State Detection and Segmentation (SDS)

May the best detector win.

Arthur Grisel-Davy

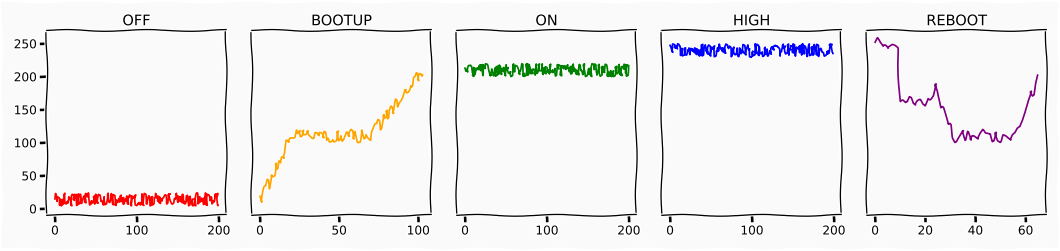
University of Waterloo - EET2 Project

Goal

Detect the state of the machine at any point in time.

Training Data

Proto Examples:



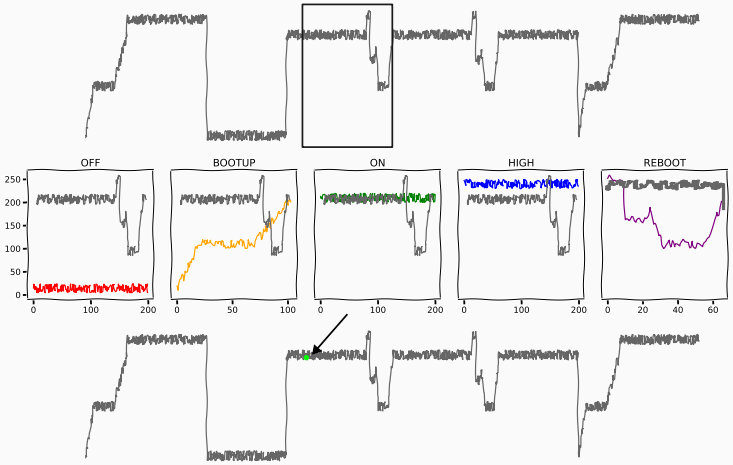
- Not exacts examples.
- Various lengths.
- Tile any trace completely.

Evaluation Ground

- Synthetically generated input trace & protos.
- Trace start at randomly selected sample.
- Score: global accuracy $\left(\frac{TP + TN}{TP + TN + FP + FN}\right)$

Simplest Detector

Label each sample with the closest proto example.

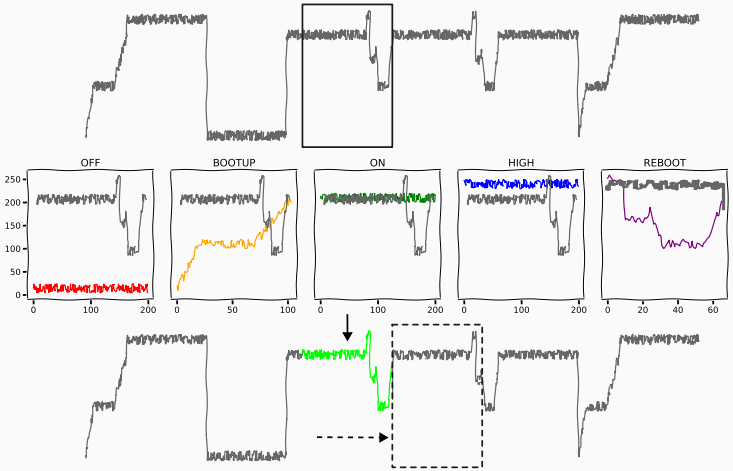


Scoreboard

Detector	Simplest
Score	0.32

Confident Detector

The complete length of the closest proto example is assigned the label.

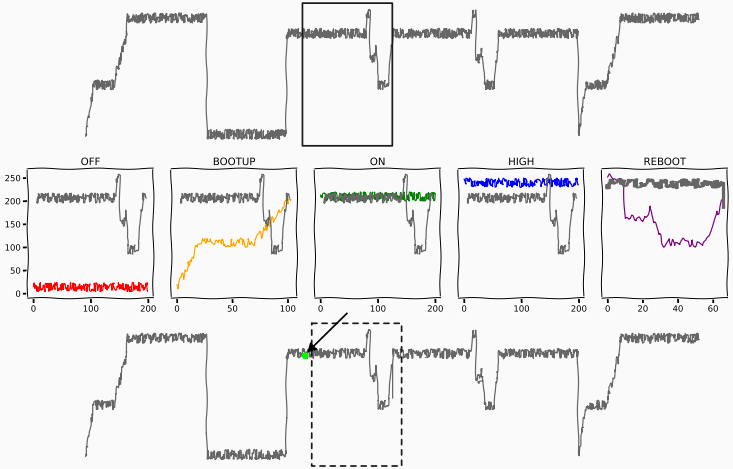


Scoreboard

Detector	Simplest	Confident
Score	0.32	0.69

Cautious Detector

The complete length of the closest proto example is assigned the label, but still moves by 1 sample.



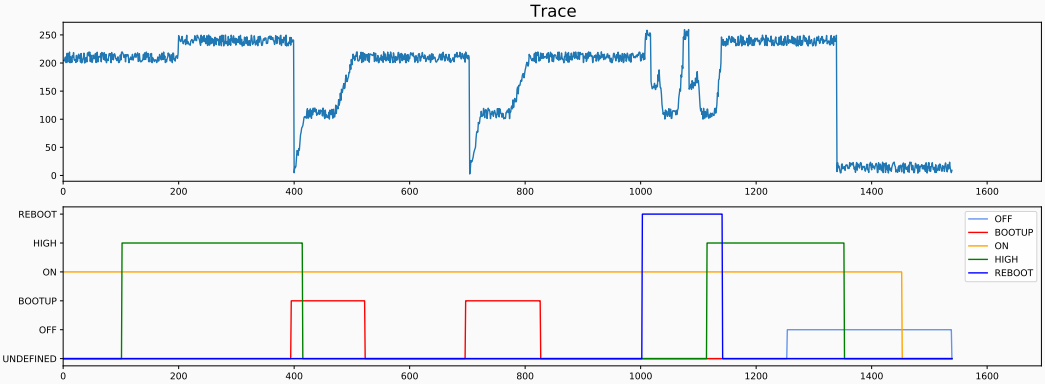
Scoreboard

Detector	Simplest	Confident	Cautious
Score	0.32	0.69	0.39

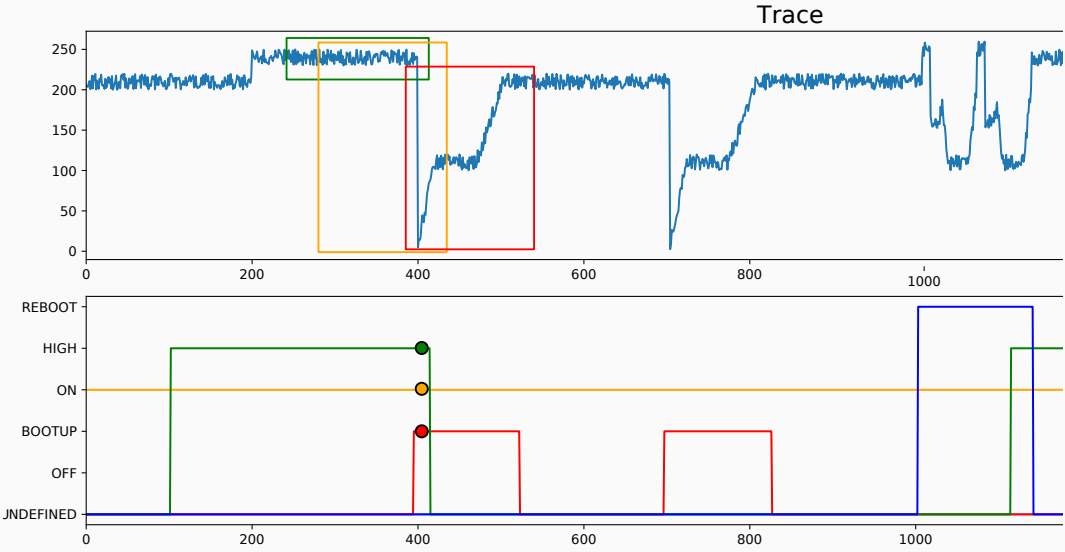
Let's be smart

- ~~Respect Causality~~ $\rightarrow$ Use all data available.
- Proto example represent the whole trace.
- Try to place each example as best as possible independently.

Generous label Activation



Generous label Activation

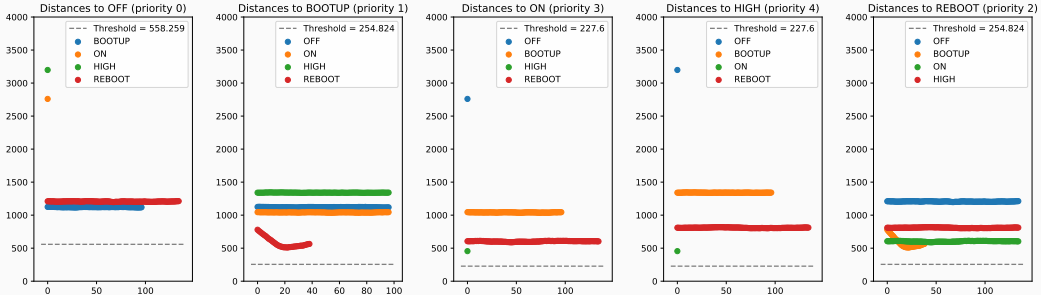


Inter-protos Distances

- Minimize overlaps.
- Resolve overlap conflicts.

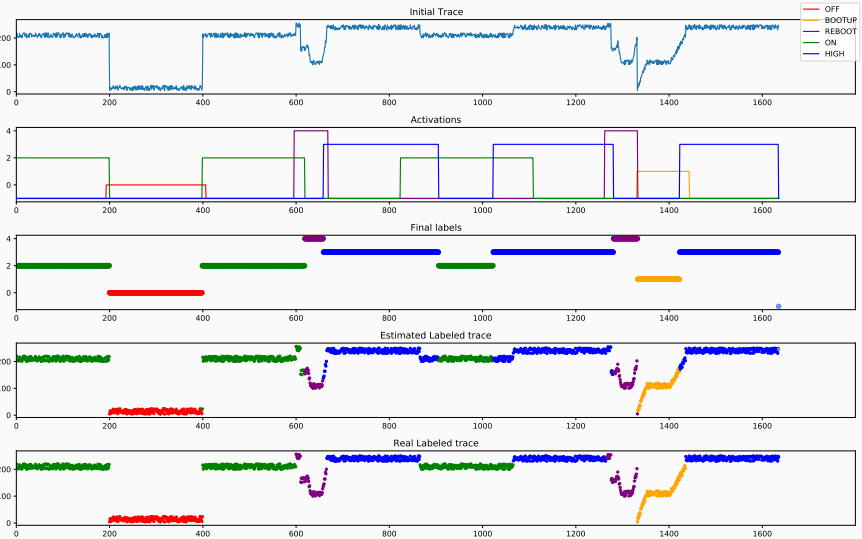
→ Compute inter-protos distances.

Inter-protos Distances

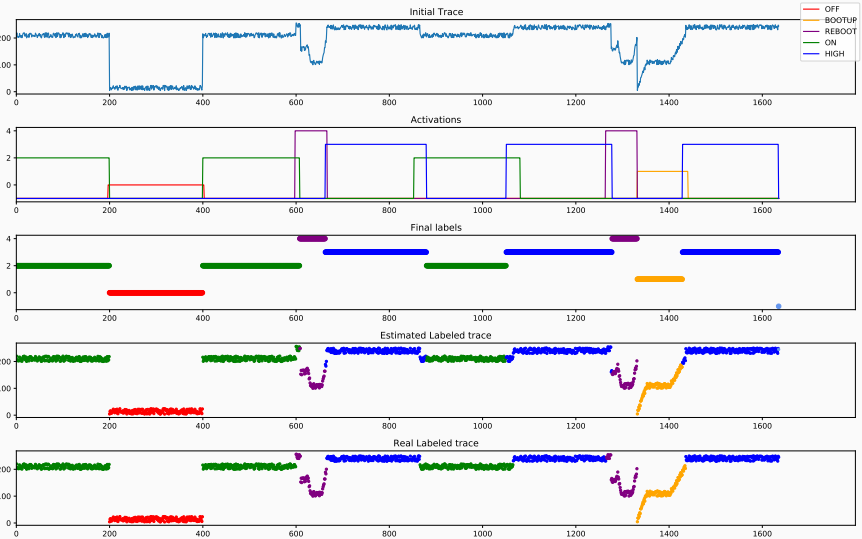


! Hyper-parameter: threshold placement coefficient (default=1)

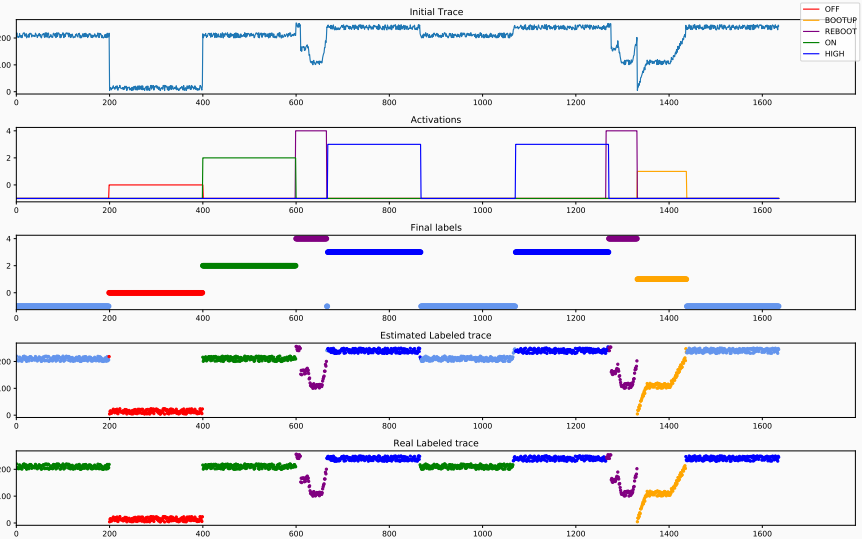
Detection


Initial Trace
OFF
BOOTUP
REBOOT
ON
HIGH
Activations
Final labels
Estimated Labeled trace
Real Labeled trace

Detection


Initial Trace
OFF
BOOTUP
REBOOT
ON
HIGH
Activations
Final labels
Estimated Labeled trace
Real Labeled trace

Detection


Initial Trace
OFF
BOOTUP
REBOOT
ON
HIGH
Activations
Final labels
Estimated Labeled trace
Real Labeled trace

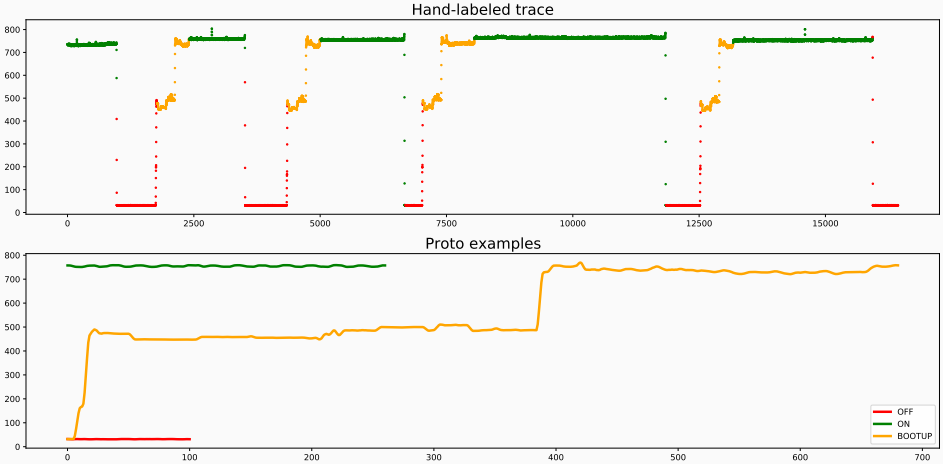
Scoreboard

Detector	Simplest	Confident	Cautious	Inter-distances
Score	0.32	0.69	0.39	0.91 - 0.99

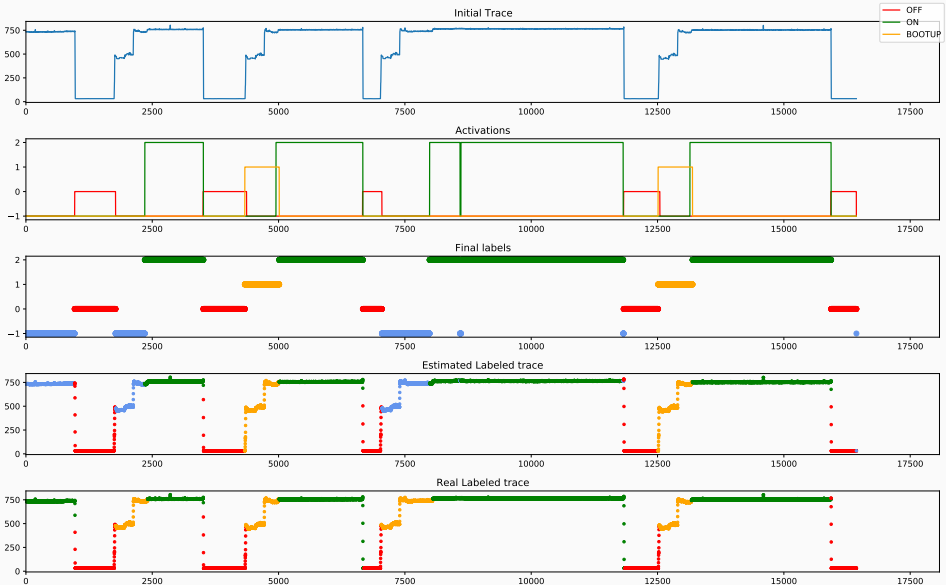
Future Work

- Generate real data.
- Evaluate impact of imperfect protos.
- Evaluate possibility of incomplete proto dictionary.
- Evaluate possibility of automatic threshold optimization.

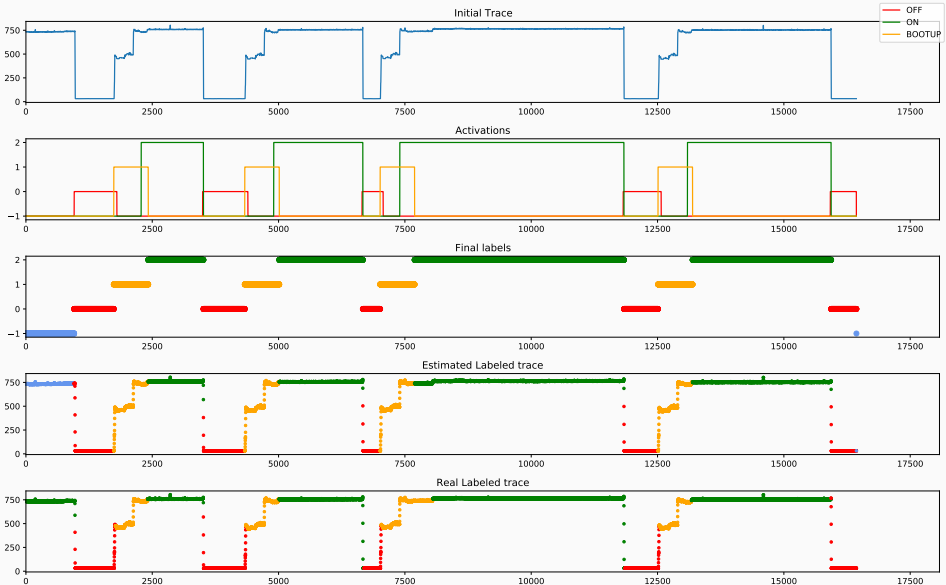
Real Data


Hand-labeled trace
0
100
200
300
400
500
600
700
800
0
2500
5000
7500
10000
12500
15000
Proto examples
0
100
200
300
400
500
600
700
800
OFF
ON
BOOTUP

Real Data


Initial Trace
OFF
ON
BOOTUP
Activations
Final labels
Estimated Labeled trace
Real Labeled trace

Real Data


Initial Trace
OFF
ON
BOOTUP
Activations
Final labels
Estimated Labeled trace
Real Labeled trace