Stats AI

Case Study - Smart Glass Data Mining

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Data – Deep Dive

- “Command” has 4 distinct values with 76% being 0.
- “Act_volt” has 1760 distinct values.
  - Distribution has heavy skew, negative mean, and positive median.
- “Set_volt” has 917 distinct values with 72% of them being 0.
  - Distribution has heavy skew, negative mean, and median is 0.
- “Current” has 1068 distinct values with 53% of them being 0. The distribution is slightly skewed with positive mean, but median 0.
- “State” has 12 unique values with 75% of them being state 6.
- 88% of the “States” fall into “States” 6, 10, and 3 respectively.
- “States” 0, 13, and 17 are the most rare.
- 6 is the midpoint of the “States” -there are 5 “States” below 6 and five “States” above 6

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Data Mining - Improper Sequences

	command	state	freq
1	-5	-4	22
2	-5	-3	1
3	-5	-1	15
4	-5	0	25
5	-5	1	5
6	-5	9	20
7	0	-17	8
8	0	-8	18
9	0	-6	5
10	0	-4	37
11	0	-2	33
12	0	-1	9
13	0	0	71863
14	0	1	71
15	0	3	2
16	0	8	8
17	0	9	7
18	0	11	8
19	0	13	13
20	5	-8	22
21	5	0	7
22	5	1	1
23	5	3	1
24	10	0	8
25	10	8	21

The chart on the left shows that anomalous conditions tend to fall in two segments:

- Command issued, but a state change does not occur.
- No command issued, but a state change still occurs.

Conclusions:

- The system seems to not be responding to commands that are issued. This occurs 40 times.
- The system changes states without commands being issued. This occurs 110 times.
- The timestamps at which these instances occur can be found by looking at the indices within the matrix
- These anomalies represent only 0.2% of the data.

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Econometric Analysis

1. The State variable tends to be mean reverting
   - Thus, increases tend to be followed by decreases, and vice versa
2. The state variable follows a “popcorn process” in that it stays at 6 for long periods of time, goes above 6, below 6, and then reverts back to 6
3. Mapping states to commands, we see that whenever the state is 6, usually, but not always, a command of 0 occurs
4. Observe that some states, such as state 10, can be reached 3 different ways

	state	command	command_freq
1	0	0	18
2	2	15	1563
3	3	10	7
4	3	15	3921
5	5	0	1629
6	6	0	53829
7	6	10	8
8	9	0	6
9	9	5	1166
10	10	5	3
11	10	10	5597
12	10	15	5
13	11	5	1450
14	11	10	2
15	12	5	9
16	12	10	1245
17	13	0	13
18	14	10	1752
19	17	0	8