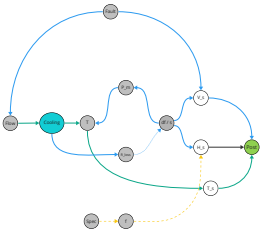
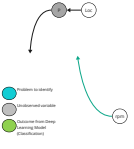
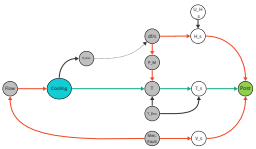


df = Difference zw. magnetischer und elektrischer Frequenz
r_loss = inner losses (temperature depended)
fault = Fehlerfall am Schaufelrad / Fanplates
P_m = Mech. Power (or electrical due to high efficiency)



Variable	Meaning	Observed (Run-Time)	Annotated (Training)
Flow	Airflow (m3/s)	no	yes
H_s	Magnetic Field measured	yes	yes
Loc	Location of installation (height)	yes	yes
P	Air Pressure outside	no	no
Pred	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
Voc	Torque	no	no
U1, U2, U3	Sensor noises	no	no
V_s	Vibrations measured	yes	yes
xBs	Vibrations	no	no
Φ	Magnetic Flux	no	no

- Motor Condition



Minimal sufficient adjustment sets for estimating the total effect of Cooling on Pred:
1. Flow
2. H_s, Mec.Fault
3. H_s, T_a
4. Mec.Fault, rpm
5. T_s, rpm

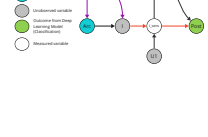
The model implies the following conditional independencies:
1. Cooling ⊥ Pred | H_s, T_a, V_s
2. Cooling ⊥ Mec.Fault | H_s, rpm
3. Cooling ⊥ H_s | rpm
4. T_s ⊥ H_s | rpm
5. T_s ⊥ H_s | rpm
6. T_s ⊥ Cooling
7. T_s ⊥ rpm | Cooling
8. Pred ⊥ T_a | Cooling
9. Pred ⊥ rpm | Cooling, H_s, V_s
10. H_s ⊥ V_s
11. rpm ⊥ V_s

Variable	Meaning	Observed (Run-Time)	Annotated (Training)
xBrk	Magnetic Flux	no	no
Flow	Airflow (m3/s)	no	yes
H_s	Magnetic Field measured	yes	yes
Mec. Fault	fault in antiblade	no	no
P_M	Mechanical Power	no	no
Pred	Classification (Flow OK / NOK)	no	yes
R_loss	Inner losses	no	no
s	Slip	no	no
T	Temperature	no	no
T_s	Temperature measured	yes	yes
T_Env	Environment Temperature	no	no
U1, U2, U3	Sensor noises	no	no
V_s	Vibrations measured	yes	yes

Testable independence criteria:
1. Typ ⊥ Post | I_s
2. Arc ⊥ Post | I_s
3. Post ⊥ Load | I_s

Minimal sufficient adjustment sets for estimating the total effect of Arc on Post:
1. Load, HF_noise

- Arc Detection



Variable	Meaning	Observed (Run-Time)	Annotated (Training)
Arc	Arc Occurance	no	yes
I_secs	Second current	yes	yes
Load	Load Profile (incl. fixed or flexible connect. loads)	no	yes
Post	Classification (Arc occurred / not occured)	no	yes
Pro	Property of fault (Serial or Parallel arc) => we only care about serial arc right now.	no	yes
Typ	Type of installation (material, classfication fix or flexible)	yes (constant)	yes
U1	Sensor Noise (statistical)	no	yes
U2	Unmodelled aspect of load	no	no
Load Type	Passive or active components (power electronics)	yes	yes

Switch between two models:
- With and without HF noise from inverter