Wrocław University of Science
and Technology

We all collect many trends – how can we make use of it for automatic prognosis

Hamid Shiri

This activity has supported under the Marie Sklodowska Curie programme through the ETN MOIRA project (GA 955681) by European Commission.

Agenda

- **Introduction**
- **Prognosis and diagnosis**
- **Model**
- **Results**
- **Conclusion**

This activity has supported under the Marie Sklodowska Curie programme through the ETN MOIRA project (GA 955681) by European Commission.

Machines in industries

- Automation
- Efficiency and Speed.
- Innovation and Advanced Capabilities.

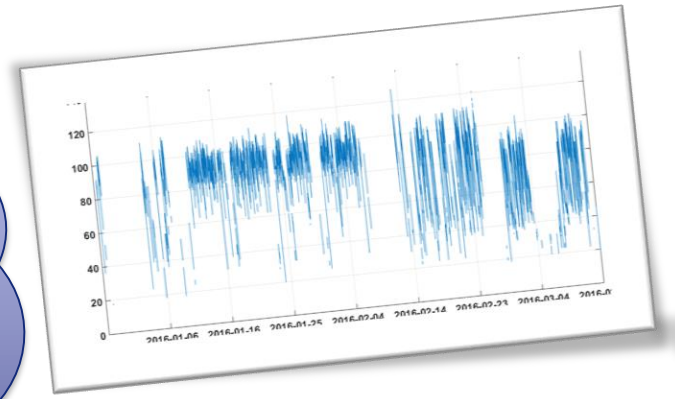
This activity has supported under the Marie Sklodowska Curie programme through the ETN MOIRA project (GA 955681) by European Commission.

Prognosis and diagnosis

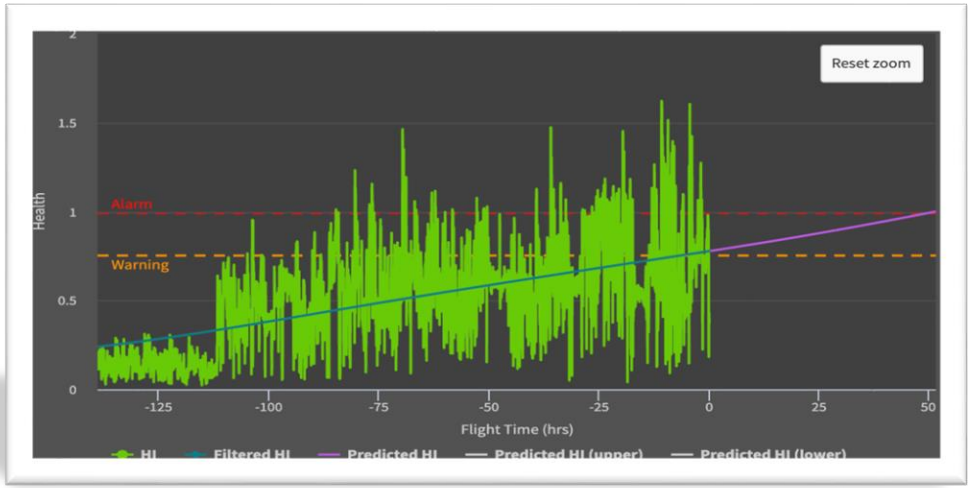
- **Preventive Maintenance**
- **Optimal Performance**
- **Cost Reduction**

Collecting signal

We have collected a vast amount of data over the course of hours, days, months, and even years. However, I am unsure how to extract meaningful information from this data in order to enhance our company's performance.

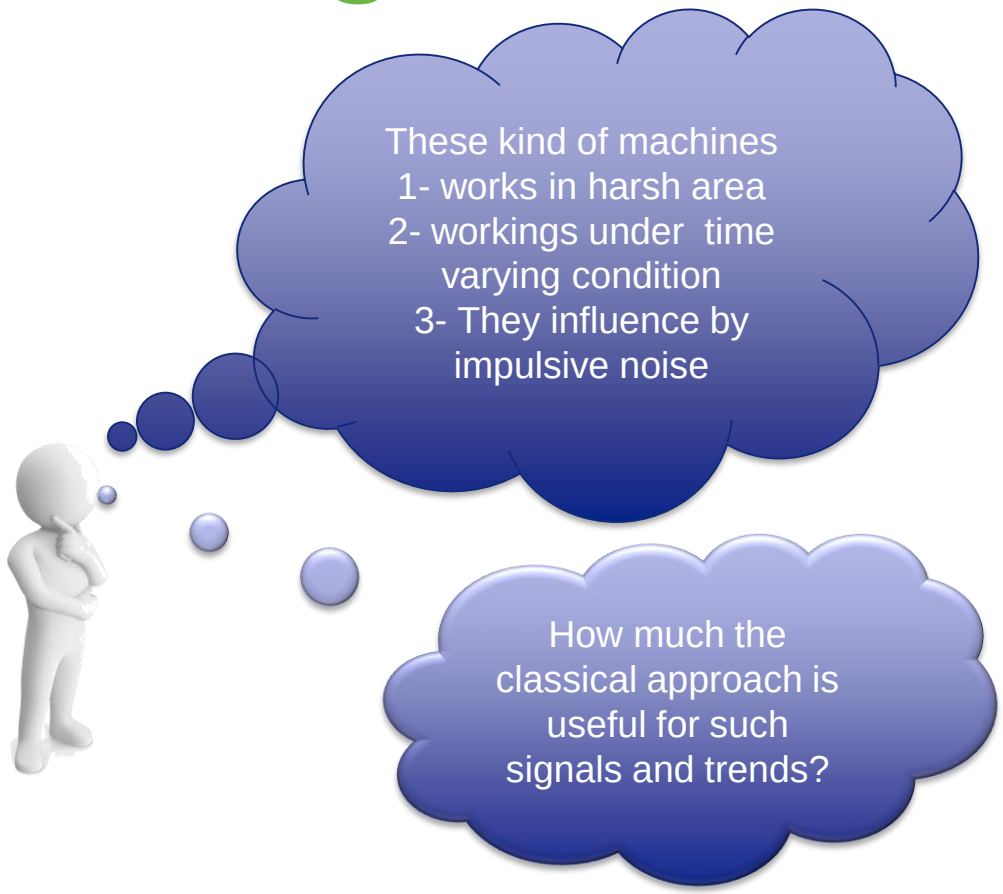


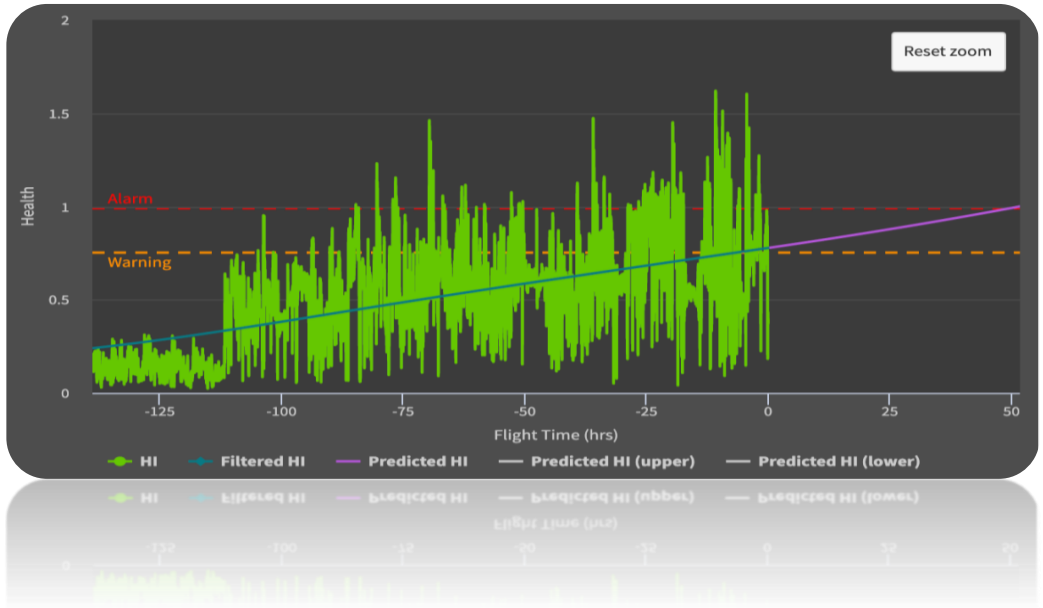
Do not worry we are here to answer these questions!



This activity has supported under the Marie Sklodowska Curie programme through the ETN MOIRA project (GA 955681) by European Commission.

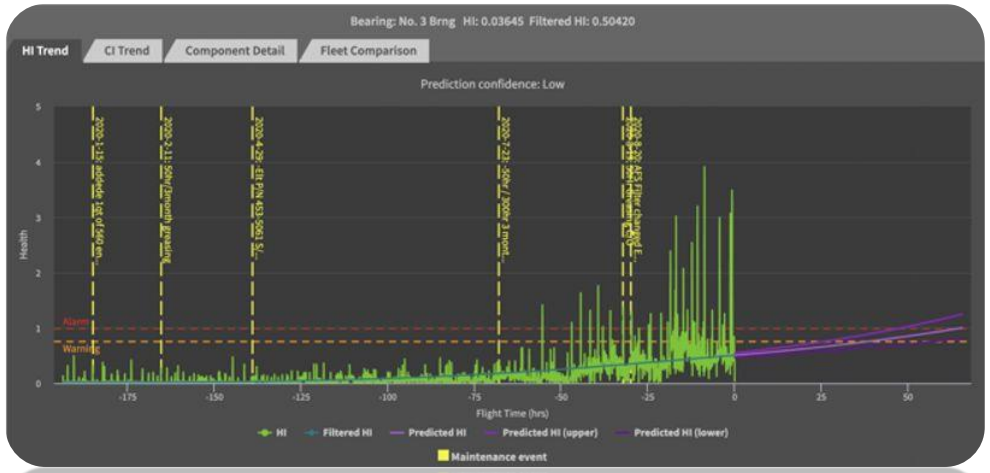
Challenges





This activity has supported under the Marie Sklodowska Curie programme through the ETN MOIRA project (GA 955681) by European Commission.

Important question?



What we should do for such a signal?

Ask from chat GPT!!!

I. Statistical Analysis

II. Machine Learning Techniques

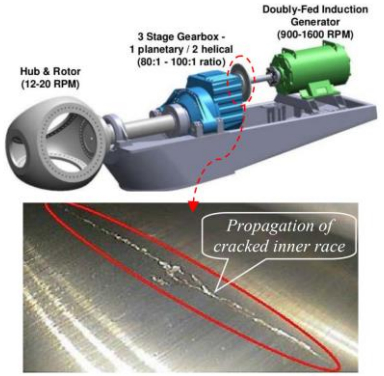
III. Frequency Analysis

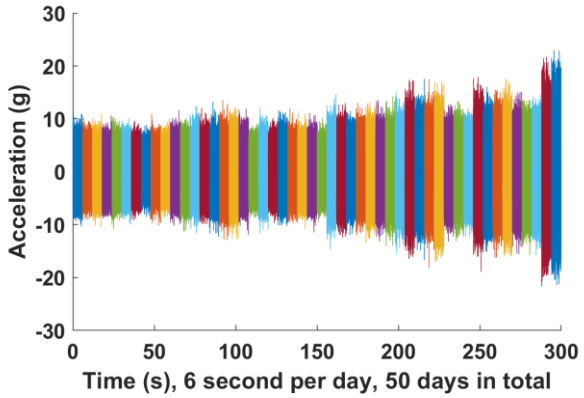
IV. Pattern Recognition

This activity has supported under the Marie Sklodowska Curie programme through the ETN MOIRA project (GA 955681) by European Commission.

Statistical Analysis

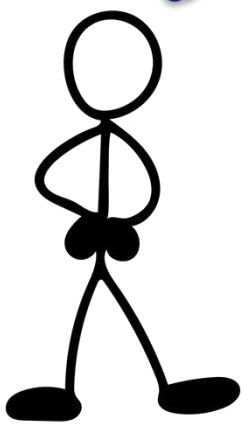
Statistical Analysis: SA utilizes statistical techniques to monitor and control processes, including vibration condition monitoring. It analyzes the statistical properties of data over time, such as control charts, to identify deviations from normal behavior.

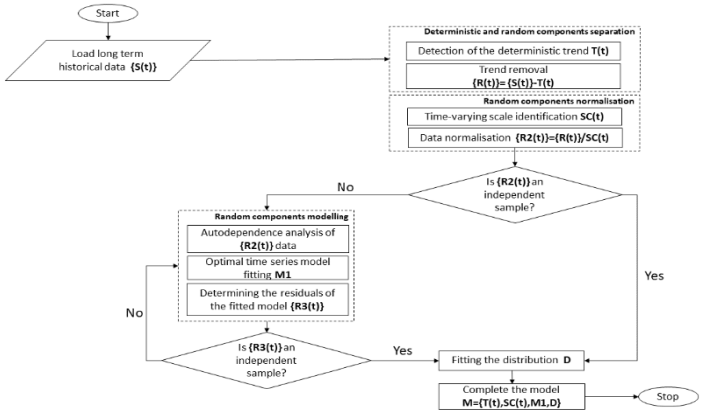




Identification and modeling

Here we proposed a framework to identify and modeling such kind of signal for prognosis purpose





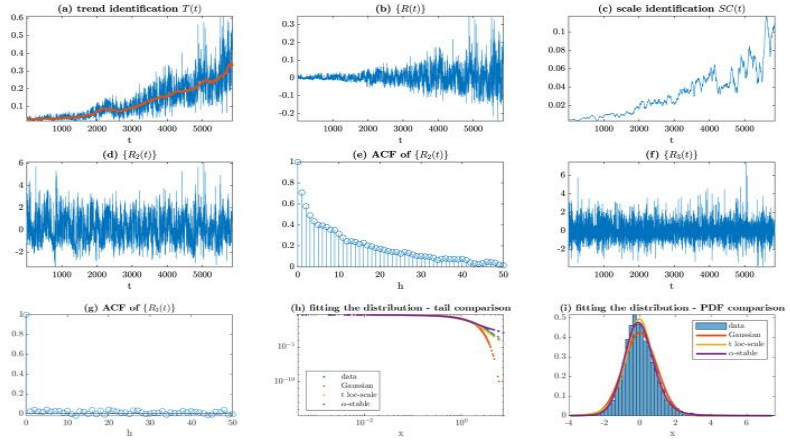
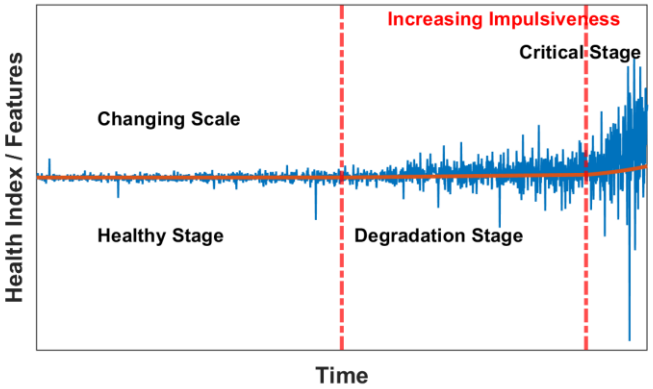


Table 1: Main characteristics of the data for three regimes indicated in Fig. 3.

	Regime 1	Regime 2	Regime 3
Trend	constant	linear	exponential
Scale	nearly constant	linearly growing	exp. growing
Autodependence of random component	relatively small	significant	significant
Coefficients of the stochastic model	negligible	significant	significant
Distribution of the random component	nearly Gaussian	non-Gaussian	strongly non-Gaussian



Contents lists available at ScienceDirect

Mechanical Systems and Signal Processing

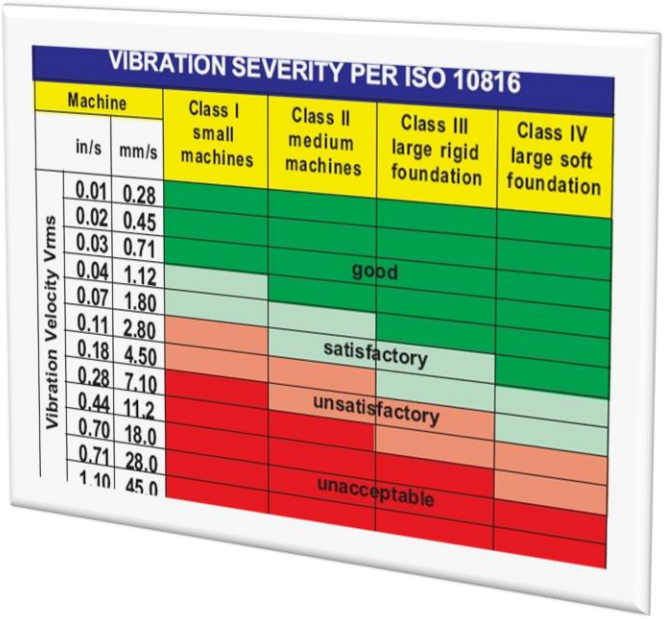
journal homepage: www.elsevier.com/locate/ymssp

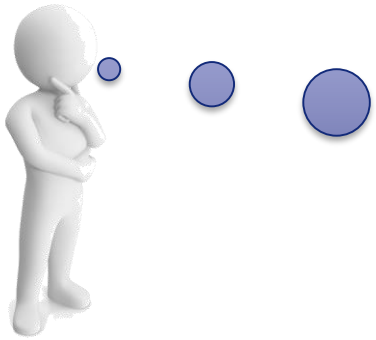
Framework for stochastic modelling of long-term non-homogeneous data with non-Gaussian characteristics for machine condition prognosis

Wojciech Żuławiński [b], Katarzyna Maraj-Zygmąt [b], Hamid Shiri [a], Agnieszka Wyłomańska [b], Radosław Zimroz [a,*]

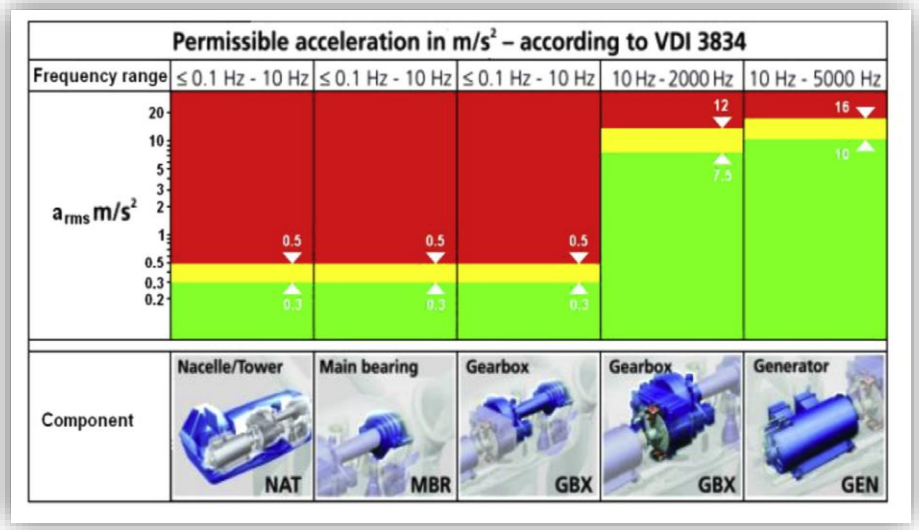
This activity has supported under the Marie Sklodowska Curie programme through the ETN MOIRA project (GA 955681) by European Commission.

Pretty nice it looks good ! Is it possible to use such model for health stage evaluation

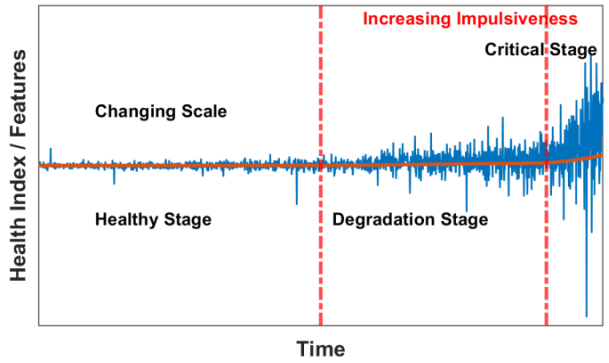


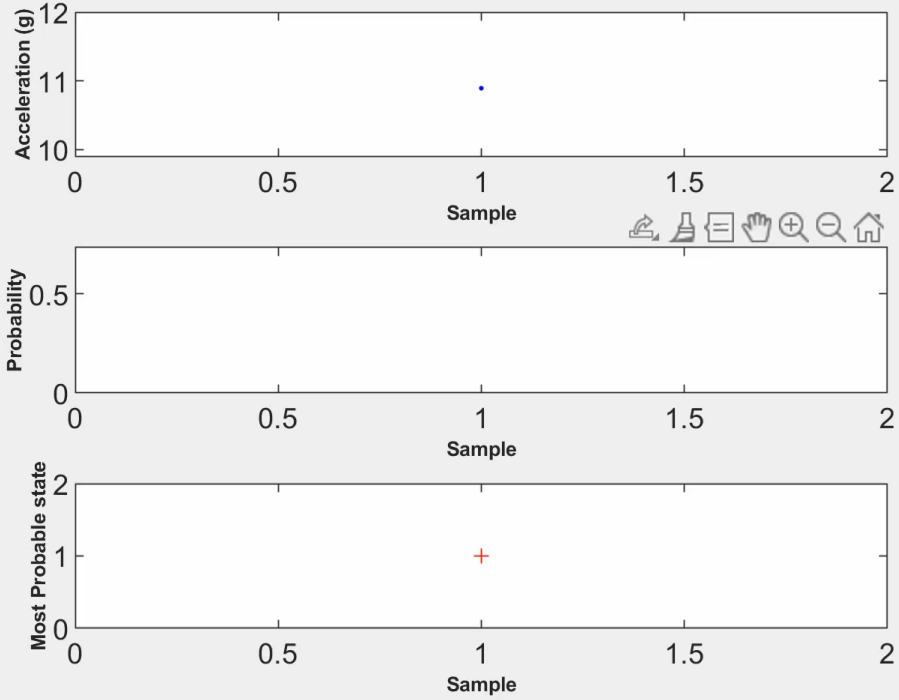


We always use classic approach to vibration monitoring however we usually face with fake warning and alarm



Statistical Analysis





Contents lists available at ScienceDirect
Mechanical Systems and Signal Processing
journal homepage: www.elsevier.com/locate/ymssp

Using long-term condition monitoring data with non-Gaussian noise for online diagnostics

Hamid Shiri [a,*], Pawel Zimroz [a], Jacek Wodecki [a], Agnieszka Wyłomańska [b], Radosław Zimroz [a], Krzysztof Szabat [c]

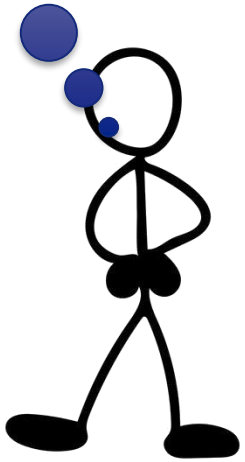
[a] Faculty of Geoengineering, Mining and Geology, Wroclaw University of Science and Technology, Na Grobli 15, 50-421 Wroclaw, Poland
[b] Faculty of Pure and Applied Mathematics, Hugo Steinhaus Center, Wroclaw University of Science and Technology, Wyspianskiego 27, 50-370 Wroclaw, Poland
[c] Faculty of Electrical Engineering, Department of Electrical Machines, Drives and Measurements, Wroclaw University of Science and Technology, Wyspianskiego 27, 50-370 Wroclaw, Poland

This activity has supported under the Marie Sklodowska Curie programme through the ETN MOIRA project (GA 955681) by European Commission.

What is the next?

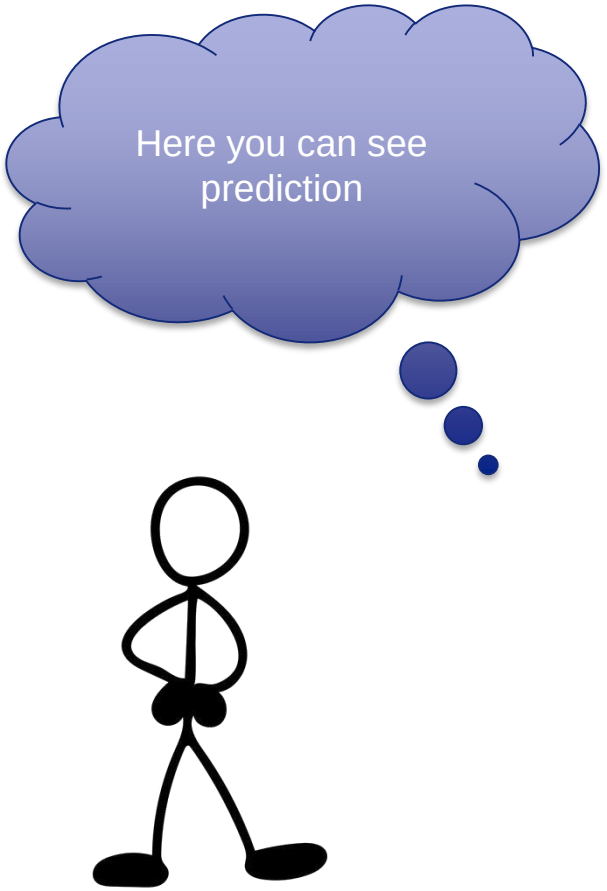
Okay, we detected the first point of the last regime. So we should shut down the Machine?
How long does it take to machine is broken?

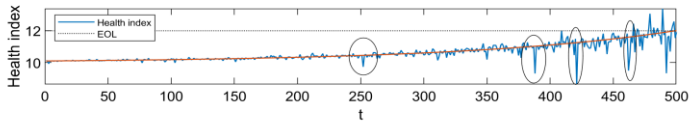
Yes, we have a model that only needs to fit model by identified parameter

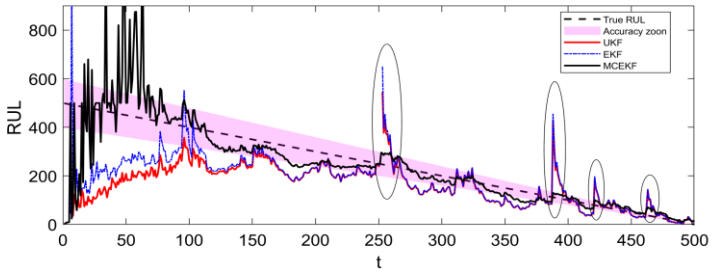


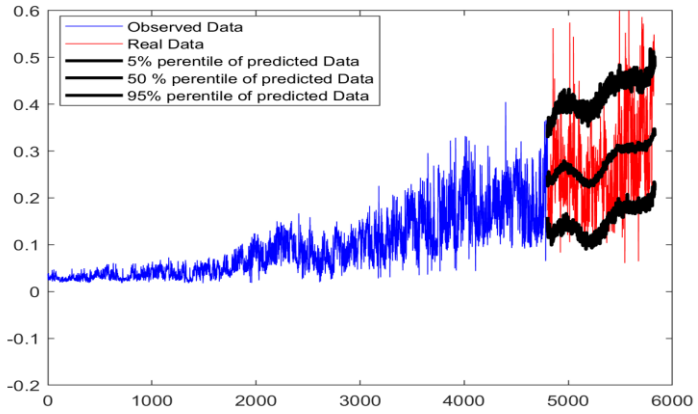
This activity has supported under the Marie Sklodowska Curie programme through the ETN MOIRA project (GA 955681) by European Commission.

What is the next?









This activity has supported under the Marie Sklodowska Curie programme through the ETN MOIRA project (GA 955681) by European Commission.

Wrocław University of Science and Technology

Digital Mining Center

Thanks for your attention!

This activity has supported under the Marie Sklodowska Curie programme through the ETN MOIRA project (GA 955681) by European Commission.

https://dmc.pwr.edu.pl/

@ radoslaw.zimroz@pwr.edu.pl

@ hamid.Shiri@pwr.edu.pl