CASE STUDY

Data-driven Digital Twin for Predictive Maintenance in Industry 4.0

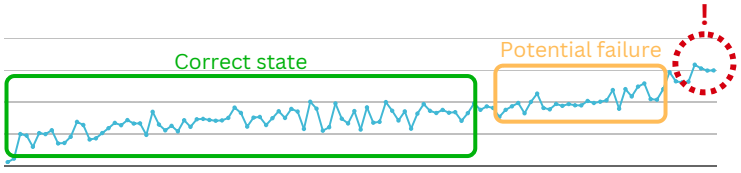
OBJECTIVES

In this project, we developed a digital twin of an electro-hydraulic oscillation system used in the process of steel, with the aim of:

- detecting faults;
- classifying the condition of the machine;
- predicting maintenance.

ACTIVITY

In this project, we used two different techniques: Principal Component Analysis with Mahalanobis distance, and Autoencoder neural network approaches to learn from the data the regime condition of the analyzed system.
The two approaches, with different levels of stochasticity and complexity, discover - from the historical data and without any knowledge about the physics - a latent low-dimensional state. This indicates that the state of the machine is deteriorating before finally, it reaches an interruption/failure at the end.



RESULTS

Both of the techniques were able to detect anomalies and let the operator stop the machine for maintenance, avoiding fatal errors and interruption. Monitoring the slope of the Mahalanobis distance or the reconstruction error can provide information on how fast the machine ages. Alarms can be raised if the slope changes suddenly. By using these two approaches, we can perform predictive maintenance, condition monitoring and fault detection.

Goals

Realization of algorithms to detect machinery/process errors, so guarantee predictive maintenance.

Benefits

- Real-time control of machine status.
- Data-driven model
- Avoid machine/process errors and damages

Our techniques allows agnostic predictive maintenance avoiding errors and damages.

- Andrea Martini
Fast Computing