Modifying the Anhøj Rules to Improve Runs Analysis in Statistical Process Control

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Abstract An abstract of less than 150 words.

Introduction

Within statistical process control (SPC) runs analysis is being used to detect persistent shifts in process location over time.

We have previously shown that runs analysis using the Anhøj rules have comparable or even better diagnostic properties than traditional control chart rules that are commonly used to detect minor to moderate *persistens* shifts in process location (Anhøj and Wentzel-Larsen, 2018).

Methods

Results

Discussion

Conclusion

Here is a reference to Figure 1.

Here is a reference to Figure 2.

Here is a reference to Figure 3.

Here is a reference to Figure 4.

Here is a reference to Figure 5.

Table 1: Signal limits for the anhøj and best box rules and borders for the cut box rules. N = number of trials. L = upper limit for longest run, C = lower limit for number of crossings, Cbord and Lbord = cut box borders to keep.

	Anhøj		Best box		Cut box	
N	L	C	L	C	Cbord	Lbord
10	2	6	2	6	3	5
11	2	6	3	7	4	6
12	3	7	3	6		
13	3	7	3	6		
14	4	7	3	6		
15	4	7	4	7	6	6
16	4	7	5	8	6	7
17	5	7	5	7		
18	5	7	5	7	6	6
19	6	7	5	7	6	5
20	6	7	6	7		
21	6	7	7	8		
22	7	7	6	7	7	6
23	7	8	6	7	7	6
24	8	8	6	7	7	6
25	8	8	6	7		
26	8	8	9	9	10	7
27	9	8	9	8	10	7
28	9	8	9	8	11	7
29	10	8	10	8		

Table 1: Signal limits for the anhøj and best box rules and borders for the *(continued)*

	Anhøj		Best box		Cut box	
N	L	C	L	C	Cbord	Lbord
30	10	8	11	10	12	9
31	11	8	11	9	14	8
32	11	8	11	8		
33	11	8	11	8	12	7
34	12	8	11	8	13	7
35	12	8	12	8		
36	13	8	13	9	15	8
37	13	8	14	10		
38	14	8	13	8		
39	14	8	15	11		
40	14	8	15	9		
41	15	8	15	9	17	8
42	15	8	14	8		
43	16	8	14	8		
44	16	8	17	10		
45	17	8	17	9		
46	17	9	17	9	19	8
47	17	9	17	9	20	7
48	18	9	19	12	20	11
49	18	9	19	10	21	9
50	19	9	19	9		
51	19	9	19	9	21	8
52	20	9	19	9	21	7
53	20	9	21	11	23	9
54	21	9	21	10	23	8
55	21	9	21	9		
56	21	9	21	9	23	8
57	22	9	23	12	25	11
58	22	9	23	10	24	9
59	23	9	23	10	26	8
60	23	9	23	9		
61	24	9	23	9	24	8
62	24	9	25	11	27	9
63	25	9	25	10	27	9
64	25	9	26	11	27	10
65	25	9	26	10	27	9
66	26	9	27	12	29	10
67	26	9	27	10		
68	27	9	27	10	29	8
69	27	9	28	11	29	8
70	28	9	29	14	30	13
71	28	9	29	11	31	9
72	29	9	29	10	30	9
73	29	9	30	11	31	10
74	29	9	30	10		
75	30	9	31	12	32	9
76	30	9	31	11	34	8
77	31	9	31	10	33	9
78	31	9	32	11	33	8
79	32	9	33	13	37	11
80	32	9	33	11	35	9
81	33	9	33	10		
82	33	9	34	11	36	10

Table 1: Signal limits for the anhøj and best box rules and borders for the *(continued)*

	Anhøj		Best box		Cut box	
N	L	C	L	C	Cbord	Lbord
83	34	9	33	10	36	7
84	34	9	35	11		
85	34	9	35	11	38	8
86	35	9	35	10	36	9
87	35	9	35	10	38	8
88	36	9	37	12	38	10
89	36	9	37	11	39	9
90	37	9	38	12		
91	37	10	37	10	39	9
92	38	10	39	13	41	12
93	38	10	39	11	40	10
94	39	10	39	11	42	8
95	39	10	39	10		
96	39	10	39	10	41	8
97	40	10	41	12	42	9
98	40	10	41	11	44	9
99	41	10	42	12	43	10
100	41	10	41	10	42	9

Bibliography

J. Anhøj and T. Wentzel-Larsen. Sense and sensibility: on the diagnostic value of control chart rules for detection of shifts in time series data. *BMC Medical Research Methodology*, 18(1):100, 2018. doi: 10.1186/s12874-018-0564-0. URL https://doi.org/10.1186/s12874-018-0564-0. [p1]

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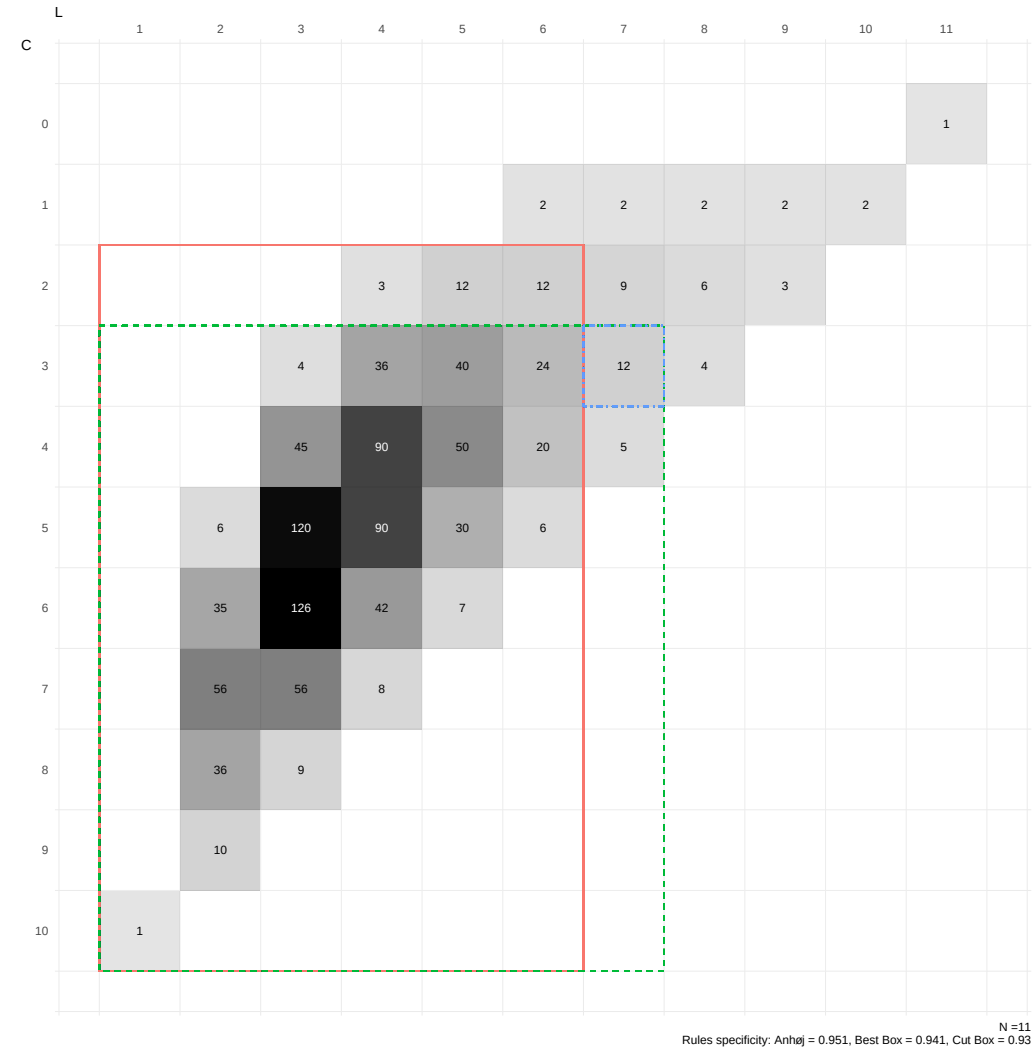

Figure 1: Borders of the anhøj, best box, and cut box rules. The numbers in the cells are times representation of of the joint probabilities of longest run and number of crossings.

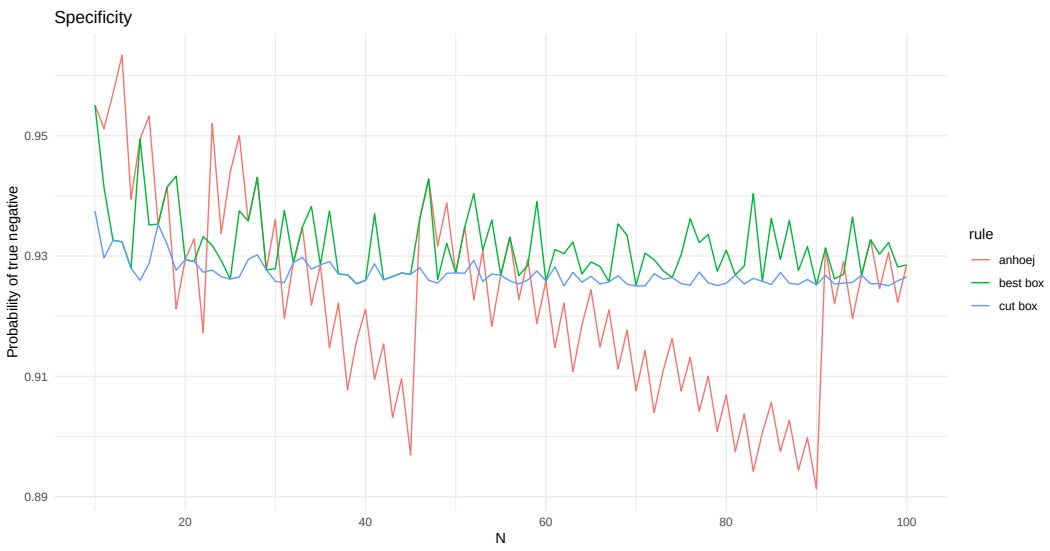

Figure 2: Specificity of the anhøj, best box, and cut box rules.

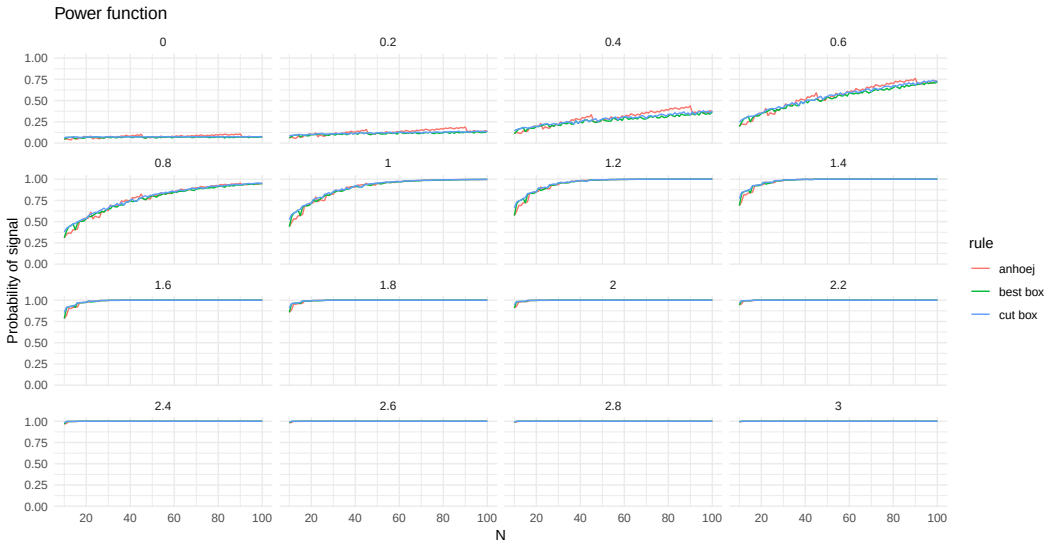

Figure 3: Power function.

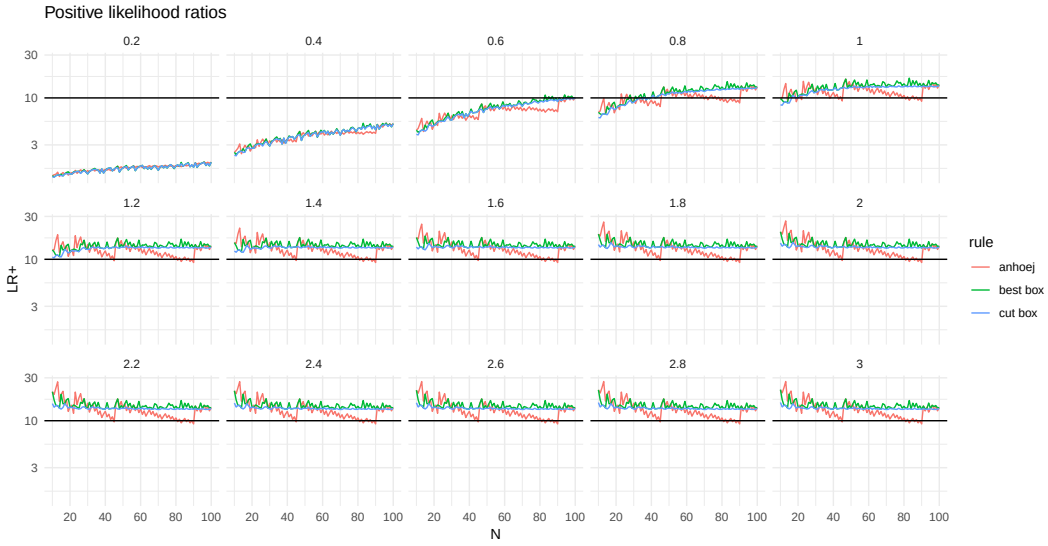

Figure 4: Positive likelihood ratio.

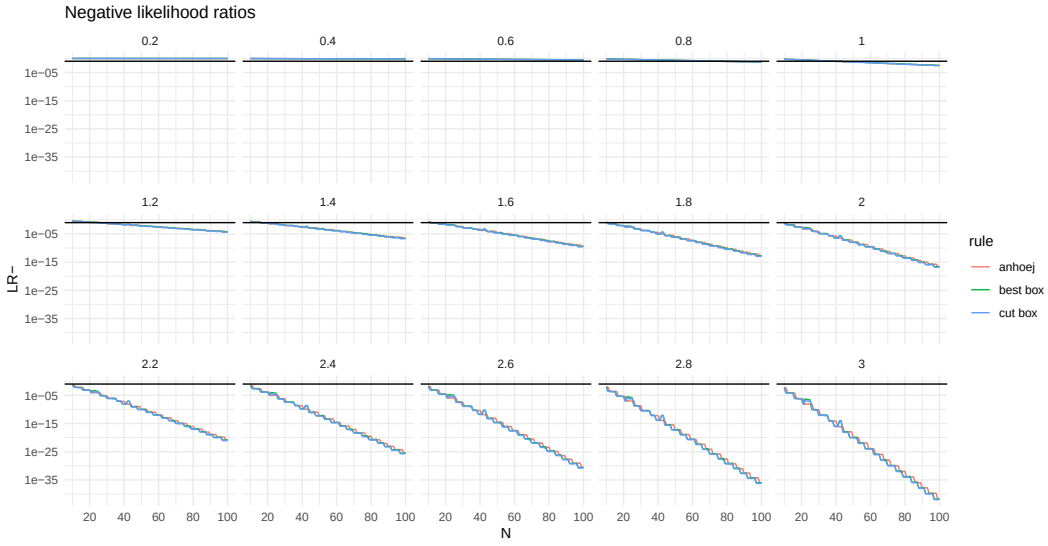

Figure 5: Negative likelihood ratio.