Karlsruher Institut für Technologie

Institut für
Thermische Strömungsmaschinen
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ITS

Summer Term 2021
30.04.2021 – 30.07.2021

Data Driven Engineering 2
Advanced Topics

1. Introduction 30/04/2021
- 1.1 The style
- 1.2 Content of the lecture
- 1.3 Group projects and work flow

2. Data-driven image processing and analysis 07/05/2021
- 2.1 Neural networks for image processing
- 2.2 Feature extraction
- 2.3 Convolutional networks
- 2.4 Contemporary architectures
- 2.5 Coding session

3. Dynamic Mode Decomposition 21/05/2021
- 3.1 Dynamic Mode Decomposition (DMD)
- 3.2 Koopman analysis
- 3.3 DMD in fluid flow & image processing
- 3.4 Applications and alternatives
- 3.5 Coding session

4. Project Meeting I 04/06/2021
- 4.1 Group presentations
- 4.2 Evaluations & discussions
- 4.3 Description of the next phase studies

5. Modelling of transport phenomena with neural networks 11/06/2021
- 5.1 Latent space physics
- 5.2 Physics informed/constraint models
- 5.3 Graph neural networks
- 5.4 Coding session

6. State space models 25/06/2021

- 6.1 The Kalman filter
- 6.2 Hidden Markov models
- 6.3 Bayesian Structural Time Series
- 6.4 Coding sessions

7. Project Meeting II 09/07/2021

- 7.1 Group presentations
- 7.2 Evaluations & discussions
- 7.3 Description of the next phase

8. Genetic algorithms 16/07/2021

- 8.1 Essentials
- 8.2 Integration with machine learning
- 8.3 Coding session

9. Data Driven Control 23/07/2021

- 9.1 Control systems & linear control theory
- 9.2 Machine learning control (MLC)
- 9.3 MLC with genetic programming
- 9.4 Hybrid methods for data-driven control
- 9.5 Coding sessions

10. Project Presentations 06/08/2021