dados_Originais ...
1256 Plotando gráficos de  PAA ...
1257 Plotando gráficos de  [0]_DecisionTreeClassifier ...
1258 Plotando gráficos de  [1]_AdaBoostClassifier ...
1259 Plotando gráficos de  [2]_SVC ...
1260 Plotando gráficos de  [3]_RandomForestClassifier ...
1261 Plotando gráficos de  [4]_GaussianNB ...
1262 Plotando gráficos de  [5]_KNeighborsClassifier ...
1263 Plotando gráficos de  [6]_SGDClassifier ...
1264 Plotando gráficos de  [7]_AdaBoostClassifier ...
1265 Plotando gráficos de  [8]_LogisticRegression ...
1266 Plotando gráficos de  [9]_BaggingClassifier ...
1267 Plotando gráficos de  PREDICOES_FINAIS ...
1268 Score do [0]_DecisionTreeClassifier: 0.9898366164870879
1269 Score do [1]_AdaBoostClassifier: 0.18983668452165567
1270 Score do [2]_SVC: 0.9659446007182815
1271 Score do [3]_RandomForestClassifier: 0.9902099999508708
1272 Score do [4]_GaussianNB: 0.9698879875402622
```

```
1273 Score do [5]_KNeighborsClassifier: 0.9779132598184436
1274 Score do [6]_SGDClassifier: 0.9108702792953363
1275 Score do [7]_AdaBoostClassifier: 0.9946963794436301
1276 Score do [8]_LogisticRegression: 0.9954703647646823
1277 Score do [9]_BaggingClassifier: 0.9892654027233071
1278
1279
1280 Circuito: CTSV mc + 4bitPRBS [FALHA].raw
1281 Obtendo dados do arquivo 'CTSV mc + 4bitPRBS [FALHA].raw
     '...
1282
1283 Lendo grandeza: time
1284 "time" lido.
1285
1286 Lendo grandeza: V(bpo)
1287 "V(bpo)" lido.
1288 Grandezas lidas.
1289 Leitura do arquivo raw executada em:  144.4356918334961
       segundos
1290 Salvando características do circuito...
1291
1292 Iniciando a aplicação do PAA
1293 Quantidade de segmentos de PAA: 100
1294 Aplicação do Paa executada em:  1.363194227218628
1295
1296 Iniciando a aplicação dos métodos de aprendizagem
     supervisionados
1297 Elementos de treino: 4275
1298 Elementos de teste: 1425
1299
1300 Classificador: DecisionTreeClassifier
1301 Score de teste: 0.9857454953272707
1302 Confusion Matrix:
1303         0      1      2      3      4      5      6
     7      8      9   \
1304 0   100.0    0.0    0.0    0.0   0.00   0.00   0.00   0.
     00    0.0   0.00
1305 1     0.0  100.0    0.0    0.0   0.00   0.00   0.00   0.
     00    0.0   0.00
1306 2     0.0    0.0  100.0    0.0   0.00   0.00   0.00   0.
     00    0.0   0.00
1307 3     0.0    0.0    0.0  100.0   0.00   0.00   0.00   0.
     00    0.0   0.00
1308 4     0.0    0.0    0.0    0.0  95.38   0.00   0.00   0.
     00    0.0   0.00
```

```
1309 5     0.0    0.0    0.0    0.0   0.00  96.30   0.00   0.
     00    0.0   0.00
1310 6     0.0    0.0    0.0    0.0   0.00   0.00  97.37   0.
     00    0.0   0.00
1311 7     0.0    0.0    0.0    0.0   0.00   0.00   0.00  97.
     44    0.0   0.00
1312 8     0.0    0.0    0.0    0.0   0.00   0.00   0.00   0.
     00  100.0   0.00
1313 9     0.0    0.0    0.0    0.0   0.00   0.00   0.00   0.
     00    0.0  97.18
1314 10    0.0    0.0    0.0    0.0   0.00   0.00   0.00   0.
     00    0.0   0.00
1315 11    0.0    0.0    0.0    0.0   0.00   0.00   0.00   0.
     00    0.0   0.00
1316 12    0.0    0.0    0.0    0.0   0.00   0.00   0.00   0.
     00    0.0   0.00
1317 13    0.0    0.0    0.0    0.0   0.00   0.00   0.00   0.
     00    0.0   0.00
1318 14    0.0    0.0    0.0    0.0   0.00   0.00   0.00   0.
     00    0.0   0.00
1319 15    0.0    0.0    0.0    0.0   0.00   1.23   0.00   0.
     00    0.0   0.00
1320 16    0.0    0.0    0.0    0.0   0.00   0.00   0.00   0.
     00    0.0   0.00
1321 17    0.0    0.0    0.0    0.0   0.00   0.00   0.00   5.
     26    0.0   1.32
1322 18    0.0    0.0    0.0    0.0   0.00   0.00   0.00   0.
     00    0.0   0.00
1323
1324         10      11     12      13      14     15      16
           17     18
1325 0     0.00    0.00   0.00    0.00    0.00   0.00    0.00
         0.00   0.00
1326 1     0.00    0.00   0.00    0.00    0.00   0.00    0.00
         0.00   0.00
1327 2     0.00    0.00   0.00    0.00    0.00   0.00    0.00
         0.00   0.00
1328 3     0.00    0.00   0.00    0.00    0.00   0.00    0.00
         0.00   0.00
1329 4     0.00    0.00   0.00    0.00    4.62   0.00    0.00
         0.00   0.00
1330 5     0.00    0.00   0.00    0.00    0.00   3.70    0.00
         0.00   0.00
1331 6     0.00    0.00   0.00    0.00    0.00   0.00    2.63
         0.00   0.00
```

```
1332 7    0.00    0.00   0.00    0.00    0.00   0.00    0.00
        2.56   0.00
1333 8    0.00    0.00   0.00    0.00    0.00   0.00    0.00
        0.00   0.00
1334 9    0.00    0.00   0.00    0.00    0.00   0.00    0.00
        2.82   0.00
1335 10  98.25    0.00   0.00    1.75    0.00   0.00    0.00
        0.00   0.00
1336 11   0.00  100.00   0.00    0.00    0.00   0.00    0.00
        0.00   0.00
1337 12   0.00    1.25  98.75    0.00    0.00   0.00    0.00
        0.00   0.00
1338 13   0.00    0.00   0.00  100.00    0.00   0.00    0.00
        0.00   0.00
1339 14   0.00    0.00   0.00    0.00  100.00   0.00    0.00
        0.00   0.00
1340 15   0.00    0.00   0.00    0.00    0.00  98.77    0.00
        0.00   0.00
1341 16   0.00    0.00   0.00    0.00    0.00   0.00  100.00
        0.00   0.00
1342 17   0.00    0.00   0.00    0.00    0.00   0.00    0.00
       93.42   0.00
1343 18   0.00    1.64   0.00    0.00    0.00   0.00    0.00
        0.00  98.36
1344
1345 Treino, teste e predições do [0]_DecisionTreeClassifier
     executados em: 3.839864730834961 segundos
1346
1347
1348 Elementos de treino: 4275
1349 Elementos de teste: 1425
1350
1351 Classificador: AdaBoostClassifier
1352 Score de teste: 0.19005006615935194
1353 Confusion Matrix:
1354         0    1    2    3    4    5      6    7    8    9
           10   11     12  \
1355 0   100.0  0.0  0.0  0.0  0.0  0.0    0.0  0.0  0.0  0.0
         0.0  0.0    0.0
1356 1     0.0  0.0  0.0  0.0  0.0  0.0    0.0  0.0  0.0  0.0
         0.0  0.0    0.0
1357 2     0.0  0.0  0.0  0.0  0.0  0.0    0.0  0.0  0.0  0.0
         0.0  0.0    0.0
1358 3     0.0  0.0  0.0  0.0  0.0  0.0    0.0  0.0  0.0  0.0
         0.0  0.0    0.0
```

```
1359 4      0.0   0.0   0.0   0.0   0.0   0.0     0.0   0.0   0.0   0.0
          0.0   0.0     0.0
1360 5      0.0   0.0   0.0   0.0   0.0   0.0     0.0   0.0   0.0   0.0
          0.0   0.0     0.0
1361 6      0.0   0.0   0.0   0.0   0.0   0.0   100.0   0.0   0.0   0.0
          0.0   0.0     0.0
1362 7      0.0   0.0   0.0   0.0   0.0   0.0     0.0   0.0   0.0   0.0
          0.0   0.0     0.0
1363 8      0.0   0.0   0.0   0.0   0.0   0.0     0.0   0.0   0.0   0.0
          0.0   0.0     0.0
1364 9      0.0   0.0   0.0   0.0   0.0   0.0     0.0   0.0   0.0   0.0
          0.0   0.0     0.0
1365 10     0.0   0.0   0.0   0.0   0.0   0.0     0.0   0.0   0.0   0.0
        100.0   0.0     0.0
1366 11     0.0   0.0   0.0   0.0   0.0   0.0     0.0   0.0   0.0   0.0
          0.0   0.0     0.0
1367 12     0.0   0.0   0.0   0.0   0.0   0.0     0.0   0.0   0.0   0.0
          0.0   0.0   100.0
1368 13     0.0   0.0   0.0   0.0   0.0   0.0     0.0   0.0   0.0   0.0
          0.0   0.0     0.0
1369 14     0.0   0.0   0.0   0.0   0.0   0.0     0.0   0.0   0.0   0.0
          0.0   0.0     0.0
1370 15     0.0   0.0   0.0   0.0   0.0   0.0     0.0   0.0   0.0   0.0
          0.0   0.0     0.0
1371 16     0.0   0.0   0.0   0.0   0.0   0.0   100.0   0.0   0.0   0.0
          0.0   0.0     0.0
1372 17     0.0   0.0   0.0   0.0   0.0   0.0     0.0   0.0   0.0   0.0
          0.0   0.0     0.0
1373 18     0.0   0.0   0.0   0.0   0.0   0.0     0.0   0.0   0.0   0.0
          0.0   0.0     0.0
1374
1375       13    14    15    16    17      18
1376 0    0.0   0.0   0.0   0.0   0.0     0.0
1377 1    0.0   0.0   0.0   0.0   0.0   100.0
1378 2    0.0   0.0   0.0   0.0   0.0   100.0
1379 3    0.0   0.0   0.0   0.0   0.0   100.0
1380 4    0.0   0.0   0.0   0.0   0.0   100.0
1381 5    0.0   0.0   0.0   0.0   0.0   100.0
1382 6    0.0   0.0   0.0   0.0   0.0     0.0
1383 7    0.0   0.0   0.0   0.0   0.0   100.0
1384 8    0.0   0.0   0.0   0.0   0.0   100.0
1385 9    0.0   0.0   0.0   0.0   0.0   100.0
1386 10   0.0   0.0   0.0   0.0   0.0     0.0
1387 11   0.0   0.0   0.0   0.0   0.0   100.0
1388 12   0.0   0.0   0.0   0.0   0.0     0.0
```

```
1389 13  0.0  0.0  0.0  0.0  0.0  100.0
1390 14  0.0  0.0  0.0  0.0  0.0  100.0
1391 15  0.0  0.0  0.0  0.0  0.0  100.0
1392 16  0.0  0.0  0.0  0.0  0.0    0.0
1393 17  0.0  0.0  0.0  0.0  0.0  100.0
1394 18  0.0  0.0  0.0  0.0  0.0  100.0
1395
1396 Treino, teste e predições do [1]_AdaBoostClassifier
     executados em: 30.094775676727295 segundos
1397
1398
1399 Elementos de treino: 4275
1400 Elementos de teste: 1425
1401
1402 Classificador: SVC
1403 Score de teste: 0.9237297056997305
1404 Confusion Matrix:
1405         0      1      2      3      4      5      6
     7      8      9   \
1406 0   100.0    0.0    0.0    0.0   0.00   0.00   0.00   0.
     00    0.0   0.00
1407 1     0.0  100.0    0.0    0.0   0.00   0.00   0.00   0.
     00    0.0   0.00
1408 2     0.0    0.0  100.0    0.0   0.00   0.00   0.00   0.
     00    0.0   0.00
1409 3     0.0    0.0    0.0  100.0   0.00   0.00   0.00   0.
     00    0.0   0.00
1410 4     0.0    0.0    0.0    0.0  90.77   0.00   0.00   0.
     00    0.0   0.00
1411 5     0.0    0.0    0.0    0.0   0.00  66.67   0.00   0.
     00    0.0   1.23
1412 6     0.0    0.0    0.0    0.0   0.00   0.00  94.74   0.
     00    0.0   0.00
1413 7     0.0    0.0    0.0    0.0   0.00   0.00   0.00  70.
     51    0.0   1.28
1414 8     0.0    0.0    0.0    0.0   0.00   0.00   0.00   0.
     00  100.0   0.00
1415 9     0.0    0.0    0.0    0.0   0.00   1.41   0.00   1.
     41    0.0  97.18
1416 10    0.0    0.0    0.0    0.0   0.00   0.00   0.00   0.
     00    0.0   0.00
1417 11    0.0    0.0    0.0    0.0   0.00   0.00   0.00   0.
     00    0.0   0.00
1418 12    0.0    0.0    0.0    0.0   0.00   0.00   0.00   0.
     00    0.0   0.00
```

```
1419 13     0.0     0.0     0.0     0.0    0.00    0.00    0.00    0.
     00     0.0    0.00
1420 14     0.0     0.0     0.0     0.0   15.00    0.00    0.00    0.
     00     0.0    0.00
1421 15     0.0     0.0     0.0     0.0    0.00    9.88    0.00    0.
     00     0.0    0.00
1422 16     0.0     0.0     0.0     0.0    0.00    0.00    2.47    0.
     00     0.0    0.00
1423 17     0.0     0.0     0.0     0.0    0.00    0.00    0.00   32.
     89     0.0    1.32
1424 18     0.0     0.0     0.0     0.0    0.00    0.00    0.00    0.
     00     0.0    0.00
1425
1426          10      11      12      13      14      15      16
     17       18
1427 0      0.0    0.00     0.0     0.0    0.00    0.00    0.00    0.
     00    0.00
1428 1      0.0    0.00     0.0     0.0    0.00    0.00    0.00    0.
     00    0.00
1429 2      0.0    0.00     0.0     0.0    0.00    0.00    0.00    0.
     00    0.00
1430 3      0.0    0.00     0.0     0.0    0.00    0.00    0.00    0.
     00    0.00
1431 4      0.0    0.00     0.0     0.0    9.23    0.00    0.00    0.
     00    0.00
1432 5      0.0    0.00     0.0     0.0    0.00   32.10    0.00    0.
     00    0.00
1433 6      0.0    0.00     0.0     0.0    0.00    0.00    5.26    0.
     00    0.00
1434 7      0.0    0.00     0.0     0.0    0.00    0.00    0.00   28.
     21    0.00
1435 8      0.0    0.00     0.0     0.0    0.00    0.00    0.00    0.
     00    0.00
1436 9      0.0    0.00     0.0     0.0    0.00    0.00    0.00    0.
     00    0.00
1437 10   100.0    0.00     0.0     0.0    0.00    0.00    0.00    0.
     00    0.00
1438 11     0.0   97.47     0.0     0.0    0.00    0.00    0.00    0.
     00    2.53
1439 12     0.0    0.00   100.0     0.0    0.00    0.00    0.00    0.
     00    0.00
1440 13     0.0    0.00     0.0   100.0    0.00    0.00    0.00    0.
     00    0.00
1441 14     0.0    0.00     0.0     0.0   85.00    0.00    0.00    0.
     00    0.00
```

```
1442 15    0.0   0.00    0.0    0.0   0.00  90.12   0.00   0.
     00    0.00
1443 16    0.0   0.00    0.0    0.0   0.00   0.00  97.53   0.
     00    0.00
1444 17    0.0   0.00    0.0    0.0   0.00   0.00   0.00  65.
     79    0.00
1445 18    0.0   0.00    0.0    0.0   0.00   0.00   0.00   0.
     00  100.00
1446
1447 Treino, teste e predições do [2]_SVC executados em: 11.
     202521800994873 segundos
1448
1449
1450 Elementos de treino: 4275
1451 Elementos de teste: 1425
1452
1453 Classificador: RandomForestClassifier
1454 Score de teste: 0.9925123912533742
1455 Confusion Matrix:
1456         0      1      2      3      4      5      6
             7      8      9   \
1457 0   100.0    0.0    0.0    0.0   0.00   0.00   0.00    0
     .00    0.0   0.00
1458 1     0.0  100.0    0.0    0.0   0.00   0.00   0.00    0
     .00    0.0   0.00
1459 2     0.0    0.0  100.0    0.0   0.00   0.00   0.00    0
     .00    0.0   0.00
1460 3     0.0    0.0    0.0  100.0   0.00   0.00   0.00    0
     .00    0.0   0.00
1461 4     0.0    0.0    0.0    0.0  96.92   0.00   0.00    0
     .00    0.0   0.00
1462 5     0.0    0.0    0.0    0.0   0.00  98.77   0.00    0
     .00    0.0   0.00
1463 6     0.0    0.0    0.0    0.0   0.00   0.00  97.37    0
     .00    0.0   0.00
1464 7     0.0    0.0    0.0    0.0   0.00   0.00   0.00  100
     .00    0.0   0.00
1465 8     0.0    0.0    0.0    0.0   0.00   0.00   0.00    0
     .00  100.0   0.00
1466 9     0.0    0.0    0.0    0.0   0.00   0.00   0.00    0
     .00    0.0  97.18
1467 10    0.0    0.0    0.0    0.0   0.00   0.00   0.00    0
     .00    0.0   0.00
1468 11    0.0    0.0    0.0    0.0   0.00   0.00   0.00    0
     .00    0.0   0.00
```

```
1469 12    0.0    0.0    0.0    0.0   0.00   0.00   0.00    0
     .00    0.0   0.00
1470 13    0.0    0.0    0.0    0.0   0.00   0.00   0.00    0
     .00    0.0   0.00
1471 14    0.0    0.0    0.0    0.0   0.00   0.00   0.00    0
     .00    0.0   0.00
1472 15    0.0    0.0    0.0    0.0   0.00   1.23   0.00    0
     .00    0.0   0.00
1473 16    0.0    0.0    0.0    0.0   0.00   0.00   0.00    0
     .00    0.0   0.00
1474 17    0.0    0.0    0.0    0.0   0.00   0.00   0.00    1
     .32    0.0   1.32
1475 18    0.0    0.0    0.0    0.0   0.00   0.00   0.00    0
     .00    0.0   0.00
1476
1477         10      11     12     13      14     15      16
          17     18
1478 0     0.0    0.00    0.0    0.0    0.00   0.00    0.00
        0.00   0.00
1479 1     0.0    0.00    0.0    0.0    0.00   0.00    0.00
        0.00   0.00
1480 2     0.0    0.00    0.0    0.0    0.00   0.00    0.00
        0.00   0.00
1481 3     0.0    0.00    0.0    0.0    0.00   0.00    0.00
        0.00   0.00
1482 4     0.0    0.00    0.0    0.0    3.08   0.00    0.00
        0.00   0.00
1483 5     0.0    0.00    0.0    0.0    0.00   1.23    0.00
        0.00   0.00
1484 6     0.0    0.00    0.0    0.0    0.00   0.00    2.63
        0.00   0.00
1485 7     0.0    0.00    0.0    0.0    0.00   0.00    0.00
        0.00   0.00
1486 8     0.0    0.00    0.0    0.0    0.00   0.00    0.00
        0.00   0.00
1487 9     0.0    0.00    0.0    0.0    0.00   0.00    0.00
        2.82   0.00
1488 10  100.0    0.00    0.0    0.0    0.00   0.00    0.00
        0.00   0.00
1489 11    0.0  100.00    0.0    0.0    0.00   0.00    0.00
        0.00   0.00
1490 12    0.0    0.00  100.0    0.0    0.00   0.00    0.00
        0.00   0.00
1491 13    0.0    0.00    0.0  100.0    0.00   0.00    0.00
        0.00   0.00
```

```
1492 14    0.0    0.00    0.0    0.0  100.00   0.00    0.00
        0.00   0.00
1493 15    0.0    0.00    0.0    0.0    0.00  98.77    0.00
        0.00   0.00
1494 16    0.0    0.00    0.0    0.0    0.00   0.00  100.00
        0.00   0.00
1495 17    0.0    0.00    0.0    0.0    0.00   0.00    0.00
     97.37   0.00
1496 18    0.0    1.64    0.0    0.0    0.00   0.00    0.00
        0.00  98.36
1497
1498 Treino, teste e predições do [3]_RandomForestClassifier
     executados em: 5.385212421417236 segundos
1499
1500
1501 Elementos de treino: 4275
1502 Elementos de teste: 1425
1503
1504 Classificador: GaussianNB
1505 Score de teste: 0.921315863457593
1506 Confusion Matrix:
1507         0      1      2      3      4      5      6
     7      8      9   \
1508 0   100.0    0.0    0.0    0.0   0.00   0.00   0.00   0.
     00    0.0   0.00
1509 1     0.0  100.0    0.0    0.0   0.00   0.00   0.00   0.
     00    0.0   0.00
1510 2     0.0    0.0  100.0    0.0   0.00   0.00   0.00   0.
     00    0.0   0.00
1511 3     0.0    0.0    0.0  100.0   0.00   0.00   0.00   0.
     00    0.0   0.00
1512 4     0.0    0.0    0.0    0.0  86.15   0.00   0.00   0.
     00    0.0   0.00
1513 5     0.0    0.0    0.0    0.0   0.00  72.84   0.00   0.
     00    0.0   2.47
1514 6     0.0    0.0    0.0    0.0   0.00   0.00  96.05   0.
     00    0.0   0.00
1515 7     0.0    0.0    0.0    0.0   0.00   0.00   0.00  85.
     90    0.0   0.00
1516 8     0.0    0.0    0.0    0.0   0.00   0.00   0.00   0.
     00  100.0   0.00
1517 9     0.0    0.0    0.0    0.0   0.00   1.41   0.00   5.
     63    0.0  92.96
1518 10    0.0    0.0    0.0    0.0   0.00   0.00   0.00   0.
     00    0.0   0.00
```

```
1519 11     0.0     0.0     0.0     0.0   0.00   0.00   0.00   0.
     00     0.0   0.00
1520 12     0.0     0.0     0.0     0.0   0.00   0.00   0.00   0.
     00     0.0   0.00
1521 13     0.0     0.0     0.0     0.0   0.00   0.00   0.00   0.
     00     0.0   0.00
1522 14     0.0     0.0     0.0     0.0  22.50   0.00   0.00   0.
     00     0.0   0.00
1523 15     0.0     0.0     0.0     0.0   0.00  13.58   0.00   0.
     00     0.0   0.00
1524 16     0.0     0.0     0.0     0.0   0.00   0.00   9.88   0.
     00     0.0   0.00
1525 17     0.0     0.0     0.0     0.0   0.00   0.00   0.00  34.
     21     0.0   1.32
1526 18     0.0     0.0     0.0     0.0   0.00   0.00   0.00   0.
     00     0.0   0.00
1527
1528         10      11      12      13      14      15      16
           17      18
1529 0     0.00   0.00     0.0    0.00   0.00   0.00   0.00   0
     .00    0.00
1530 1     0.00   0.00     0.0    0.00   0.00   0.00   0.00   0
     .00    0.00
1531 2     0.00   0.00     0.0    0.00   0.00   0.00   0.00   0
     .00    0.00
1532 3     0.00   0.00     0.0    0.00   0.00   0.00   0.00   0
     .00    0.00
1533 4     0.00   0.00     0.0    0.00  13.85   0.00   0.00   0
     .00    0.00
1534 5     0.00   0.00     0.0    0.00   0.00  24.69   0.00   0
     .00    0.00
1535 6     0.00   0.00     0.0    0.00   0.00   0.00   3.95   0
     .00    0.00
1536 7     0.00   0.00     0.0    0.00   0.00   0.00   0.00  14
     .10    0.00
1537 8     0.00   0.00     0.0    0.00   0.00   0.00   0.00   0
     .00    0.00
1538 9     0.00   0.00     0.0    0.00   0.00   0.00   0.00   0
     .00    0.00
1539 10   98.25   0.00     0.0    1.75   0.00   0.00   0.00   0
     .00    0.00
1540 11    0.00  98.73     0.0    0.00   0.00   0.00   0.00   0
     .00    1.27
1541 12    0.00   0.00   100.0    0.00   0.00   0.00   0.00   0
     .00    0.00
```

```
1542 13   0.00   0.00    0.0  100.00   0.00   0.00   0.00   0
     .00    0.00
1543 14   0.00   0.00    0.0    0.00  77.50   0.00   0.00   0
     .00    0.00
1544 15   0.00   0.00    0.0    0.00   0.00  86.42   0.00   0
     .00    0.00
1545 16   0.00   0.00    0.0    0.00   0.00   0.00  90.12   0
     .00    0.00
1546 17   0.00   0.00    0.0    0.00   0.00   0.00   0.00  64
     .47    0.00
1547 18   0.00   0.00    0.0    0.00   0.00   0.00   0.00   0
     .00  100.00
1548
1549 Treino, teste e predições do [4]_GaussianNB executados
     em: 5.60626220703125 segundos
1550
1551
1552 Elementos de treino: 4275
1553 Elementos de teste: 1425
1554
1555 Classificador: KNeighborsClassifier
1556 Score de teste: 0.9835318891637632
1557 Confusion Matrix:
1558        0      1      2      3      4      5      6
     7      8      9   \
1559 0   100.0    0.0    0.0    0.0    0.0   0.00   0.00   0.
     00    0.0   0.00
1560 1     0.0  100.0    0.0    0.0    0.0   0.00   0.00   0.
     00    0.0   0.00
1561 2     0.0    0.0  100.0    0.0    0.0   0.00   0.00   0.
     00    0.0   0.00
1562 3     0.0    0.0    0.0  100.0    0.0   0.00   0.00   0.
     00    0.0   0.00
1563 4     0.0    0.0    0.0    0.0  100.0   0.00   0.00   0.
     00    0.0   0.00
1564 5     0.0    0.0    0.0    0.0    0.0  97.53   0.00   0.
     00    0.0   0.00
1565 6     0.0    0.0    0.0    0.0    0.0   0.00  96.05   0.
     00    0.0   0.00
1566 7     0.0    0.0    0.0    0.0    0.0   0.00   0.00  91.
     03    0.0   1.28
1567 8     0.0    0.0    0.0    0.0    0.0   0.00   0.00   0.
     00  100.0   0.00
1568 9     0.0    0.0    0.0    0.0    0.0   1.41   0.00   2.
     82    0.0  95.77
```

```
1569 10     0.0     0.0     0.0     0.0     0.0    0.00    0.00    0.
     00     0.0    0.00
1570 11     0.0     0.0     0.0     0.0     0.0    0.00    0.00    0.
     00     0.0    0.00
1571 12     0.0     0.0     0.0     0.0     0.0    0.00    0.00    0.
     00     0.0    0.00
1572 13     0.0     0.0     0.0     0.0     0.0    0.00    0.00    0.
     00     0.0    0.00
1573 14     0.0     0.0     0.0     0.0     0.0    0.00    0.00    0.
     00     0.0    0.00
1574 15     0.0     0.0     0.0     0.0     0.0    1.23    0.00    0.
     00     0.0    0.00
1575 16     0.0     0.0     0.0     0.0     0.0    0.00    3.70    0.
     00     0.0    0.00
1576 17     0.0     0.0     0.0     0.0     0.0    0.00    0.00    3.
     95     0.0    1.32
1577 18     0.0     0.0     0.0     0.0     0.0    0.00    0.00    0.
     00     0.0    0.00
1578
1579          10      11      12      13      14      15      16
     17       18
1580 0      0.0    0.00     0.0     0.0     0.0    0.00    0.00    0.
     00    0.00
1581 1      0.0    0.00     0.0     0.0     0.0    0.00    0.00    0.
     00    0.00
1582 2      0.0    0.00     0.0     0.0     0.0    0.00    0.00    0.
     00    0.00
1583 3      0.0    0.00     0.0     0.0     0.0    0.00    0.00    0.
     00    0.00
1584 4      0.0    0.00     0.0     0.0     0.0    0.00    0.00    0.
     00    0.00
1585 5      0.0    0.00     0.0     0.0     0.0    2.47    0.00    0.
     00    0.00
1586 6      0.0    0.00     0.0     0.0     0.0    0.00    3.95    0.
     00    0.00
1587 7      0.0    0.00     0.0     0.0     0.0    0.00    0.00    7.
     69    0.00
1588 8      0.0    0.00     0.0     0.0     0.0    0.00    0.00    0.
     00    0.00
1589 9      0.0    0.00     0.0     0.0     0.0    0.00    0.00    0.
     00    0.00
1590 10   100.0    0.00     0.0     0.0     0.0    0.00    0.00    0.
     00    0.00
1591 11     0.0   98.73     0.0     0.0     0.0    0.00    0.00    0.
     00    1.27
```

```
1592 12    0.0   0.00  100.0    0.0    0.0   0.00   0.00   0.
     00    0.00
1593 13    0.0   0.00    0.0  100.0    0.0   0.00   0.00   0.
     00    0.00
1594 14    0.0   0.00    0.0    0.0  100.0   0.00   0.00   0.
     00    0.00
1595 15    0.0   0.00    0.0    0.0    0.0  98.77   0.00   0.
     00    0.00
1596 16    0.0   0.00    0.0    0.0    0.0   0.00  96.30   0.
     00    0.00
1597 17    0.0   0.00    0.0    0.0    0.0   0.00   0.00  94.
     74    0.00
1598 18    0.0   0.00    0.0    0.0    0.0   0.00   0.00   0.
     00  100.00
1599
1600 Treino, teste e predições do [5]_KNeighborsClassifier
     executados em: 8.09681487083435 segundos
1601
1602
1603 Elementos de treino: 4275
1604 Elementos de teste: 1425
1605
1606 Classificador: SGDClassifier
1607 Score de teste: 0.8629649021288687
1608 Confusion Matrix:
1609         0       1      2      3      4      5      6
           7      8      9   \
1610 0   100.00    0.00    0.0    0.0   0.00   0.00   0.00
     0.00   0.00   0.00
1611 1     0.00  100.00    0.0    0.0   0.00   0.00   0.00
     0.00   0.00   0.00
1612 2     0.00    0.00  100.0    0.0   0.00   0.00   0.00
     0.00   0.00   0.00
1613 3     0.00    0.00    0.0  100.0   0.00   0.00   0.00
     0.00   0.00   0.00
1614 4     0.00    0.00    0.0    0.0  69.23   0.00   0.00
     0.00   0.00   0.00
1615 5    62.96    0.00    0.0    0.0   0.00  13.58   0.00
     0.00   0.00   4.94
1616 6     0.00    0.00    0.0    0.0   0.00   0.00  97.37
     0.00   0.00   0.00
1617 7     0.00    0.00    0.0    0.0   0.00   0.00   0.00
     98.72   0.00   1.28
1618 8     0.00    0.00    0.0    0.0   0.00   0.00   0.00
     0.00  98.72   0.00
```

```
1619 9      0.00     0.00     0.0     0.0    0.00    1.41    0.00
     2.82    0.00   95.77
1620 10     0.00     0.00     0.0     0.0    0.00    0.00    0.00
     0.00    0.00    0.00
1621 11     0.00     0.00     0.0     0.0    0.00    0.00    0.00
     0.00    0.00    0.00
1622 12     0.00     0.00     0.0     0.0    0.00    0.00    0.00
     0.00    0.00    0.00
1623 13     0.00     0.00     0.0     0.0    0.00    0.00    0.00
     0.00    0.00    0.00
1624 14     0.00     0.00     0.0     0.0    0.00    0.00    0.00
     0.00    0.00    0.00
1625 15     0.00     0.00     0.0     0.0    0.00    0.00    0.00
     0.00    0.00    0.00
1626 16     0.00     0.00     0.0     0.0    0.00    0.00    0.00
     0.00    0.00    0.00
1627 17    30.26     1.32     0.0     0.0    0.00    0.00    0.00
     59.21    0.00    1.32
1628 18     0.00     0.00     0.0     0.0    0.00    0.00    0.00
     0.00    0.00    0.00
1629
1630          10      11      12      13       14      15       16
          17      18
1631 0      0.00    0.00     0.0     0.0    0.00    0.00     0.00
     0.00    0.00
1632 1      0.00    0.00     0.0     0.0    0.00    0.00     0.00
     0.00    0.00
1633 2      0.00    0.00     0.0     0.0    0.00    0.00     0.00
     0.00    0.00
1634 3      0.00    0.00     0.0     0.0    0.00    0.00     0.00
     0.00    0.00
1635 4      0.00    0.00     0.0     0.0   30.77    0.00     0.00
     0.00    0.00
1636 5      1.23    0.00     0.0     0.0    0.00   17.28     0.00
     0.00    0.00
1637 6      0.00    0.00     0.0     0.0    0.00    0.00     2.63
     0.00    0.00
1638 7      0.00    0.00     0.0     0.0    0.00    0.00     0.00
     0.00    0.00
1639 8      0.00    0.00     0.0     0.0    1.28    0.00     0.00
     0.00    0.00
1640 9      0.00    0.00     0.0     0.0    0.00    0.00     0.00
     0.00    0.00
1641 10   100.00    0.00     0.0     0.0    0.00    0.00     0.00
     0.00    0.00
```

```
1642 11    0.00  98.73    0.0    0.0    0.00   0.00    0.00
     0.00   1.27
1643 12    0.00   0.00  100.0    0.0    0.00   0.00    0.00
     0.00   0.00
1644 13    0.00   0.00    0.0  100.0    0.00   0.00    0.00
     0.00   0.00
1645 14    0.00   0.00    0.0    0.0  100.00   0.00    0.00
     0.00   0.00
1646 15    1.23   0.00    0.0    0.0    0.00  98.77    0.00
     0.00   0.00
1647 16    0.00   0.00    0.0    0.0    0.00   0.00  100.00
     0.00   0.00
1648 17    0.00   0.00    0.0    0.0    0.00   0.00    0.00
     7.89   0.00
1649 18    0.00   3.28    0.0    0.0    0.00   0.00    0.00
     0.00  96.72
1650
1651 Treino, teste e predições do [6]_SGDClassifier
     executados em: 2.2365031242370605 segundos
1652
1653
1654 Elementos de treino: 4275
1655 Elementos de teste: 1425
1656
1657 Classificador: AdaBoostClassifier
1658 Score de teste: 0.9932048674589011
1659 Confusion Matrix:
1660         0      1      2      3      4      5      6
             7      8      9   \
1661 0   100.0    0.0    0.0    0.0   0.00   0.00   0.00    0
     .00    0.0   0.00
1662 1     0.0  100.0    0.0    0.0   0.00   0.00   0.00    0
     .00    0.0   0.00
1663 2     0.0    0.0  100.0    0.0   0.00   0.00   0.00    0
     .00    0.0   0.00
1664 3     0.0    0.0    0.0  100.0   0.00   0.00   0.00    0
     .00    0.0   0.00
1665 4     0.0    0.0    0.0    0.0  98.46   0.00   0.00    0
     .00    0.0   0.00
1666 5     0.0    0.0    0.0    0.0   0.00  98.77   0.00    0
     .00    0.0   0.00
1667 6     0.0    0.0    0.0    0.0   0.00   0.00  97.37    0
     .00    0.0   0.00
1668 7     0.0    0.0    0.0    0.0   0.00   0.00   0.00  100
     .00    0.0   0.00
```

```
1669 8     0.0    0.0    0.0    0.0   0.00   0.00   0.00    0
     .00  100.0   0.00
1670 9     0.0    0.0    0.0    0.0   0.00   0.00   0.00    0
     .00    0.0  98.59
1671 10    0.0    0.0    0.0    0.0   0.00   0.00   0.00    0
     .00    0.0   0.00
1672 11    0.0    0.0    0.0    0.0   0.00   0.00   0.00    0
     .00    0.0   0.00
1673 12    0.0    0.0    0.0    0.0   0.00   0.00   0.00    0
     .00    0.0   0.00
1674 13    0.0    0.0    0.0    0.0   0.00   0.00   0.00    0
     .00    0.0   0.00
1675 14    0.0    0.0    0.0    0.0   0.00   0.00   0.00    0
     .00    0.0   0.00
1676 15    0.0    0.0    0.0    0.0   0.00   1.23   0.00    0
     .00    0.0   0.00
1677 16    0.0    0.0    0.0    0.0   0.00   0.00   0.00    0
     .00    0.0   0.00
1678 17    0.0    0.0    0.0    0.0   0.00   0.00   0.00    2
     .63    0.0   0.00
1679 18    0.0    0.0    0.0    0.0   0.00   0.00   0.00    0
     .00    0.0   0.00
1680
1681         10      11     12      13      14     15      16
          17     18
1682 0     0.00    0.00    0.0    0.00    0.00   0.00    0.00
        0.00   0.00
1683 1     0.00    0.00    0.0    0.00    0.00   0.00    0.00
        0.00   0.00
1684 2     0.00    0.00    0.0    0.00    0.00   0.00    0.00
        0.00   0.00
1685 3     0.00    0.00    0.0    0.00    0.00   0.00    0.00
        0.00   0.00
1686 4     0.00    0.00    0.0    0.00    1.54   0.00    0.00
        0.00   0.00
1687 5     0.00    0.00    0.0    0.00    0.00   1.23    0.00
        0.00   0.00
1688 6     0.00    0.00    0.0    0.00    0.00   0.00    2.63
        0.00   0.00
1689 7     0.00    0.00    0.0    0.00    0.00   0.00    0.00
        0.00   0.00
1690 8     0.00    0.00    0.0    0.00    0.00   0.00    0.00
        0.00   0.00
1691 9     0.00    0.00    0.0    0.00    0.00   0.00    0.00
        1.41   0.00
```

```
1692 10  98.25    0.00    0.0    1.75    0.00   0.00    0.00
        0.00   0.00
1693 11   0.00  100.00    0.0    0.00    0.00   0.00    0.00
        0.00   0.00
1694 12   0.00    0.00  100.0    0.00    0.00   0.00    0.00
        0.00   0.00
1695 13   0.00    0.00    0.0  100.00    0.00   0.00    0.00
        0.00   0.00
1696 14   0.00    0.00    0.0    0.00  100.00   0.00    0.00
        0.00   0.00
1697 15   0.00    0.00    0.0    0.00    0.00  98.77    0.00
        0.00   0.00
1698 16   0.00    0.00    0.0    0.00    0.00   0.00  100.00
        0.00   0.00
1699 17   0.00    0.00    0.0    0.00    0.00   0.00    0.00
       97.37   0.00
1700 18   0.00    1.64    0.0    0.00    0.00   0.00    0.00
        0.00  98.36
1701
1702 Treino, teste e predições do [7]_AdaBoostClassifier
     executados em: 9.151068925857544 segundos
1703
1704
1705 Elementos de treino: 4275
1706 Elementos de teste: 1425
1707
1708 Classificador: LogisticRegression
1709 Score de teste: 0.99349519501896
1710 Confusion Matrix:
1711         0      1      2      3      4      5      6
     7      8      9   \
1712 0   100.0    0.0    0.0    0.0    0.0   0.00   0.00   0.
     00   0.00   0.00
1713 1     0.0  100.0    0.0    0.0    0.0   0.00   0.00   0.
     00   0.00   0.00
1714 2     0.0    0.0  100.0    0.0    0.0   0.00   0.00   0.
     00   0.00   0.00
1715 3     0.0    0.0    0.0  100.0    0.0   0.00   0.00   0.
     00   0.00   0.00
1716 4     0.0    0.0    0.0    0.0  100.0   0.00   0.00   0.
     00   0.00   0.00
1717 5     0.0    0.0    0.0    0.0    0.0  98.77   0.00   0.
     00   0.00   1.23
1718 6     0.0    0.0    0.0    0.0    0.0   0.00  98.68   0.
     00   0.00   0.00
```

```
1719 7     0.0    0.0    0.0    0.0    0.0   0.00   0.00  98.
     72   0.00   1.28
1720 8     0.0    0.0    0.0    0.0    0.0   0.00   0.00   0.
     00  98.72   0.00
1721 9     0.0    0.0    0.0    0.0    0.0   1.41   0.00   1.
     41   0.00  97.18
1722 10    0.0    0.0    0.0    0.0    0.0   0.00   0.00   0.
     00   0.00   0.00
1723 11    0.0    0.0    0.0    0.0    0.0   0.00   0.00   0.
     00   0.00   0.00
1724 12    0.0    0.0    0.0    0.0    0.0   0.00   0.00   0.
     00   0.00   0.00
1725 13    0.0    0.0    0.0    0.0    0.0   0.00   0.00   0.
     00   0.00   0.00
1726 14    0.0    0.0    0.0    0.0    0.0   0.00   0.00   0.
     00   0.00   0.00
1727 15    0.0    0.0    0.0    0.0    0.0   0.00   0.00   0.
     00   0.00   0.00
1728 16    0.0    0.0    0.0    0.0    0.0   0.00   0.00   0.
     00   0.00   0.00
1729 17    0.0    0.0    0.0    0.0    0.0   0.00   0.00   0.
     00   0.00   1.32
1730 18    0.0    0.0    0.0    0.0    0.0   0.00   0.00   0.
     00   0.00   0.00
1731
1732          10     11     12     13     14     15     16
           17     18
1733 0     0.00   0.00    0.0    0.0   0.00   0.00   0.00
        0.00   0.00
1734 1     0.00   0.00    0.0    0.0   0.00   0.00   0.00
        0.00   0.00
1735 2     0.00   0.00    0.0    0.0   0.00   0.00   0.00
        0.00   0.00
1736 3     0.00   0.00    0.0    0.0   0.00   0.00   0.00
        0.00   0.00
1737 4     0.00   0.00    0.0    0.0   0.00   0.00   0.00
        0.00   0.00
1738 5     0.00   0.00    0.0    0.0   0.00   0.00   0.00
        0.00   0.00
1739 6     0.00   0.00    0.0    0.0   0.00   0.00   1.32
        0.00   0.00
1740 7     0.00   0.00    0.0    0.0   0.00   0.00   0.00
        0.00   0.00
1741 8     0.00   0.00    0.0    0.0   1.28   0.00   0.00
        0.00   0.00
```

```
1742 9     0.00   0.00    0.0    0.0    0.00   0.00    0.00
        0.00    0.00
1743 10  100.00   0.00    0.0    0.0    0.00   0.00    0.00
        0.00    0.00
1744 11    0.00  98.73    0.0    0.0    0.00   0.00    0.00
        0.00    1.27
1745 12    0.00   0.00  100.0    0.0    0.00   0.00    0.00
        0.00    0.00
1746 13    0.00   0.00    0.0  100.0    0.00   0.00    0.00
        0.00    0.00
1747 14    0.00   0.00    0.0    0.0  100.00   0.00    0.00
        0.00    0.00
1748 15    1.23   0.00    0.0    0.0    0.00  98.77    0.00
        0.00    0.00
1749 16    0.00   0.00    0.0    0.0    0.00   0.00  100.00
        0.00    0.00
1750 17    0.00   0.00    0.0    0.0    0.00   0.00    0.00
     98.68    0.00
1751 18    0.00   0.00    0.0    0.0    0.00   0.00    0.00
        0.00  100.00
1752
1753 Treino, teste e predições do [8]_LogisticRegression
     executados em: 14.226202964782715 segundos
1754
1755
1756 Elementos de treino: 4275
1757 Elementos de teste: 1425
1758
1759 Classificador: BaggingClassifier
1760 Score de teste: 0.9925152480884971
1761 Confusion Matrix:
1762         0      1      2      3      4      5      6
             7      8      9   \
1763 0   100.0    0.0    0.0    0.0   0.00   0.00    0.0    0
     .00    0.0   0.00
1764 1     0.0  100.0    0.0    0.0   0.00   0.00    0.0    0
     .00    0.0   0.00
1765 2     0.0    0.0  100.0    0.0   0.00   0.00    0.0    0
     .00    0.0   0.00
1766 3     0.0    0.0    0.0  100.0   0.00   0.00    0.0    0
     .00    0.0   0.00
1767 4     0.0    0.0    0.0    0.0  93.85   0.00    0.0    0
     .00    0.0   0.00
1768 5     0.0    0.0    0.0    0.0   0.00  98.77    0.0    0
     .00    0.0   0.00
```

```
1769 6      0.0     0.0     0.0     0.0    0.00    0.00  100.0     0
     .00     0.0    0.00
1770 7      0.0     0.0     0.0     0.0    0.00    0.00    0.0   100
     .00     0.0    0.00
1771 8      0.0     0.0     0.0     0.0    0.00    0.00    0.0     0
     .00   100.0    0.00
1772 9      0.0     0.0     0.0     0.0    0.00    0.00    0.0     0
     .00     0.0   97.18
1773 10     0.0     0.0     0.0     0.0    0.00    0.00    0.0     0
     .00     0.0    0.00
1774 11     0.0     0.0     0.0     0.0    0.00    0.00    0.0     0
     .00     0.0    0.00
1775 12     0.0     0.0     0.0     0.0    0.00    0.00    0.0     0
     .00     0.0    0.00
1776 13     0.0     0.0     0.0     0.0    0.00    0.00    0.0     0
     .00     0.0    0.00
1777 14     0.0     0.0     0.0     0.0    0.00    0.00    0.0     0
     .00     0.0    0.00
1778 15     0.0     0.0     0.0     0.0    0.00    1.23    0.0     0
     .00     0.0    0.00
1779 16     0.0     0.0     0.0     0.0    0.00    0.00    0.0     0
     .00     0.0    0.00
1780 17     0.0     0.0     0.0     0.0    0.00    0.00    0.0     1
     .32     0.0    1.32
1781 18     0.0     0.0     0.0     0.0    0.00    0.00    0.0     0
     .00     0.0    0.00
1782
1783          10      11      12      13      14      15      16
           17      18
1784 0      0.0     0.00    0.00     0.0    0.00    0.00     0.0
     0.00     0.0
1785 1      0.0     0.00    0.00     0.0    0.00    0.00     0.0
     0.00     0.0
1786 2      0.0     0.00    0.00     0.0    0.00    0.00     0.0
     0.00     0.0
1787 3      0.0     0.00    0.00     0.0    0.00    0.00     0.0
     0.00     0.0
1788 4      0.0     0.00    0.00     0.0    6.15    0.00     0.0
     0.00     0.0
1789 5      0.0     0.00    0.00     0.0    0.00    1.23     0.0
     0.00     0.0
1790 6      0.0     0.00    0.00     0.0    0.00    0.00     0.0
     0.00     0.0
1791 7      0.0     0.00    0.00     0.0    0.00    0.00     0.0
     0.00     0.0
```

```
1792 8     0.0    0.00   0.00    0.0    0.00   0.00    0.0
     0.00    0.0
1793 9     0.0    0.00   0.00    0.0    0.00   0.00    0.0
     2.82    0.0
1794 10  100.0    0.00   0.00    0.0    0.00   0.00    0.0
     0.00    0.0
1795 11    0.0  100.00   0.00    0.0    0.00   0.00    0.0
     0.00    0.0
1796 12    0.0    1.25  98.75    0.0    0.00   0.00    0.0
     0.00    0.0
1797 13    0.0    0.00   0.00  100.0    0.00   0.00    0.0
     0.00    0.0
1798 14    0.0    0.00   0.00    0.0  100.00   0.00    0.0
     0.00    0.0
1799 15    0.0    0.00   0.00    0.0    0.00  98.77    0.0
     0.00    0.0
1800 16    0.0    0.00   0.00    0.0    0.00   0.00  100.0
     0.00    0.0
1801 17    0.0    0.00   0.00    0.0    0.00   0.00    0.0
     97.37    0.0
1802 18    0.0    0.00   0.00    0.0    0.00   0.00    0.0
     0.00  100.0
1803
1804 Treino, teste e predições do [9]_BaggingClassifier
     executados em: 16.79378080368042 segundos
1805
1806
1807 Aplicando tuning do modelo...
1808 Elementos de treino: 4275
1809 Elementos de teste: 1425
1810 Otimização de parâmetros executada em:  314.
     01068806648254  segundos
1811 Melhor Score:  0.736248097761949
1812 Melhores Parâmetros:  {'learning_rate': 0.1, '
     random_state': 20}
1813
1814 ------
1815 Modelo não-otimizado
1816 ------
1817 F-score dos dados de teste: 0.1901
1818
1819 ------
1820 Modelo otimizado
1821 ------
1822 F-score dos dados de teste: 0.6921
```

```
1823
1824
1825 Confusion Matrix:
1826 [[75  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
       0]
1827  [ 0 88  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
       0]
1828  [ 0  0 76  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
       0]
1829  [ 0  0  0 69  0  0  0  0  0  0  0  0  0  0  0  0  0  0
       0]
1830  [ 0  0  0  0 65  0  0  0  0  0  0  0  0  0  0  0  0  0
       0]
1831  [ 0  0  0  0  0 79  0  0  0  1  0  0  0  0  0  1  0  0
       0]
1832  [ 0  0  0  0  0  0 73  0  0  0  0  0  0  0  0  0  3  0
       0]
1833  [ 0  0  0  0  0  0  0  0  0  1  0  0  0  0  0  0  0 77
       0]
1834  [ 0  0  0  0  0  0  0  0 78  0  0  0  0  0  0  0  0  0
       0]
1835  [ 0  0  0  0  0  0  0  0  0 71  0  0  0  0  0  0  0  0
       0]
1836  [ 0  0  0  0  0  0  0  0  0  0 56  0  0  1  0  0  0  0
       0]
1837  [ 0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
     79]
1838  [ 0  0  0  0  0  0  0  0  0  0  0  0 79  0  0  0  0  0
       1]
1839  [ 0  0  0  0  0  0  0  0  0  0  0  0  0 73  0  0  0  0
       0]
1840  [ 0  0  0  0 80  0  0  0  0  0  0  0  0  0  0  0  0  0
       0]
1841  [ 0  0  0  0  0 70  0  0  0  0  0  0  0  0  0 11  0  0
       0]
1842  [ 0  0  0  0  0  0 25  0  0  0  0  0  0  0  0  0 56  0
       0]
1843  [ 0  0  0  0  0  0  0  0  0  2  0  0  0  0  0  0  0 74
       0]
1844  [ 0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
     61]]
1845
1846 Plotando gráficos de  Dados_Originais ...
1847 Plotando gráficos de  PAA ...
1848 Plotando gráficos de  [0]_DecisionTreeClassifier ...
```

```
1849 Plotando gráficos de  [1]_AdaBoostClassifier ...
1850 Plotando gráficos de  [2]_SVC ...
1851 Plotando gráficos de  [3]_RandomForestClassifier ...
1852 Plotando gráficos de  [4]_GaussianNB ...
1853 Plotando gráficos de  [5]_KNeighborsClassifier ...
1854 Plotando gráficos de  [6]_SGDClassifier ...
1855 Plotando gráficos de  [7]_AdaBoostClassifier ...
1856 Plotando gráficos de  [8]_LogisticRegression ...
1857 Plotando gráficos de  [9]_BaggingClassifier ...
1858 Plotando gráficos de  PREDICOES_FINAIS ...
1859 Score do [0]_DecisionTreeClassifier: 0.9857454953272707
1860 Score do [1]_AdaBoostClassifier: 0.19005006615935194
1861 Score do [2]_SVC: 0.9237297056997305
1862 Score do [3]_RandomForestClassifier: 0.9925123912533742
1863 Score do [4]_GaussianNB: 0.921315863457593
1864 Score do [5]_KNeighborsClassifier: 0.9835318891637632
1865 Score do [6]_SGDClassifier: 0.8629649021288687
1866 Score do [7]_AdaBoostClassifier: 0.9932048674589011
1867 Score do [8]_LogisticRegression: 0.99349519501896
1868 Score do [9]_BaggingClassifier: 0.9925152480884971
1869 Executado em:  2897.7899639606476  segundos
1870
1871 Process finished with exit code 0
1872
```