

## A. Final SRI-based one class classifier to detect anomalies in Car Hacking 2018 dataset

### Classifier 2 classifier to distinguish normal and attack in Car hack 2018 dataset

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1: if row['Arbitration_ID'] == '0002' then:
2:   if row['D0'] < 0.5 and row['PP_CAN_ID_01f1'] >= 0.5 then:
3:     return 'normal'
4:   else if row['D1'] < 0.5 and row['D7'] >= 22.5 and row['P_CAN_ID_0545'] >= 0.5 then:
5:     return 'normal'
6:   else if row['D1'] < 0.5 and row['D7'] >= 22.5 and row['P_CAN_ID_02c0'] >= 0.5 then:
7:     return 'normal'
8:   else if row['D1'] < 0.5 and row['D7'] >= 22.5 and row['P_CAN_ID_02b0'] >= 0.5 then:
9:     return 'normal'
10:  else if row['D1'] < 0.5 and row['D7'] >= 22.5 and row['P_CAN_ID_0350'] >= 0.5 then:
11:    return 'normal'
12:  else if row['D1'] < 0.5 and row['D7'] >= 22.5 and row['PP_CAN_ID_02c0'] >= 0.5 then:
13:    return 'normal'
14:  else if row['D1'] < 0.5 and row['D7'] >= 22.5 and row['PP_CAN_ID_043f'] >= 0.5 then:
15:    return 'normal'
16:  else if row['D3'] < 0.5 and row['D7'] >= 22.5 and row['P_CAN_ID_0440'] >= 0.5 then:
17:    return 'normal'
18:  else if row['D3'] < 0.5 and row['D7'] >= 22.5 and row['P_CAN_ID_04f0'] >= 0.5 then:
19:    return 'normal'
20:  else if row['D3'] < 0.5 and row['D6'] >= 0.5 and row['P_CAN_ID_0545'] >= 0.5 then:
21:    return 'normal'
22:  else if row['D3'] < 0.5 and row['D6'] >= 0.5 and row['P_CAN_ID_0440'] >= 0.5 then:
23:    return 'normal'
24:  else if row['D3'] < 0.5 and row['D6'] >= 0.5 and row['P_CAN_ID_04f0'] >= 0.5 then:
25:    return 'normal'
26:  else if row['D7'] >= 22.5 and row['D5'] < 10.5 and row['PP_CAN_ID_0260'] >= 0.5 then:
27:    return 'normal'
28:  else if row['D0'] < 0.5 and row['D4'] < 0.5 and row['D7'] >= 22.5 then:
29:    return 'normal'
30:  else if row['D0'] < 0.5 and row['D4'] < 0.5 and row['D7'] >= 20.5 then:
31:    return 'normal'
32:  else if row['D1'] < 0.5 and row['D6'] >= 0.5 and row['P_CAN_ID_02b0'] >= 0.5 then:
33:    return 'normal'
34:  else if row['D1'] < 0.5 and row['D6'] >= 0.5 and row['PP_CAN_ID_0545'] >= 0.5 then:
35:    return 'normal'
36:  else if row['D3'] < 0.5 and row['D4'] < 0.5 and row['D6'] >= 0.5 then:
37:    return 'normal'
38:  else
39:    return 'attack'
40: else if row['Arbitration_ID'] == '00a0' then:
41:   if row['Timeperiod'] >= 0.07486641407012935 and row['D6'] >= 1.5 then:
42:     return 'normal'
43:   else
44:     return 'attack'
45: else if row['Arbitration_ID'] == '00a1' then:
46:   if row['P_CAN_ID_00a0'] >= 0.5 then:
47:     return 'normal'
48:   else if row['Timeperiod'] >= 0.07483148574829095 and row['D5'] < 0.5 then:
49:     return 'normal'
50:   else
51:     return 'attack'
52: else if row['Arbitration_ID'] == '0130' then:
53:   if row['D3'] >= 254.5 and row['D1'] >= 107.5 then:
54:     return 'normal'
55:   else
56:     return 'attack'
57: else if row['Arbitration_ID'] == '0131' then:
58:   if row['P_CAN_ID_0130'] >= 0.5 and row['D5'] >= 118.5 then:
59:     return 'normal'
60:   else if row['D1'] >= 126.5 and row['D3'] < 0.5 and row['D7'] >= 21.5 then:
61:     return 'normal'
62:   else
63:     return 'attack'
64: else if row['Arbitration_ID'] == '0140' then:
65:   if row['P_CAN_ID_0131'] >= 0.5 and row['D6'] >= 31.5 then:
66:     return 'normal'
67:   else if row['D6'] >= 31.5 and row['D0'] < 0.5 then:
68:     return 'normal'
69:   else
70:     return 'attack'
71: else if row['Arbitration_ID'] == '0153' then:
72:   if row['D5'] >= 254.5 and row['D0'] < 0.5 then:
73:     return 'normal'
74:   else
75:     return 'attack'
76: else if row['Arbitration_ID'] == '018f' then:
77:   if row['D0'] >= 253.5 and row['P_CAN_ID_0316'] >= 0.5 then:
78:     return 'normal'
79:   else if row['D0'] >= 253.5 and row['D5'] >= 59.5 and row['D4'] < 0.5 then:
80:     return 'normal'
81:   else

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82:     return 'attack'
83: else if row['Arbitration_ID'] == '01f1' then:
84:     if row['P_CAN_ID_04b1'] >= 0.5 and row['D0'] < 0.5 then:
85:         return 'normal'
86:     else if row['Timeperiod'] >= 0.0178101062774658 then:
87:         return 'normal'
88:     else if row['Timeperiod'] >= 0.0178101062774658 and row['PP_CAN_ID_04b1'] >= 0.5 then:
89:         return 'normal'
90:     else
91:         return 'attack'
92: else if row['Arbitration_ID'] == '0260' then:
93:     if row['P_CAN_ID_018f'] >= 0.5 and row['PP_CAN_ID_0140'] >= 0.5 then:
94:         return 'normal'
95:     else if row['P_CAN_ID_018f'] >= 0.5 and row['PP_CAN_ID_0370'] >= 0.5 then:
96:         return 'normal'
97:     else if row['D4'] >= 254.5 and row['D6'] >= 69.5 then:
98:         return 'normal'
99:     else if row['P_CAN_ID_018f'] >= 0.5 and row['D6'] >= 79.5 and row['D7'] >= 20.5 then:
100:         return 'normal'
101:     else if row['P_CAN_ID_018f'] >= 0.5 and row['D6'] >= 79.5 and row['PP_CAN_ID_0002'] >= 0.5 then:
102:         return 'normal'
103:     else if row['P_CAN_ID_018f'] >= 0.5 and row['D6'] >= 79.5 and row['PP_CAN_ID_0153'] >= 0.5 then:
104:         return 'normal'
105:     else if row['P_CAN_ID_018f'] >= 0.5 and row['D6'] >= 79.5 and row['PP_CAN_ID_02c0'] >= 0.5 then:
106:         return 'normal'
107:     else if row['P_CAN_ID_018f'] >= 0.5 and row['D5'] >= 141.5 and row['PP_CAN_ID_0316'] >= 0.5 then:
108:         return 'normal'
109:     else if row['P_CAN_ID_018f'] >= 0.5 and row['D5'] >= 141.5 and row['D0'] >= 9.5 then:
110:         return 'normal'
111:     else if row['D6'] >= 79.5 and row['D5'] >= 141.5 and row['D0'] >= 9.5 then:
112:         return 'normal'
113:     else if row['D6'] >= 79.5 and row['D7'] >= 20.5 and row['P_CAN_ID_04b1'] < 0.5 then:
114:         return 'normal'
115:     else
116:         return 'attack'
117: else if row['Arbitration_ID'] == '0329' then:
118:     if row['D2'] >= 125.5 and row['P_CAN_ID_0316'] >= 0.5 then:
119:         return 'normal'
120:     else if row['D1'] >= 174.5 and row['D2'] >= 125.5 and row['P_CAN_ID_02a0'] >= 0.5 then:
121:         return 'normal'
122:     else if row['D1'] >= 174.5 and row['D2'] >= 125.5 and row['PP_CAN_ID_0140'] >= 0.5 then:
123:         return 'normal'
124:     else if row['D1'] >= 174.5 and row['D4'] >= 16.5 and row['P_CAN_ID_02b0'] >= 0.5 then:
125:         return 'normal'
126:     else if row['D1'] >= 174.5 and row['D0'] >= 63.5 and row['D5'] >= 31.5 then:
127:         return 'normal'
128:     else if row['D1'] >= 174.5 and row['D5'] >= 31.5 and row['D0'] >= 11.5 then:
129:         return 'normal'
130:     else
131:         return 'attack'
132: else if row['Arbitration_ID'] == '0370' then:
133:     if row['D0'] < 0.5 and row['D5'] < 0.5 then:
134:         return 'normal'
135:     else if row['D0'] < 0.5 and row['P_CAN_ID_043f'] >= 0.5 and row['PP_CAN_ID_0140'] >= 0.5 then:
136:         return 'normal'
137:     else if row['D0'] < 0.5 and row['P_CAN_ID_043f'] >= 0.5 and row['PP_CAN_ID_04f0'] >= 0.5 then:
138:         return 'normal'
139:     else if row['D0'] < 0.5 and row['P_CAN_ID_043f'] >= 0.5 and row['PP_CAN_ID_0329'] >= 0.5 then:
140:         return 'normal'
141:     else if row['D0'] < 0.5 and row['P_CAN_ID_0350'] >= 0.5 and row['PP_CAN_ID_043f'] >= 0.5 then:
142:         return 'normal'
143:     else if row['D0'] < 0.5 and row['P_CAN_ID_043f'] >= 0.5 then:
144:         return 'normal'
145:     else if row['D0'] < 0.5 and row['P_CAN_ID_0329'] >= 0.5 then:
146:         return 'normal'
147:     else if row['D0'] < 0.5 and row['P_CAN_ID_0140'] >= 0.5 then:
148:         return 'normal'
149:     else if row['PP_CAN_ID_043f'] >= 0.5 and row['P_CAN_ID_02b0'] >= 0.5 then:
150:         return 'normal'
151:     else if row['PP_CAN_ID_043f'] >= 0.5 and row['P_CAN_ID_02c0'] >= 0.5 then:
152:         return 'normal'
153:     else if row['D0'] < 0.5 and row['D5'] < 0.5 and row['TimeInterval'] < 0.00023543834686274998 then:
154:         return 'normal'
155:     else if row['D0'] < 0.5 and row['D5'] < 0.5 and row['PP_CAN_ID_0140'] >= 0.5 then:
156:         return 'normal'
157:     else if row['D0'] < 0.5 and row['D5'] < 0.5 and row['PP_CAN_ID_0002'] >= 0.5 then:
158:         return 'normal'
159:     else if row['D0'] < 0.5 and row['P_CAN_ID_0350'] >= 0.5 and row['PP_CAN_ID_0329'] >= 0.5 then:
160:         return 'normal'
161:     else if row['D0'] < 0.5 and row['PP_CAN_ID_0329'] >= 0.5 and row['P_CAN_ID_02b0'] >= 0.5 then:
162:         return 'normal'
163:     else if row['D0'] < 0.5 and row['PP_CAN_ID_0329'] >= 0.5 and row['P_CAN_ID_02c0'] >= 0.5 then:
164:         return 'normal'
165:     else
166:         return 'attack'

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167: else if row['Arbitration_ID'] == '0430' then:
168:   if row['Timeperiod'] >= 0.01790452003479 and row['D0'] < 0.5 and row['P_CAN_ID_0370'] >= 0.5 then:
169:     return 'normal'
170:   else if row['Timeperiod'] >= 0.01790452003479 and row['D0'] < 0.5 and row['P_CAN_ID_04f0'] >= 0.5 then:
171:     return 'normal'
172:   else if row['Timeperiod'] >= 0.01790452003479 and row['D5'] < 0.5 and row['P_CAN_ID_05f0'] >= 0.5 then:
173:     return 'normal'
174:   else if row['Timeperiod'] >= 0.01790452003479 and row['D3'] < 0.5 and row['P_CAN_ID_0329'] >= 0.5 then:
175:     return 'normal'
176:   else if row['Timeperiod'] >= 0.01790452003479 and row['P_CAN_ID_02b0'] >= 0.5 and row['PP_CAN_ID_0329'] >= 0.5 then:
177:     return 'normal'
178:   else if row['Timeperiod'] >= 0.01790452003479 and row['P_CAN_ID_02b0'] >= 0.5 and row['PP_CAN_ID_0370'] >= 0.5 then:
179:     return 'normal'
180:   else if row['D3'] < 0.5 and row['P_CAN_ID_02c0'] >= 0.5 and row['PP_CAN_ID_0329'] >= 0.5 then:
181:     return 'normal'
182:   else if row['Timeperiod'] >= 0.01790452003479 and row['D1'] < 0.5 then:
183:     return 'normal'
184:   else
185:     return 'attack'
186: else if row['Arbitration_ID'] == '043f' then:
187:   if row['D5'] >= 0.5 then:
188:     return 'normal'
189:   else if row['D6'] >= 0.5 then:
190:     return 'normal'
191:   else
192:     return 'attack'
193: else if row['Arbitration_ID'] == '0440' then:
194:   if row['D0'] >= 254.5 and row['D3'] < 0.5 then:
195:     return 'normal'
196:   else if row['D0'] >= 254.5 and row['P_CAN_ID_043f'] >= 0.5 then:
197:     return 'normal'
198:   else if row['D0'] >= 254.5 and row['D4'] >= 254.5 and row['D1'] < 14.5 then:
199:     return 'normal'
200:   else if row['D4'] >= 254.5 and row['D3'] < 0.5 and row['D1'] < 14.5 then:
201:     return 'normal'
202:   else if row['D4'] >= 254.5 and row['D1'] < 14.5 and row['P_CAN_ID_0370'] >= 0.5 then:
203:     return 'normal'
204:   else if row['D4'] >= 254.5 and row['D1'] < 14.5 and row['P_CAN_ID_043f'] >= 0.5 then:
205:     return 'normal'
206:   else if row['D4'] >= 254.5 and row['D1'] < 14.5 and row['D2'] >= 0.5 then:
207:     return 'normal'
208:   else
209:     return 'attack'
210: else if row['Arbitration_ID'] == '04b1' then:
211:   if row['Timeperiod'] >= 0.017518520355224547 then:
212:     return 'normal'
213:   else if row['Timeperiod'] >= 0.017518520355224547 and row['P_CAN_ID_0430'] >= 0.5 and row['D5'] < 0.5 then:
214:     return 'normal'
215:   else if row['Timeperiod'] >= 0.017518520355224547 and row['PP_CAN_ID_0430'] >= 0.5 and row['P_CAN_ID_0440'] >= 0.5 then:
216:     return 'normal'
217:   else if row['D2'] >= 20.5 and row['D4'] < 0.5 and row['D3'] >= 29.5 then:
218:     return 'normal'
219:   else if row['Timeperiod'] >= 0.017518520355224547 and row['D3'] >= 30.5 and row['D0'] >= 37.5 then:
220:     return 'normal'
221:   else
222:     return 'attack'
223: else if row['Arbitration_ID'] == '04f0' then:
224:   if row['Timeperiod'] >= 0.0148950815200805 and row['D3'] >= 127.5 and row['D2'] < 0.5 then:
225:     return 'normal'
226:   else
227:     return 'attack'
228: else if row['Arbitration_ID'] == '0545' then:
229:   if row['D0'] >= 215.5 and row['P_CAN_ID_0329'] >= 0.5 and row['D0'] < 216.5 then:
230:     return 'normal'
231:   else if row['D0'] >= 215.5 and row['D1'] < 0.5 and row['D0'] < 216.5 then:
232:     return 'normal'
233:   else if row['D0'] >= 215.5 and row['D0'] < 216.5 and row['PP_CAN_ID_0329'] >= 0.5 then:
234:     return 'normal'
235:   else if row['D0'] >= 215.5 and row['D0'] < 216.5 and row['PP_CAN_ID_02b0'] >= 0.5 then:
236:     return 'normal'
237:   else if row['D3'] >= 128.5 and row['D5'] < 0.5 and row['D2'] < 0.5 then:
238:     return 'normal'
239:   else if row['D3'] >= 128.5 and row['D7'] < 0.5 and row['P_CAN_ID_0440'] >= 0.5 then:
240:     return 'normal'
241:   else if row['D0'] >= 215.5 and row['D3'] >= 128.5 and row['D7'] < 0.5 then:
242:     return 'normal'
243:   else
244:     return 'attack'
245: else if row['Arbitration_ID'] == '05a0' then:
246:   if row['Timeperiod'] >= 0.5482984781265259 and row['D0'] < 0.5 then:
247:     return 'normal'
248:   else
249:     return 'attack'
250: else if row['Arbitration_ID'] == '05a2' then:
251:   if row['P_CAN_ID_05a0'] >= 0.5 then:

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252:     return 'normal'
253: else if row['Timeperiod'] >= 0.5480740070343018 and row['D2'] >= 144.5 then:
254:     return 'normal'
255: else
256:     return 'attack'
257: else if row['Arbitration_ID'] == '05f0' then:
258:     if row['DLC'] < 3.5 then:
259:         return 'normal'
260:     else
261:         return 'attack'
262: else if row['Arbitration_ID'] == '0690' then:
263:     if row['Timeperiod'] >= 0.07405698299407955 and row['D4'] >= 159.5 then:
264:         return 'normal'
265:     else
266:         return 'attack'
267: else if row['Arbitration_ID'] == '02a0' then:
268:     if row['D6'] >= 220.5 and row['P_CAN_ID_0260'] >= 0.5 then:
269:         return 'normal'
270:     else if row['D6'] >= 220.5 and row['D0'] >= 31.5 then:
271:         return 'normal'
272:     else if row['D6'] >= 220.5 and row['P_CAN_ID_0140'] >= 0.5 then:
273:         return 'normal'
274:     else if row['D6'] >= 220.5 and row['PP_CAN_ID_0002'] >= 0.5 then:
275:         return 'normal'
276:     else if row['D2'] >= 105.5 and row['D5'] < 4.5 then:
277:         return 'normal'
278:     else if row['P_CAN_ID_0260'] >= 0.5 and row['D2'] >= 105.5 and row['D1'] < 0.5 then:
279:         return 'normal'
280:     else if row['D2'] >= 105.5 and row['D1'] < 0.5 and row['D0'] >= 31.5 then:
281:         return 'normal'
282:     else if row['D2'] >= 105.5 and row['D5'] < 4.5 and row['D5'] >= 3.5 then:
283:         return 'normal'
284:     else
285:         return 'attack'
286: else if row['Arbitration_ID'] == '02b0' then:
287:     if row['DLC'] < 6.5 and row['D1'] >= 232.0 then:
288:         return 'normal'
289:     else if row['DLC'] < 6.5 and row['D4'] >= 32.5 then:
290:         return 'normal'
291:     else if row['DLC'] < 6.5 and row['Timeperiod'] < 0.01003396511077875 then:
292:         return 'normal'
293:     else
294:         return 'attack'
295: else if row['Arbitration_ID'] == '02c0' then:
296:     if row['D1'] < 0.5 and row['P_CAN_ID_02b0'] >= 0.5 and row['PP_CAN_ID_0153'] >= 0.5 then:
297:         return 'normal'
298:     else if row['D3'] < 0.5 and row['D7'] < 0.5 and row['PP_CAN_ID_0260'] >= 0.5 then:
299:         return 'normal'
300:     else if row['D3'] < 0.5 and row['D0'] >= 19.5 and row['D0'] < 21.5 then:
301:         return 'normal'
302:     else
303:         return 'attack'
304: else if row['Arbitration_ID'] == '0316' then:
305:     if row['D0'] < 26.5 then:
306:         return 'normal'
307:     else if row['D7'] >= 120.5 and row['P_CAN_ID_0140'] >= 0.5 then:
308:         return 'normal'
309:     else if row['D0'] < 53.5 and row['D2'] >= 27.5 and row['P_CAN_ID_0350'] >= 0.5 then:
310:         return 'normal'
311:     else if row['D0'] < 53.5 and row['D6'] >= 3.5 and row['PP_CAN_ID_0440'] >= 0.5 then:
312:         return 'normal'
313:     else
314:         return 'attack'
315: else if row['Arbitration_ID'] == '0350' then:
316:     if row['D4'] >= 104.5 and row['P_CAN_ID_0329'] >= 0.5 and row['PP_CAN_ID_0140'] >= 0.5 then:
317:         return 'normal'
318:     else if row['D4'] >= 104.5 and row['P_CAN_ID_02c0'] >= 0.5 and row['PP_CAN_ID_0329'] >= 0.5 then:
319:         return 'normal'
320:     else if row['D3'] >= 101.5 and row['D7'] >= 34.5 and row['P_CAN_ID_0140'] >= 0.5 then:
321:         return 'normal'
322:     else if row['D5'] < 0.5 and row['D7'] >= 20.5 and row['P_CAN_ID_0140'] >= 0.5 then:
323:         return 'normal'
324:     else if row['D5'] < 0.5 and row['D7'] >= 20.5 and row['PP_CAN_ID_0153'] >= 0.5 then:
325:         return 'normal'
326:     else if row['D2'] >= 19.5 and row['D7'] >= 34.5 and row['P_CAN_ID_0545'] >= 0.5 then:
327:         return 'normal'
328:     else if row['D2'] >= 19.5 and row['PP_CAN_ID_0329'] >= 0.5 and row['P_CAN_ID_04f0'] >= 0.5 then:
329:         return 'normal'
330:     else if row['D1'] >= 39.5 and row['D1'] < 40.5 and row['PP_CAN_ID_0153'] >= 0.5 then:
331:         return 'normal'
332:     else if row['D4'] >= 104.5 and row['D0'] < 5.5 then:
333:         return 'normal'
334:     else
335:         return 'attack'
336: else

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337: *return 'attack'*

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