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Data Driven Methods for Fault Detection Diagnostics and Prognostics in Wind Energy Systems

Outline

- Our Project in a Nutshell
- First Results
- Lessons Learned, Challenges and Future Work

Our Project in a Nutshell

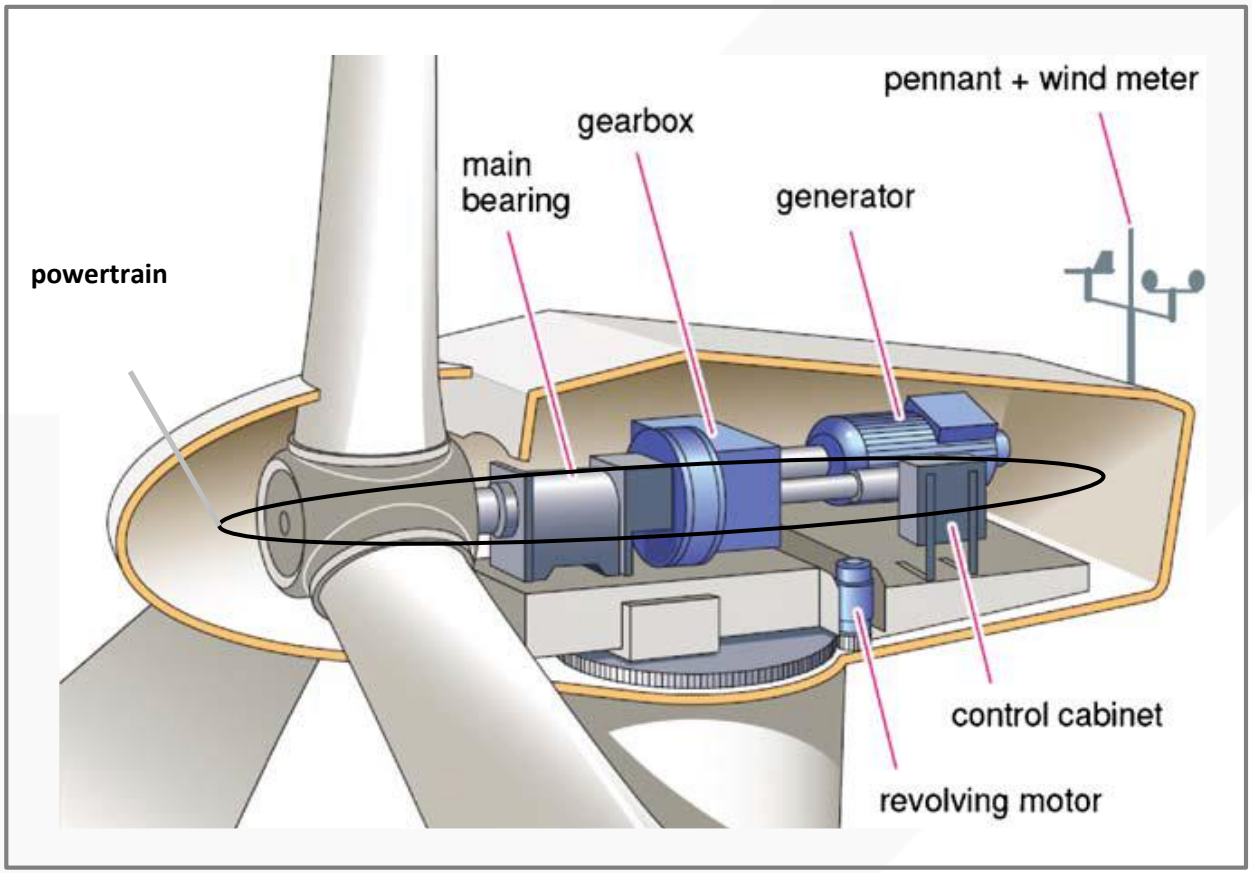
Intelligent Maintenance of Wind Energy Systems

Onshore-WEA

Offshore-WEA

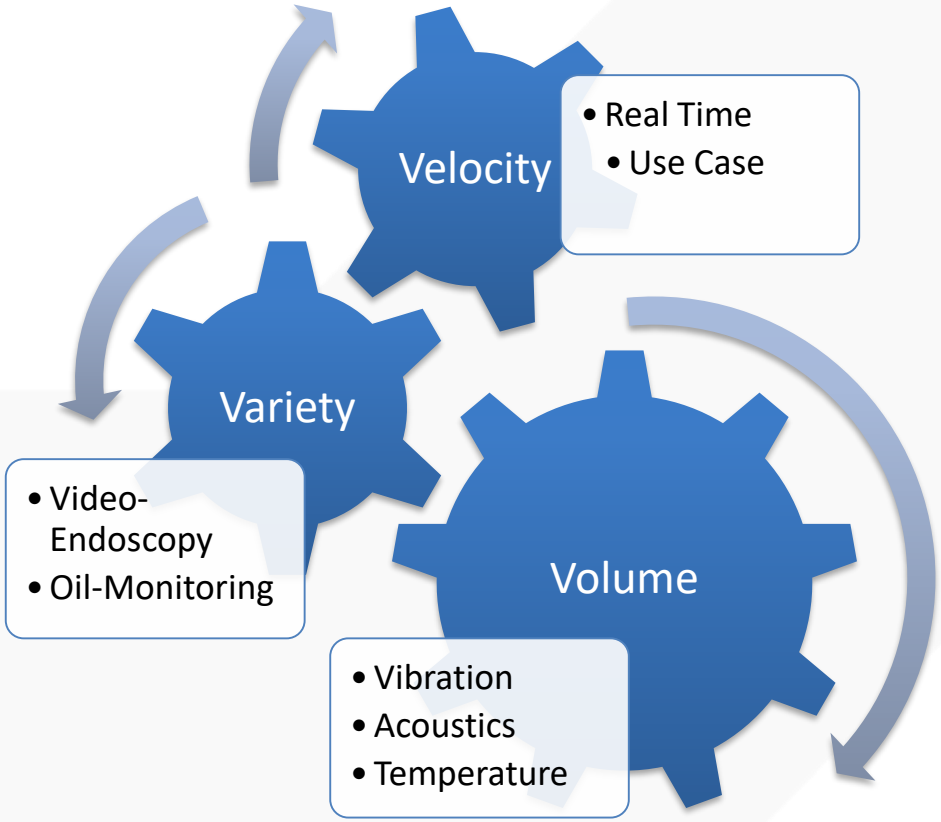
Our Project in a Nutshell

Intelligent Maintenance of Wind Energy Systems



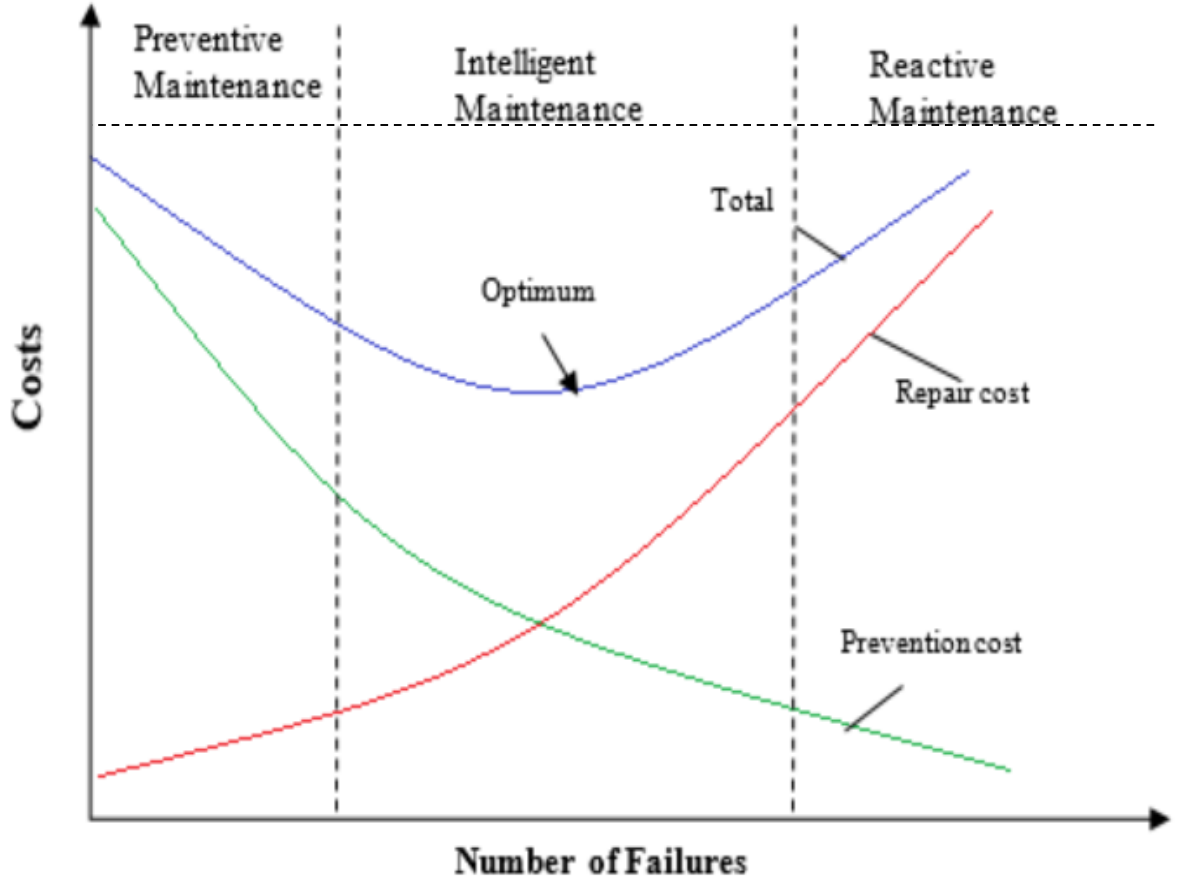
Our Project in a Nutshell

Intelligent Maintenance of Wind Energy Systems



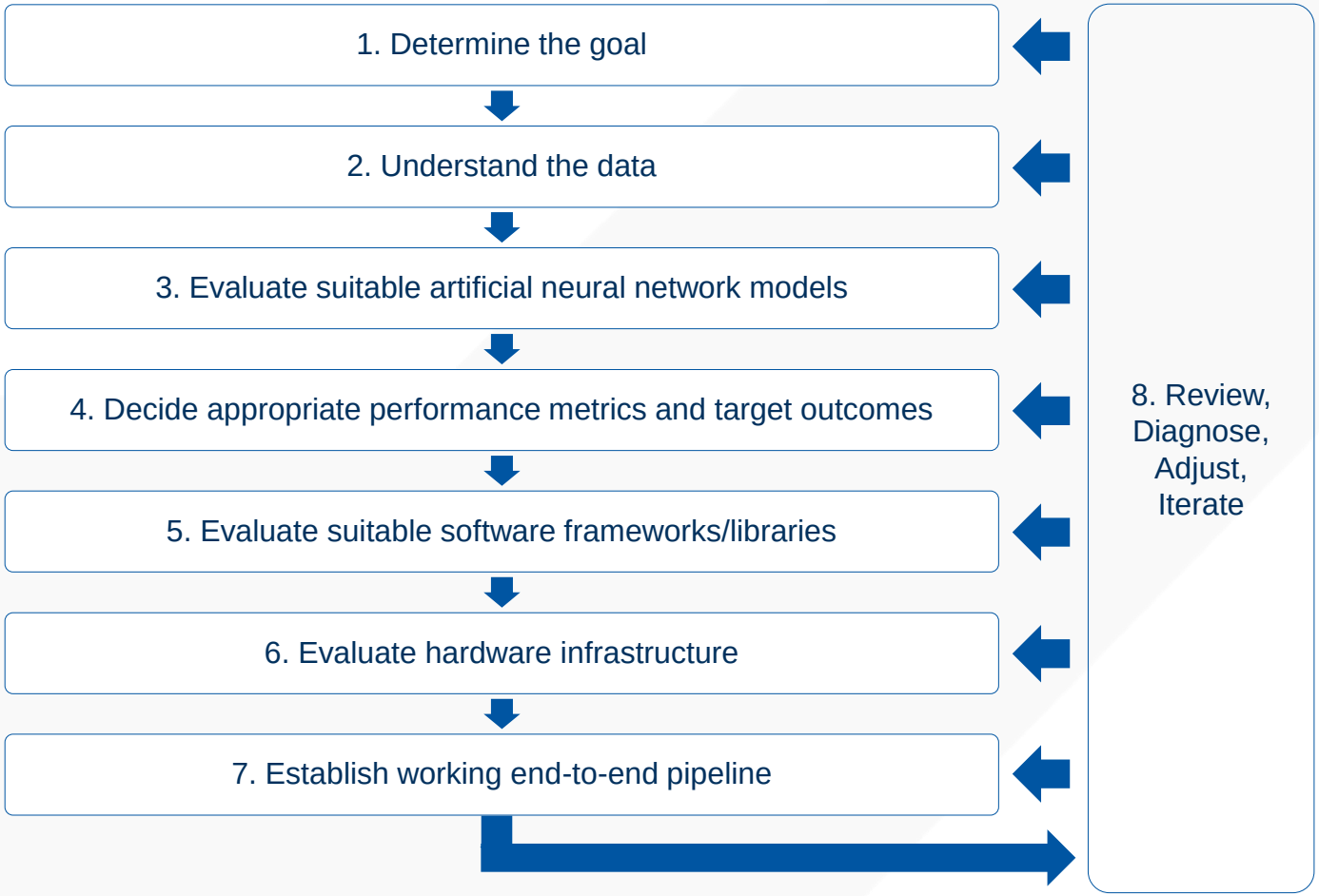
Our Project in a Nutshell

Intelligent Maintenance of Wind Energy Systems

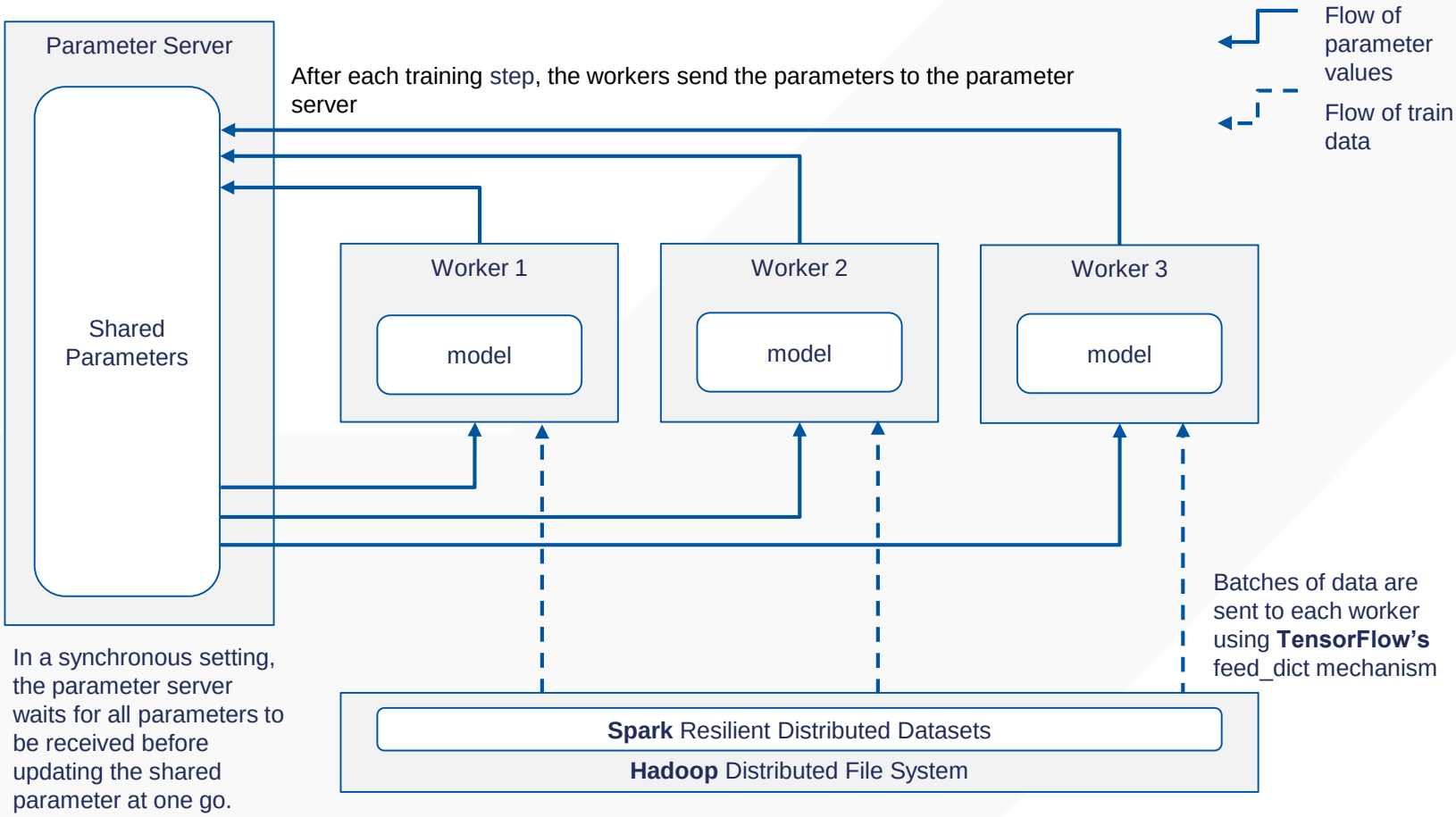


Our Project in a Nutshell

Design: a practical process



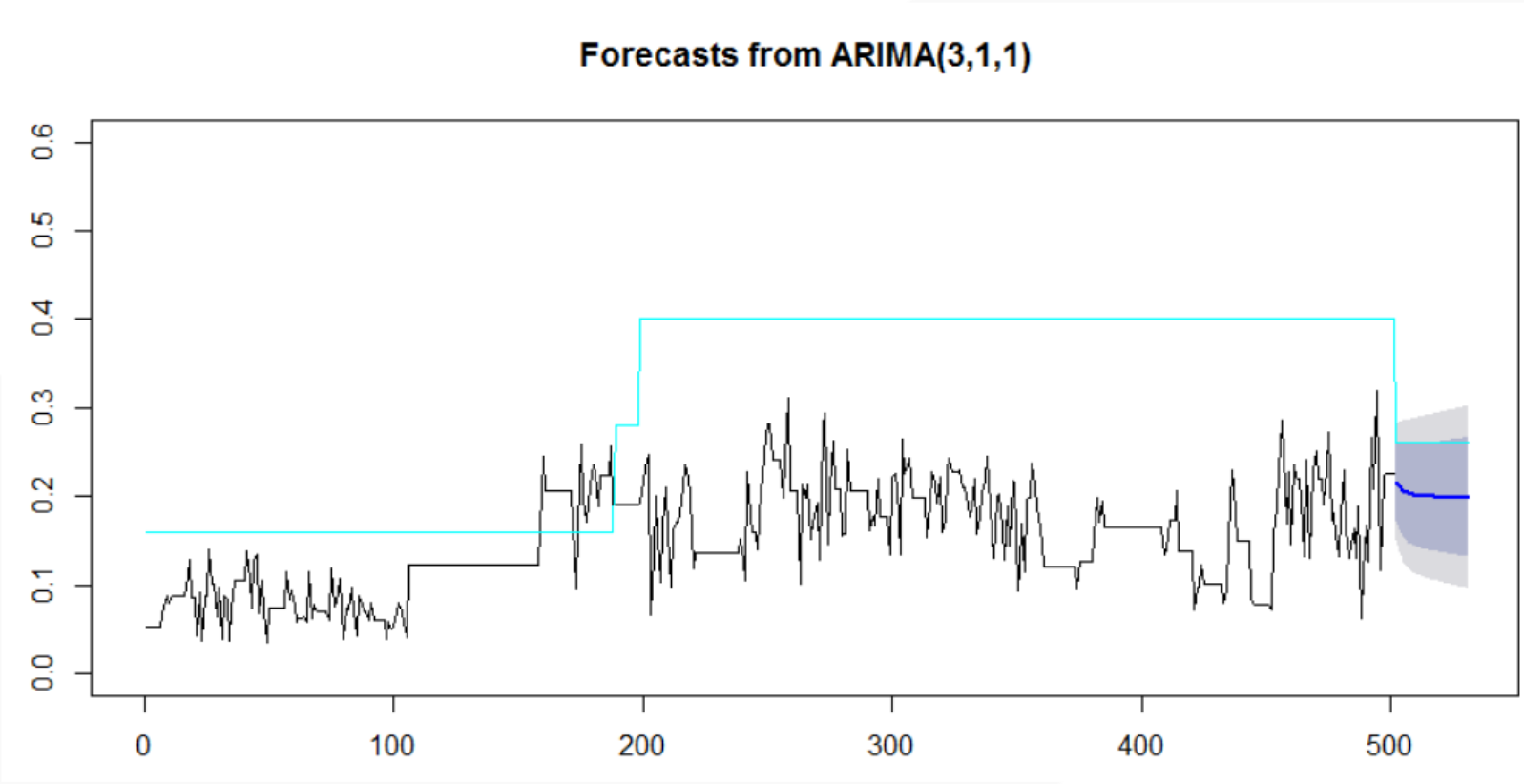
Our Project in a Nutshell



Data Parallelization = Between-graph Replication + Synchronous Training

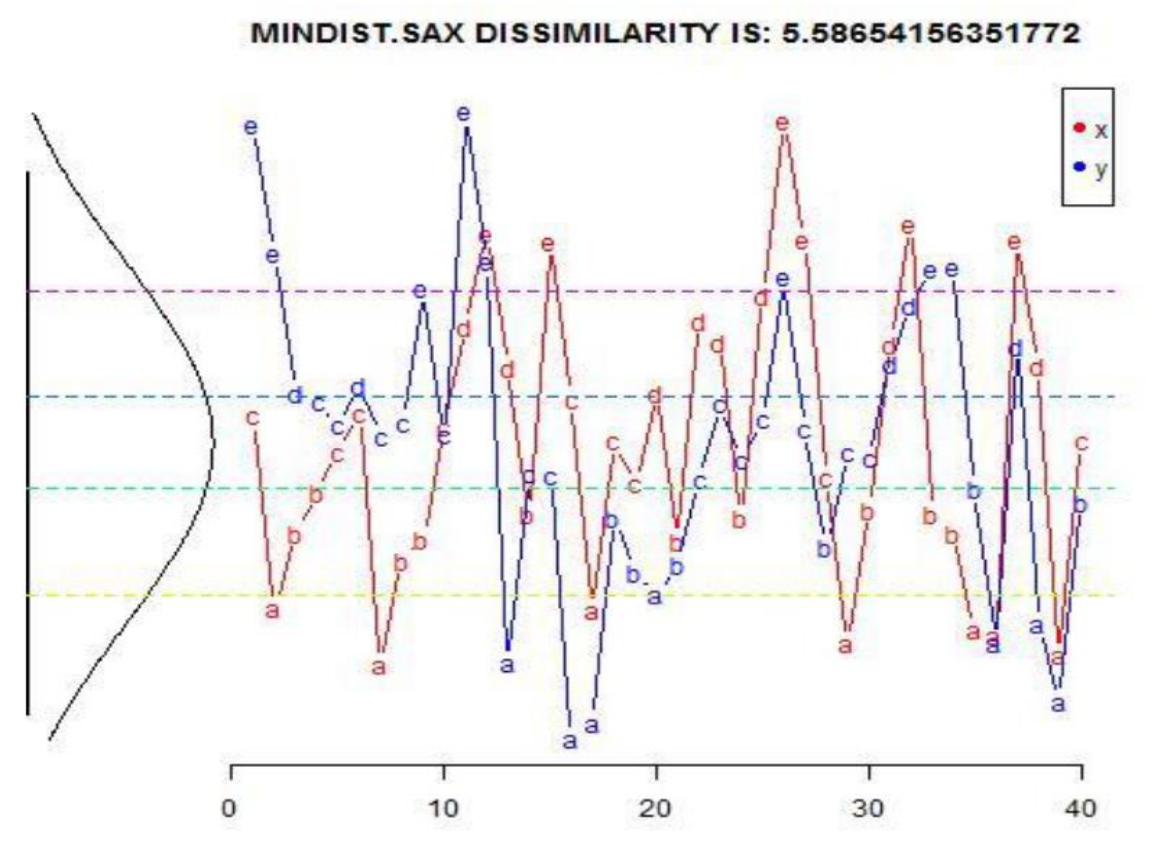
First Results

Some results using simple ARIMA models



First Results

Some results using symbolic models like SAX



First Results

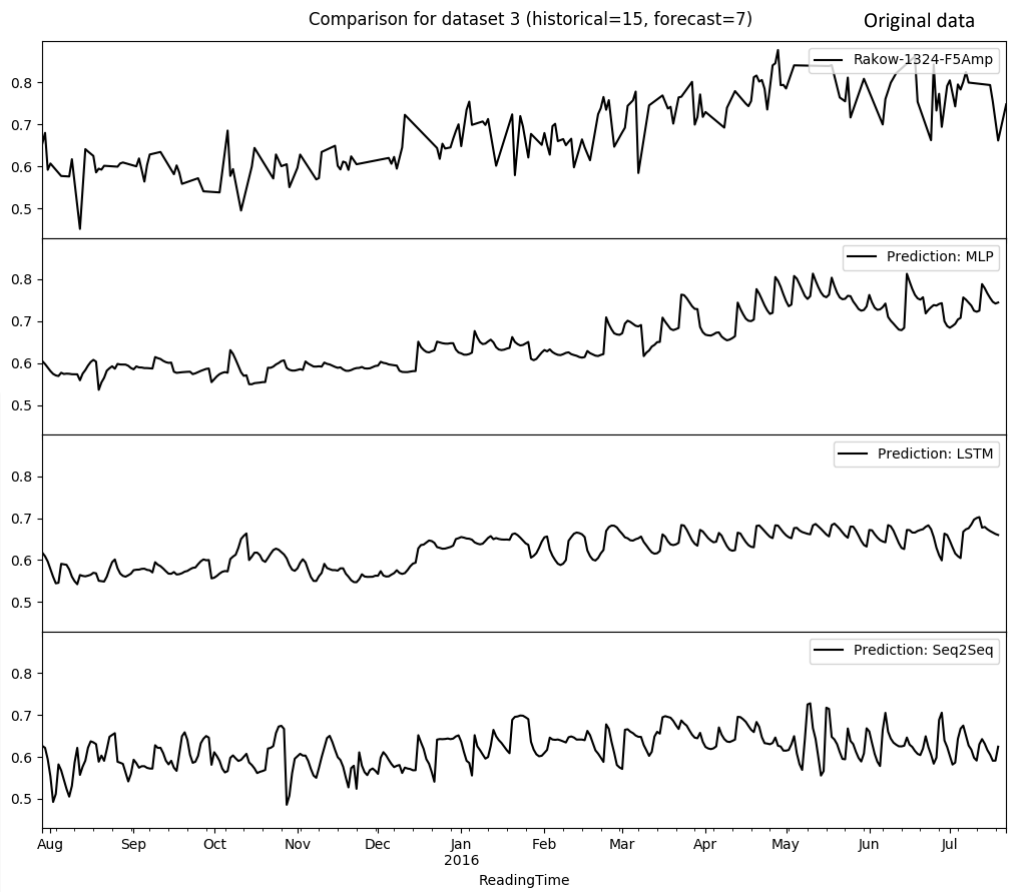
Some results using neural networks

Multiple Steps = 7 days

Multi-Layer Perceptron

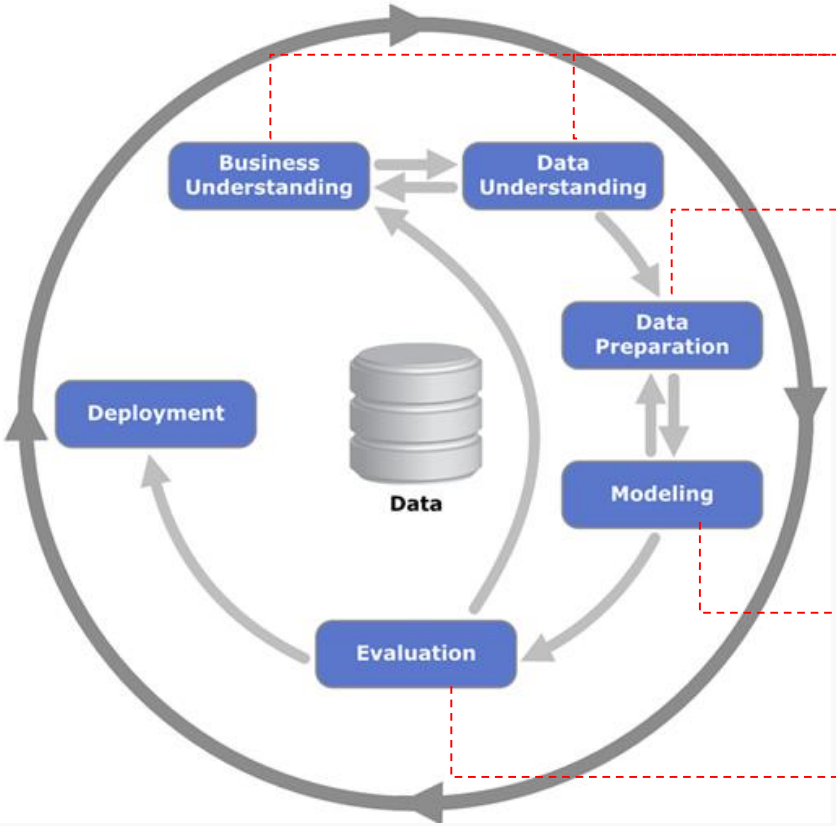
Long Short Term Memory

Sequence to Sequence



Challenges and Future Work

Applying the Standard Model CRISP-DM



Lacking Domain Knowledge

Missing Meta Data
Data Quality Issues
- Outlier
- Missing Values

- Different approaches
- Lack of understanding
- Different languages
- Different expectations

Many tools
Many models
Many calibration possibilities

„Classic model evaluation
Evaluation through experts
Many visualization tools

Challenges and Future Work

- Main challenges:
  - Understanding each other / Speaking the same language
  - Bringing together physical approaches and data driven approaches
  - Making engineers understand the results of the applied machine learning algorithms

- Future Work
  - Using multiple sources
  - Using unstructured data (reports) and video material in addition