Data Science for Assistive Health Technologies

Course content:

- Introduction to Medical Data Science for Assistive Health Technologies
- General procedure for detecting human activity
- Integration and synchronization of multiple sensors
- Feature learning from multimodal sensor data
- Supervised classification of multimodal sensor data
- General procedure for sensor-based hunger-satiety detection
- Statistical representation of multimodal sensor data
- General procedure for the analysis of flow recognition
- Approaches to extend multimodal time series
- Transfer learning for the classification of time series
- Handling long sequence data using recurrent neural network, Long Short-Term Memory and Gated Recurrent Unit.
- Learning attention mechanism and Transformer architecture
- General procedure for the analysis of audio data.
- Demonstrators from current research projects
- Summary and Conclusions

Qualification goals/skills:

- Students have an overview of known, assistive health technologies and can motivate their use medically.
- Students know the general procedure for detecting human activities.
- Students know selected methods for the integration and synchronization of multiple sensors.
- Students know selected methods for feature learning and can implement them in a programming language.
- Students know selected classification methods for multimodal sensor data and can implement them in a programming language.
- Students know the general procedure for sensor-based hunger and satiety recognition.
- Students know selected models for the statistical representation of multimodal sensor data and can implement them in a programming language.
- Students know the theory of recursive estimation of a probability density.
- Students know the general procedure for analyzing flow data.
- Students know selected approaches to expanding multimodal time series and can implement them in a programming language.
- Students know selected transfer learning methods for the classification of time series.
- Students know the general procedure for analyzing timeseries sequence data.
- Students know selected methods for recurrent neural network, Long Short-Term Memory, and Gated Recurrent Unit.
- Students know methods to learn attention-based models and Transformer architecture.
- Students know the general procedure for analyzing audio data.
- Students know the objectives and functionality of software systems from selected current research projects.
- Students know the social relevance of assistive health technologies.

Awarding of credit points and grading by:

- Three mini projects and one integration assignment (25%)
- Midterm exam (35%)
- Final term exam (40%)

Literature:

- Peter J Brockwell and Richard A Davis: *Introduction to Time Series and Forecasting* - ISBN: 978-3-319-29852-8
- Marcin Grzegorzek: *Sensor Data Understanding* - ISBN: 978-3-8325-4633-5
- Muhammad Adeel Nisar: *Sensor-Based Human Activity Recognition for Assistive Health Technologies* - ISBN: 978-3-8325-5571-9
- Frédéric Li: *Deep Learning for Time-series Classification Enhanced by Transfer Learning Based on Sensor Modality Discrimination* - ISBN: 978-3-8325-5396-8
- Xinyu Huang: *Sensor-Based Sleep Stage Classification Using Deep Learning* - ISBN: 978-3-8325-5617-4