Detecting new defects the first time

18.11.22, Mathias Pawlowsky

Challenges in Hydropower

Do more with less

45

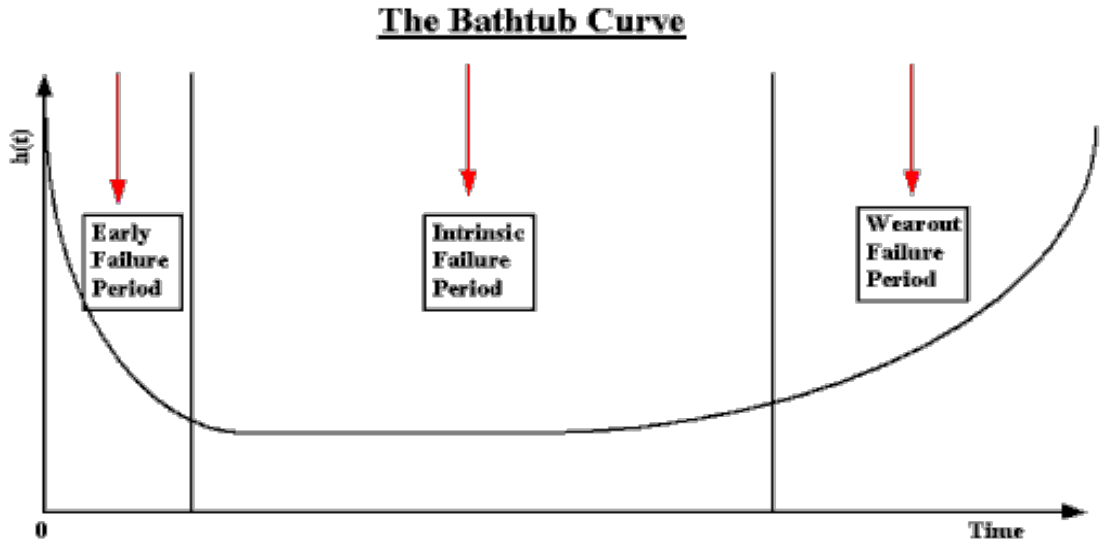
Average Age of Hydropower plants in Europe

~38%

Of the 2014 hydropower workforce in the US have left by 2030

~25%

Estimated decline in countryside workforce over next 15 years in DACH



Amount and complexity of maintenance work expected to rise sharply as plants age

Data sources: IEA, US Dept. of Energy & own calculations based on world bank data

https://www.iea.org/reports/hydropower-special-market-report/executive-summary
https://databank.worldbank.org/source/population-estimates-and-projections
https://www.osti.gov/servlets/purl/1515066
https://www.itl.nist.gov/div898/handbook/apr/section1/apr124.htm

Do more with less

How do we mitigate this?

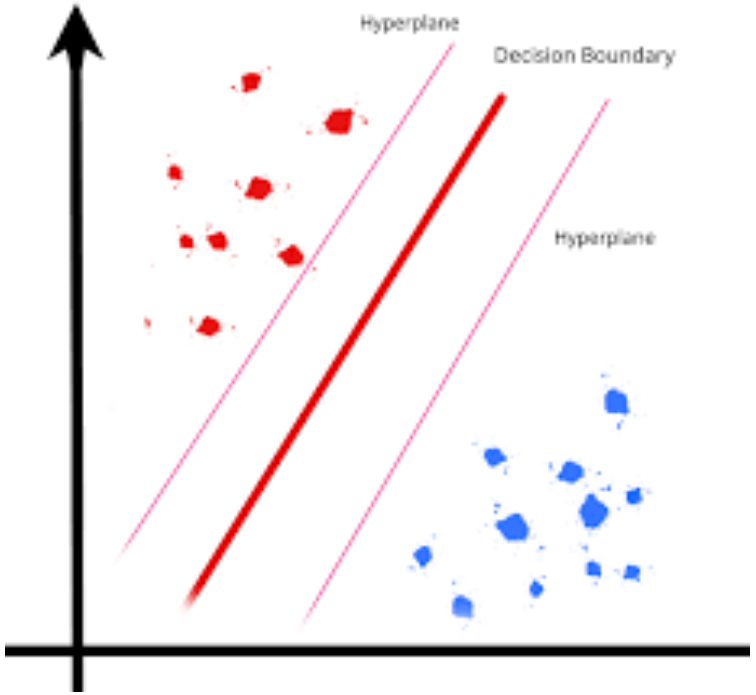
- Fixing demography is very hard

- Relieve through great tools: Enable maintenance crews to focus on high value tasks by relieving them from repetitive monitoring tasks
- Prevent loss of know-how: Formalize know-how and bring it into the organisation

→ How do we express a “I look at the time series plot, then I know if the valve/bearing/… is still good” in code?

Data Science to the rescue

First reflex: Show me some examples of failures



https://towardsdatascience.com/breaking-down-the-support-vector-machine-svm-algorithm-d2c030d58d42

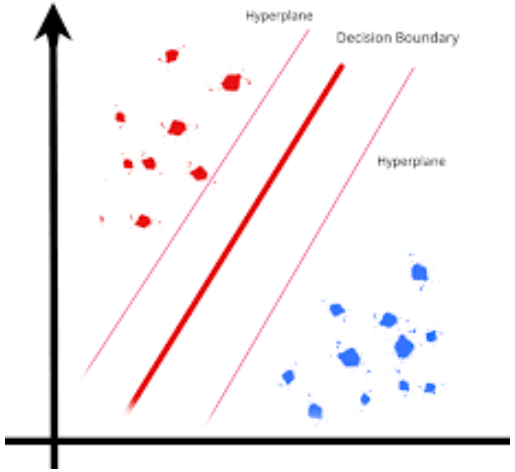
Operating hydropower plants is special

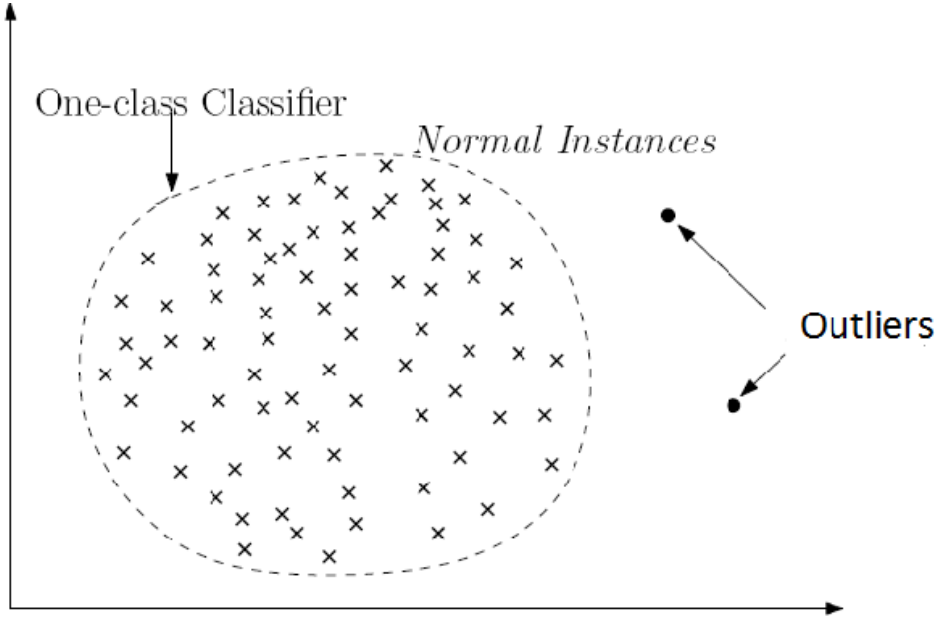
- Failures are typically rare and catastrophic
  - Fleet size is small
  - No run to failure mentality
  - Many failures should never happen
- Hydropower plants are big. A lot of stuff can potentially go wrong

Now what?

- We don’t have examples of failures
- But we (can) have tons of examples of healthy behaviour

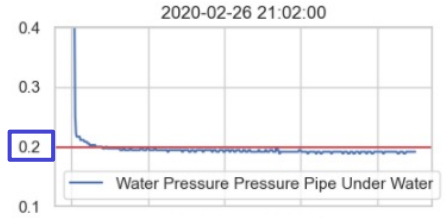
One class classification



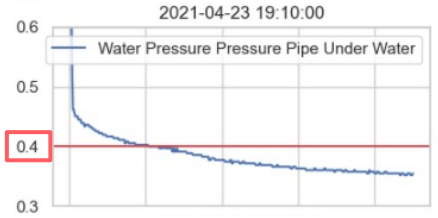


https://www.researchgate.net/figure/Plot-with-the-targets-and-outliers-in-a-one-class-classification-problem-on-the-right-On_fig7_228071338

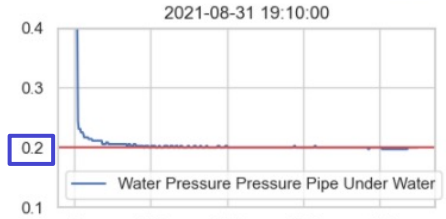
Real Data – Real Steel



Before damage

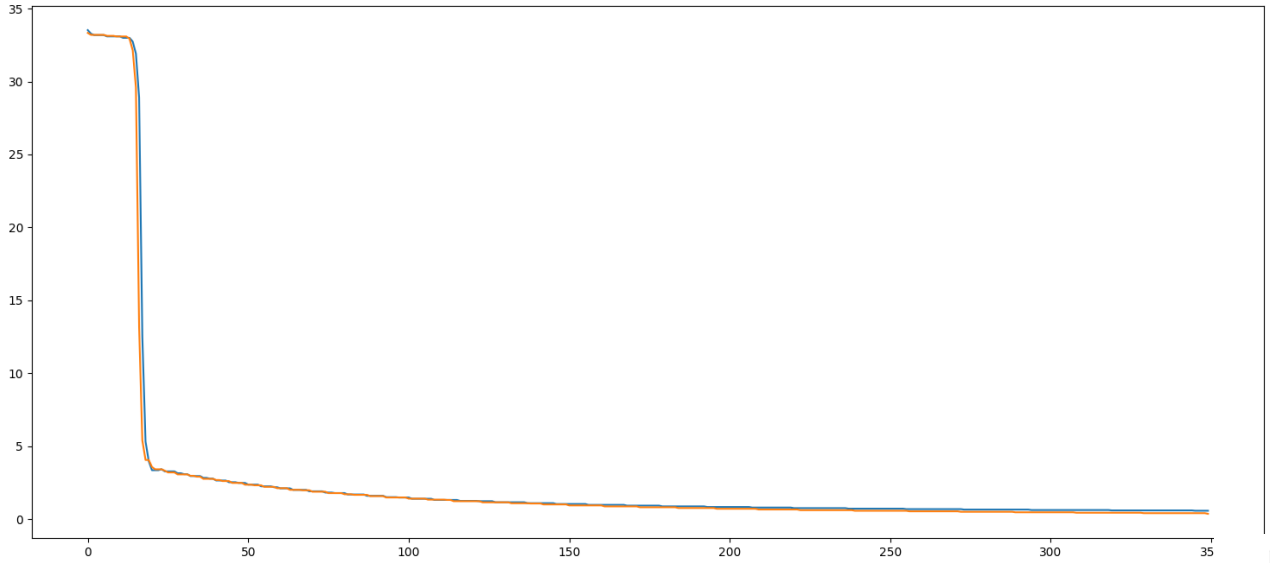


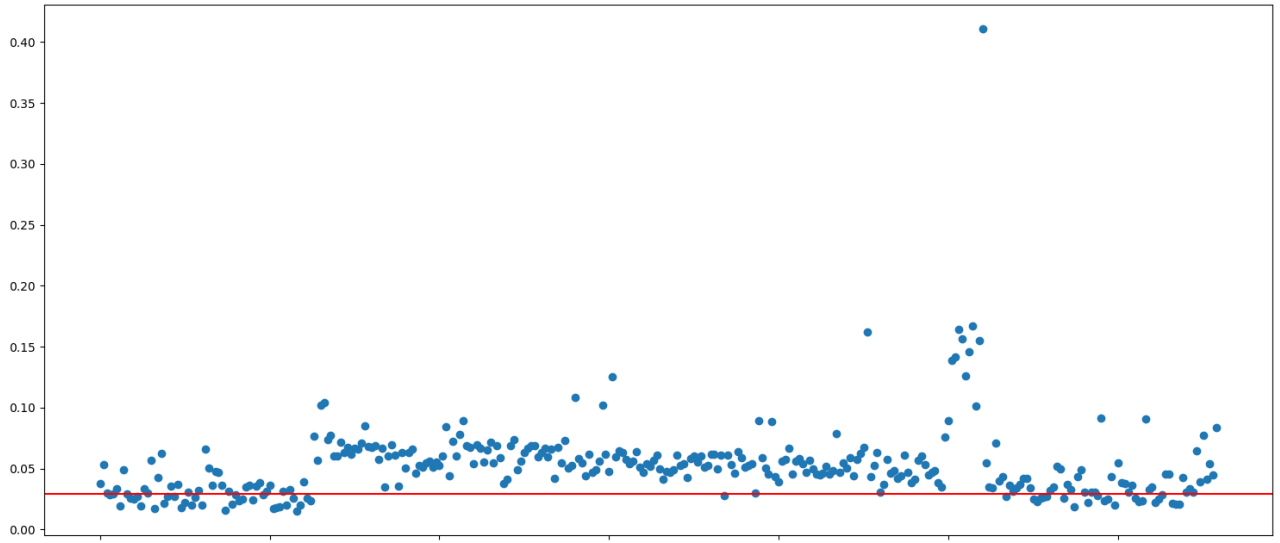
Between damage and repair



After repair

Real Data – Real Steel





-9 Months

Detection

How do we scale this?

We need to monitor a large part of the potential failures to have a good chance of catching something

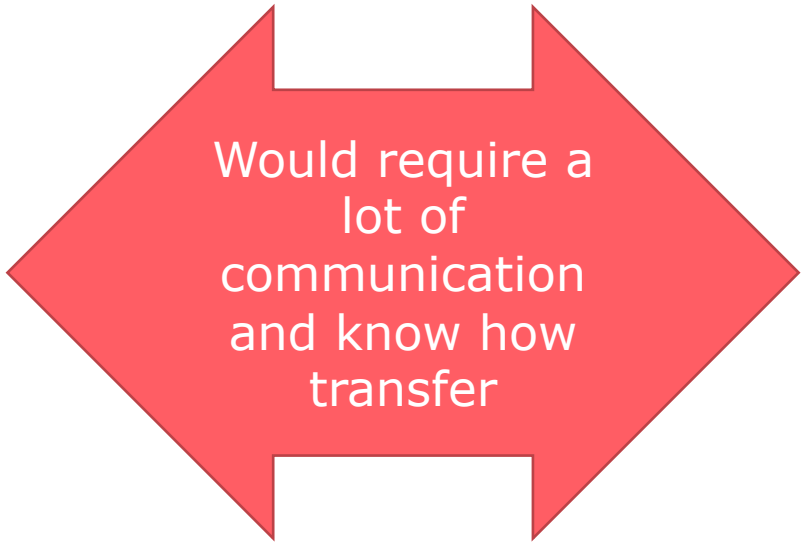
Casting the big net
Bring domain and data knowhow together

Maintenance Crew

- Knows where monitoring is necessary
- Knows which sensors are informativ

Hydro Analytics Team

- Knows how to build the algorithm



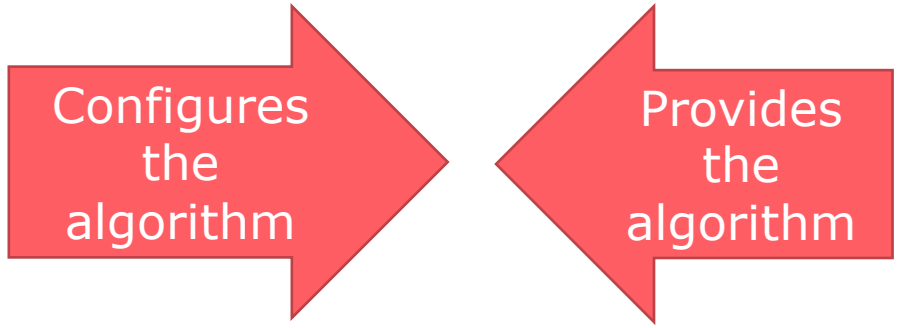
Casting the big net
Everyone does what they know best

Maintenance Crew

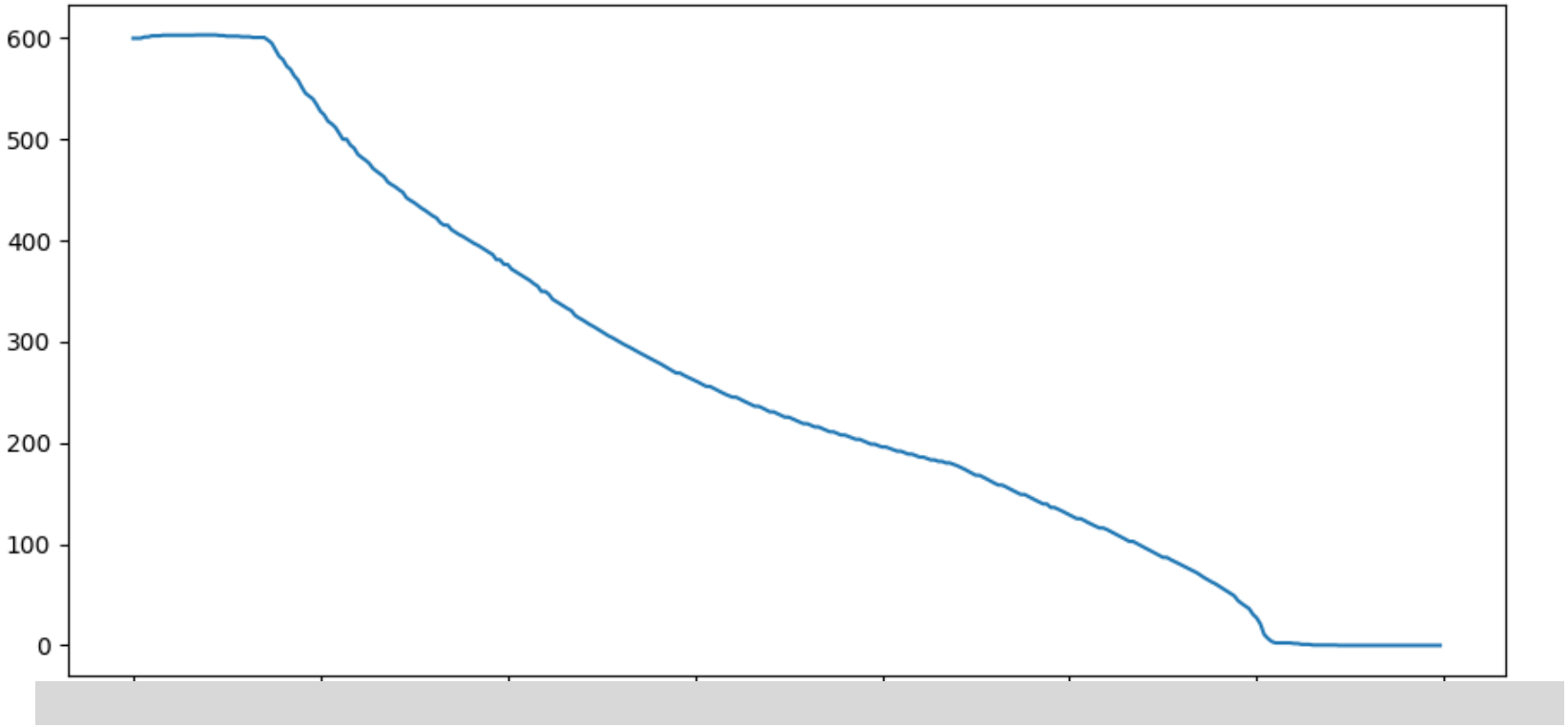
- Knows where monitoring is necessary
- Knows which sensors are informativ

Hydro Analytics Team

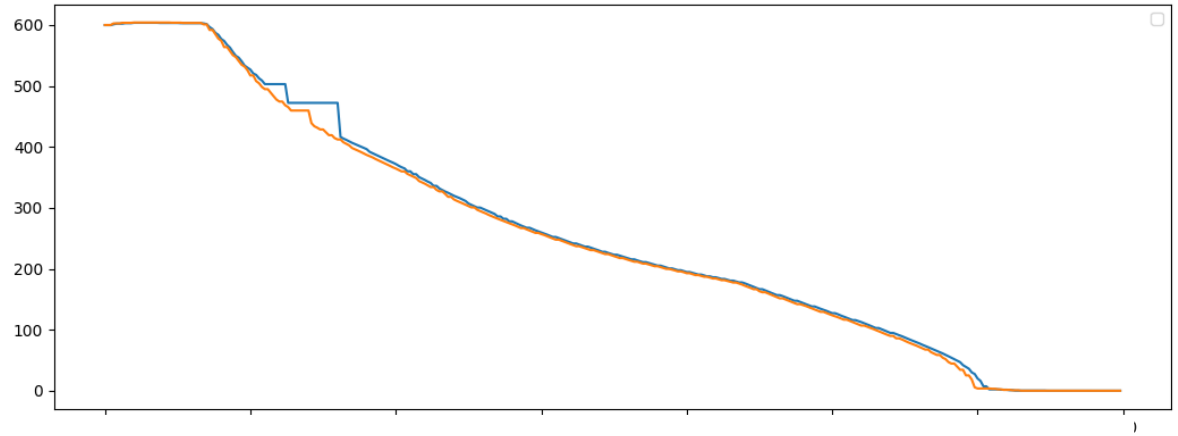
- Knows how to build the algorithm

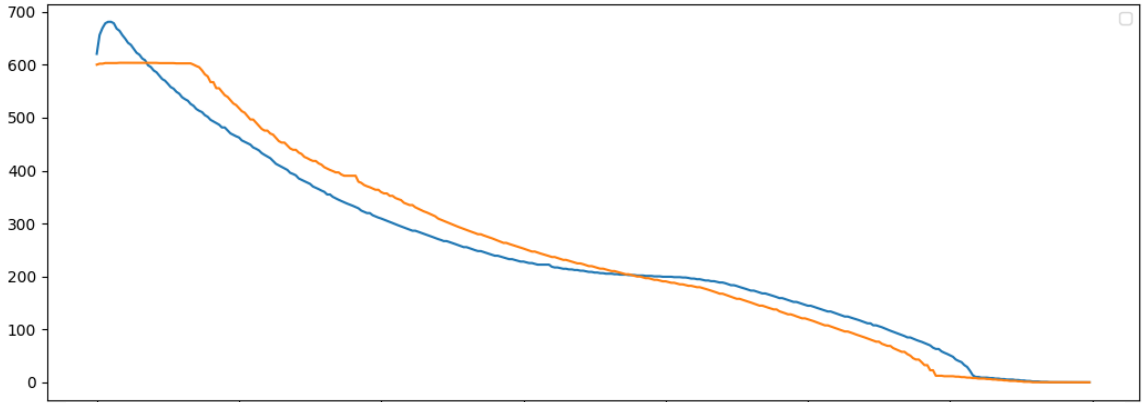


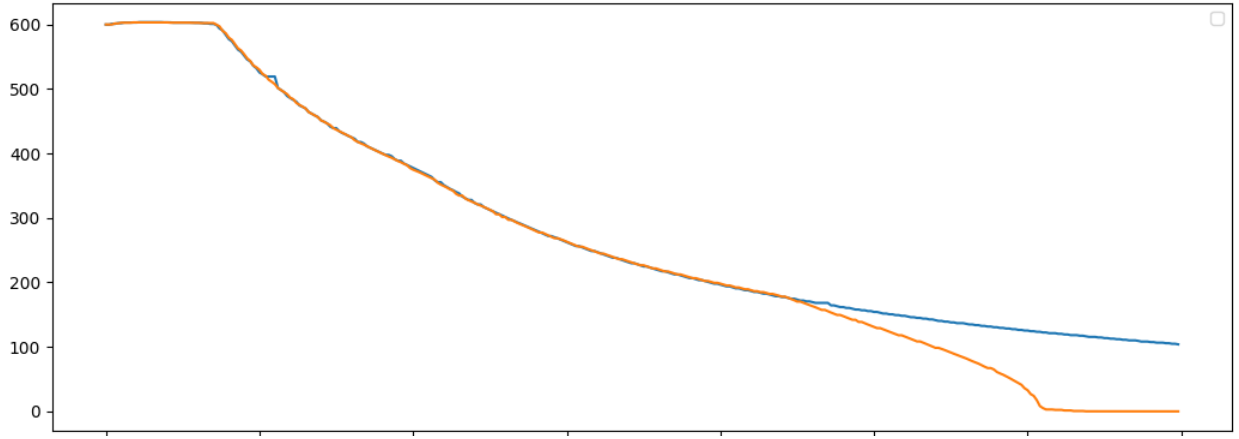
Transient Monitoring



Transient Monitoring







Live Demo HI

Configurator

Is data analytics in hydropower about improving or preserving the status quo?

- Hydropower availability is very high nowadays
- Unlucky coincidence between retirement and power plants age reaching wear out phase
- Could you maintain your availablitity if you lose your most experienced people?
- Only prudent to prepare in time for knowhow transfer and potentially longer recruitment processes

Recommended first steps

- If you don’t already collect data, start now
- Get the excels out of local drives and into your organization

Let’s have a conversation

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