

Machine Learning Applications

Winter semester 2019/2020

Simon Mehringskötter

Lecture VI

Introduction to Practical Part of Exam

What should you be able to take out of the lecture today?

- Information about EnBW
- Organizational overview of practical part of exam
- Application procedure for the exam
- Available tasks for the group work
- Brief overview of the available data








ORGANIZATIONAL OVERVIEW

What is the idea behind the practical part of the exam?

- Work on an industry-related task with real data from industry
 - Open tasks that require creative thinking
 - **Apply machine learning / data mining techniques** on a real dataset
 - Work out your methods and results together in a group
 - Document your methodology and findings
 - Present your results in a short pitch
- ➔ Get a feeling for tasks on real data instead of solely academic tasks



What do we expect from you?

-  Self-organize your tasks and your group
-  Understand and get behind the problem from industry perspective
-  Evaluate your machine learning / data mining approaches
-  Review your results critically
-  Justify your proposed methods and algorithms
-  Concise documentation and presentation
-  Comprehensible programming code

What is the form of the documentation / presentation?

Documentation

- Use available Word-Template
- Do not change the template
- Structure and chapters are given
- Maximum of 7 pages per group
- Hand-in your documentation and programming code latest on 23rd February 2020 23:59

Presentation

- Use available PowerPoint-Template
- Do not change the template
- Structure and headlines are given
- You have **exact 5** minutes to present and approximately **8 minutes** for discussion
- Only one person of the group presents
- Hand-in your presentation as PDF latest on 2nd March 2020 06:00

➔ All obligatory details can be found in **Hinweise zur Prüfung** in Moodle

APPLICATION PROCEDURE

Why is there an application process and when does it start?

- Limited slots available for exam
- Participants will be drawn randomly from interested students
- Expression of your interest to be part of the exam starts today at 4 PM
- Only students that are drawn are allowed to register in TUCaN
- **After your registration in TUCaN you must accomplish the whole exam (including written exam)!**
- Make sure you have the dates for each step in mind!
- Groups are created randomly and tasks are assigned randomly!

→ The process is described in **Moodle** and more detailed in the document

Hinweise zur Prüfung

Basis for all tasks of the practical part

DATA OVERVIEW

Which information are available about the wind farms and which are not?

Facts that we can tell

- 1st wind farm: 6 wind turbines
- 2nd wind farm: 18 wind turbines
- Wind farms are on-shore
- Available data over periods of 2-7 years duration

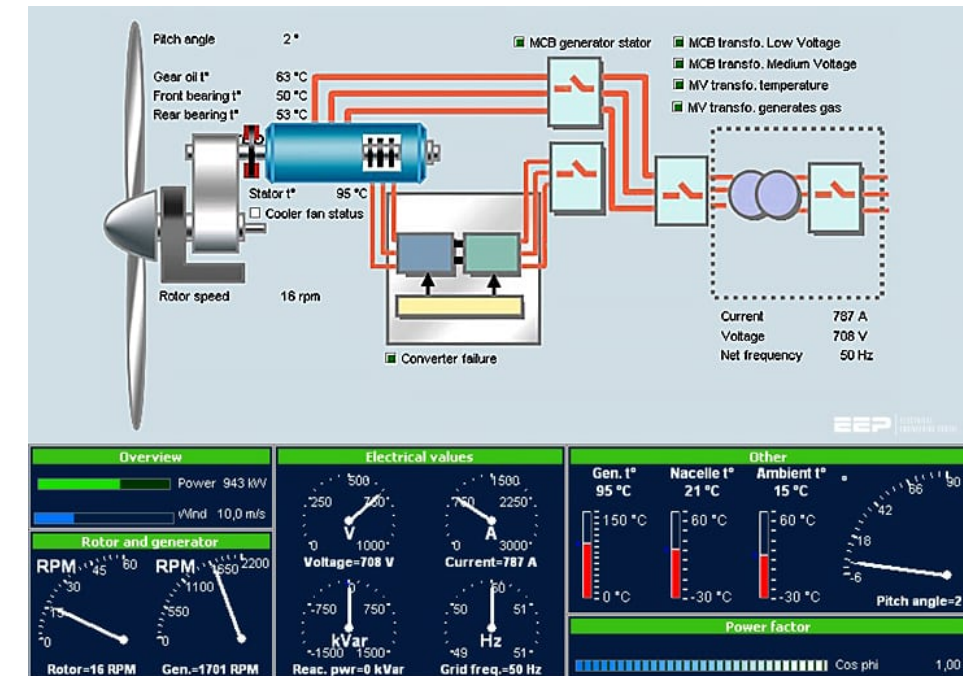
Facts that we do not know

- Location of wind farms
- Type and manufacturer of wind turbines
- Exact DAQ concept and sensor types
- Maintenance actions carried out

Where does the database come from?

- Data are so-called SCADA (Supervisory Control and Data Acquisition) data
- SCADA data is used to control and monitor a wind turbine
- Data comes from different subsystems (generator, rotor, electronics...)
- Data is aggregated on a 10 minute basis and stored on wind turbine server (mean value, standard deviation, minimum & maximum value)
- Data is stored each 10 minutes 24 hours 7 days a week

Source: (1)



How can I get the data and what do I find in the data?

- Data will be made available as comma separated files on FSR server
- There is a json-formatted file that includes further description and the units of the parameters
- Whole dataset has 524 individual parameters
- 146 parameters are available in all wind turbines
- Some parameters might be available in the files but don't contain useful information (e.g. NaN, Inf,...)

What are typical parameters that might be interesting?

- Environment
 - Temperature
 - Windspeed
 - Wind direction (absolute / relative)
- Rotor
 - Blade pitch angle
 - Rotational speed
- Generator
 - Rotational speed
 - Several bearing temperatures
 - Temperature of electrical phases
- Gearbox
 - Bearing temperature
 - Oil flow and temperature
- Electronics
 - Current phase 1-3
 - Voltage phase 1-3
 - Power frequency
 - Effective power inverter
 - Reactive power inverter
 - Effective and reactive power consumption
 - Effective and reactive power delta net
 - Sum of effective and reactive power
 - Temperatures of transformer phase 1-3
- Tower
 - Acceleration X-direction
 - Acceleration Y-direction
 - Nacelle temperature
 - Position nacelle in azimuth system

What to take with you?

LEARNING OUTCOMES

Key Findings

- Get to know EnBW as a company and energy supplier
- There is a group work to solve a industry relevant task using machine learning techniques as an exam
- The practical exam requires a documentation and presentation
- There are SCADA data available for the exam

References

- (1) <https://electrical-engineering-portal.com/download-center/books-and-guides/electricity-generation-t-d/scada-wind-power-plants>

