ML

- Recording further temperature data sets, these datasets are very small, but it's getting bigger
- Trying to better pre-process the data
- Training own ML model

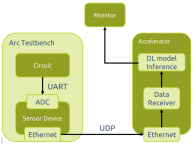
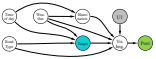


Figure 13 Demonstrator with accelerator integrated



- Environmental variables influence the ML model.
- Influence can be direct (Road Type) or indirect through a mediator (Illumination)
- We always have some unobserved noise somewhere in the system.

Minimal sufficient adjustment sets for estimating the total effect of Target on Post:

1. Illu, Road Type
2. Road Type, Time of Day, Weather

Independence Criteria

1. Road Type ⊥ Illu
2. Road Type ⊥ Weather
3. Road Type ⊥ Time of Day
4. Target ⊥ Illu | Time of Day, Weather
5. Post ⊥ Weather | Illu, Road Type, Target
6. Post ⊥ Time of Day | Illu, Road Type, Target
7. Weather ⊥ Time of Day

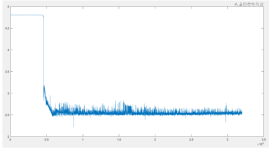


Figure 9 Arc testbench measurement with constant load

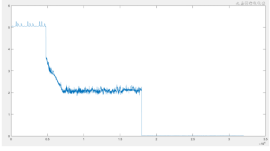


Figure 12 Arc testbench measurement with variable Load

- Arc Detection

Variable	Meaning	Observed (Run-Time)	Annotated (Training)
Arc	Arc Occurance	n/a	yes
I_serv	Sensed current	yes	yes
Load	Load Profile (incl. fixed or flexible connect. Loads)	(yes)	yes
Post	Classification (Arc occured / not occured)	n/a	yes
Pro	Property of fault (Serial or Parallel arc)	n/a	yes
Typ	Type of installation (material, classifaction fix or flexible)	yes (constant)	yes
U/I	Sensor Noise	n/a	no

Testable independence criteria

1. Typ ⊥ Post | I_a
2. Arc ⊥ Post | I_a
3. Post ⊥ Load | I_a

Minimal sufficient adjustment sets for estimating the total effect of Arc on Post:

1. Load, Pro

- Motor Condition Classification

Variable	Meaning	observed (Run-Time)	annotated (Training)
Flow	Airflow	no	yes
F_s	Magnetic Field measured	yes	yes
Loc	Location of installation	yes	yes
P	Air-Pressure outside	no	no
Prod	Classification (Flow OK / NOK)	no	yes
rpm	Rotations per minute	yes	yes
s	Slip	no	no
Spec	Motor Specification	yes	yes
T	Temperature	no	no
T_s	Temperature measured	yes	yes
tra	Torque	no	no
U1, U2, U3	Sensor noises	no	no
V_s	Vibrations measured	yes	yes
vib	Vibrations	no	no
Φ	Magnetic Flux	no	no

Testable independence criteria

1. Spec ⊥ T_s | Flow, rpm
2. Spec ⊥ F_s | Flow, rpm, V_s, rpm
3. Spec ⊥ Prod | Flow, rpm, Loc, V_s, rpm
4. Spec ⊥ Loc
5. Flow ⊥ Prod | F_s, Loc, T_s, V_s, rpm
6. Flow ⊥ Prod | Loc, Spec, T_s, rpm
7. Flow ⊥ Loc | Spec
8. Flow ⊥ rpm | Spec
9. Flow ⊥ F_s
10. T_s ⊥ Loc | Flow, Spec
11. T_s ⊥ Loc | Flow, rpm
12. T_s ⊥ V_s | Flow, Spec
13. T_s ⊥ V_s | Flow, rpm
14. T_s ⊥ F_s | Spec, rpm
15. T_s ⊥ F_s | Flow, rpm
16. Loc ⊥ V_s
17. Loc ⊥ F_s
18. Loc ⊥ V_s
19. V_s ⊥ F_s

Minimal sufficient adjustment sets for estimating the total effect of Flow on Post:

1. H_s, Loc, V_s, rpm
2. H_s, P, V_s, rpm
3. Loc, Spec
4. P, Spec

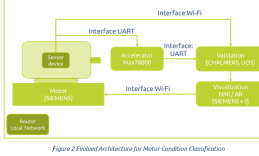


Figure 2 Evolved Architecture for Motor Condition Classification

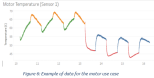


Figure 6 Example of data for the motor use case