Karlsruher Institut für Technologie

Institut für
Thermische Strömungsmaschinen
Prof. Dr.-Ing. Hans-Jörg Bauer, Ord.

ITS

Summer Term 2023
28.04.2023 – 28.07.2023

Data Driven Engineering 2
Advanced Topics

1. Introduction 28/04/2023
- 1.1 The style
- 1.2 Content of the lecture
- 1.3 Group projects and work flow

2. Feature Engineering 05/05/2023
- 2.1 Data cleaning
- 2.2 Data imputation methods
- 2.3 Outlier detection and removal
- 2.4 Feature selection for continuous data
- 2.5 Feature selection for discrete data

3. Advanced scikit-learn 18/05/2023
- 3.1 General API
- 3.2 Model tuning and metrics
- 3.3 Pipelines
- 3.4 Customization and extension options

4. Neural network training 25/05/2023
- 4.1 Learning algorithms
- 4.2 Designing training schemes
- 4.3 Overview of advanced options in TensorFlow

5. Data driven image processing 09/06/2023
- 5.1 Neural networks for image processing
- 5.2 Feature extraction
- 5.3 Convolutional networks

6. Genetic algorithms 23/06/2023
- 6.1 Essentials

6.2 Integration with machine learning
6.3 Coding session

7. Data Driven Control 07/07/2023
7.1 Control systems & linear control theory
7.2 Machine learning control (MLC)
7.3 MLC with genetic programming
7.4 Hybrid methods for data-driven control
7.5 Coding sessions

8. Modelling of transport phenomena with neural networks 14/07/2023
8.1 Latent space physics
8.2 Physics informed/constraint models
8.3 Graph neural networks
8.4 Coding session

9. Project Presentations 28/07/2023

Bonus Lectures

- Dynamic mode decomposition
- State Space Models I, II

Note

- Student must **pick a project group until 12 May 2023.**
- There will be **2 meeting appointments** for each group. We will decide the dates with the group members. One will be in early June; one will be in early July.
- Student **groups** must have **at least 3 members**.
- If you are going to work on a project, register to HPC access list on Ilias **before 5th of May** 2023.