Discovery of NWC Patterns

Onboarding & HLD

UNIVERSITY OF MINNESOTA
Driven to Discover℠

What are Non-compliance/Divergent/Anomalous Windows

Iteration	EGRkgph	Engrpm	EngTq	NOxTheoryppm
1000	2	3	7	91.3237
1001	2	4	6	65.2116
1002	2	1	5	13.6293

- Discretized data
- Variable length
- Boolean target

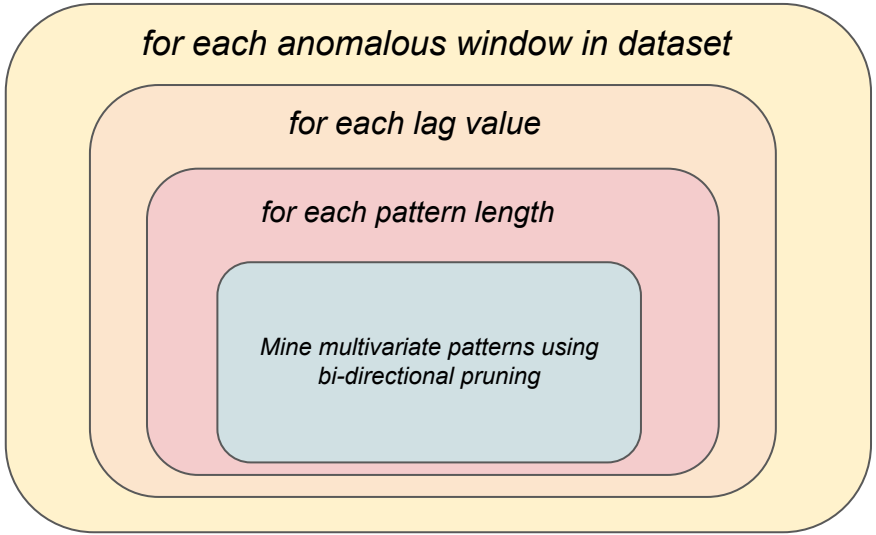
Co-occurrence Pattern

- Attribute patterns co-incinding with anomalous windows, across time-series.
- Could be univariate or multivariate patterns, with variable length.

Time	0	1	2	3	4	5	6	7
v_1: Engine Power	a_1	a_2	a_3	a_2	a_1	a_2	a_3	a_2
v_2: Engine RPM	b_1	b_1	b_2	b_3	b_1	b_1	b_2	b_2
NO_x (gm/sec)	0.011	0.011	0.015	0.023	0.023	0.021	0.019	0.019

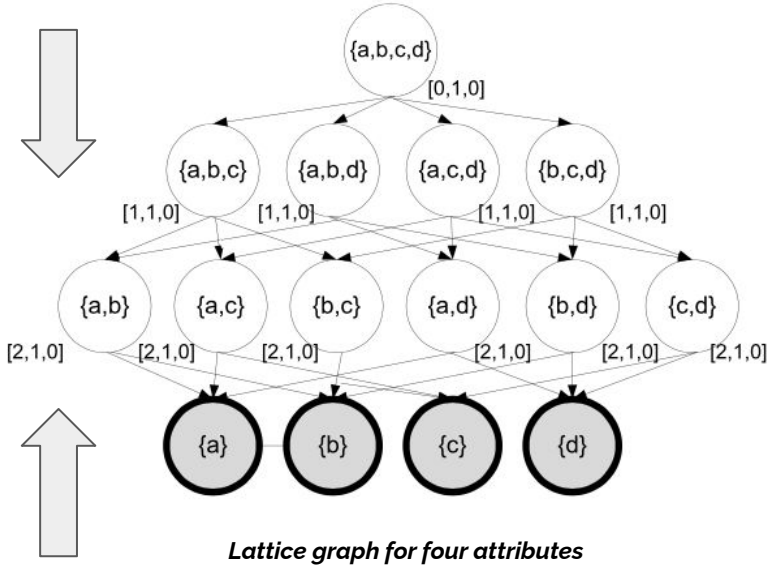
- *Candidate Patterns:* (a2, a3, a2), (b1, b2, b3), ()
- **Lag** (δ) signifies the time pattern might take to actually effect target in the anomalous window
- **Temporal Cross-k** (temporal form of space-time cross-K) used as metric.

BDNMiner Overview



• Other optimizations through indexing for counting patterns, and memoization using hashmaps.

Lattice bounds based pruning



Lattice graph for four attributes

Support based pruning

High Level Design