

Department	SciTec
Degree programme	SI
Module name	Introduction to Data Science and Machine Learning
Module number	GW.2.405
Study and Examination Regulations	ER-version 41 (16.07.2021)
Compulsory/ compulsory optional/ optional module	compulsory optional module
Module coordinator	Prof. Dr. Christina Claß
Module content	<p>Basic concepts of data science and machine learning are introduced:</p> <ul style="list-style-type: none"> ▪ Definition of data science, artificial intelligence, and machine learning ▪ Problem solving by searching and heuristics ▪ Learning ▪ Data preprocessing and exploration, Outliers, Bad data ▪ Classification ▪ Clustering ▪ Neural Networks, deep learning ▪ Model evaluation and improvements <p>The module contains a short revision in programming/introduction in Python and hands on exercises in Python.</p>
Learning objectives	<p>Upon successful completion of this module students are able to:</p> <ul style="list-style-type: none"> ▪ Sketch the fields of data science, artificial intelligence and machine learning ▪ Understand Data Science and Machine Learning as a process and describe the main steps ▪ Define the concept of learning and the terms supervised, unsupervised and reinforcement learning ▪ Preprocess and explore sample data and identify outliers ▪ Sketch and walk through basic search, classification and clustering algorithms ▪ Sketch a perceptron and basic learning algorithms ▪ Propose suitable algorithms for specific problem areas ▪ Define Type I and Type II errors and define and interpret different measures that describe the performance of different algorithms ▪ Interpret a contingency matrix and calculate measures ▪ Implement examples using Python, scikit-learn and TensorFlow
Course type (lecture, seminar, exercises, practical course)	1 L – 0 S – 1 E – 2 P
Recommended literature	<ul style="list-style-type: none"> ▪ Matthew Kirk, Thoughtful Machine Learning with Python, O'Reilly, 2017 ▪ Andreas C. Müller & Sarah Guido, Einführung in Machine Learning mit Python, O'Reilly, 2017 ▪ Ramon Wartala, Praxiseinstieg Deep Learning, O'Reilly, 2018 ▪ Pang-Ning Tan, Michael Steinbach, Anuj Karpatne, Vipin Kumar, Introduction to Data Mining, 2nd ed, Pearson, 2020
Learning materials	Slides, assignments sheets, Jupyter Notebooks, lecture videos
Method(s) of instruction/ media being used	Inverted / flipped classroom with Lectures on video, Jupyter Notebooks for interactive learning, theoretical and practical assignments
Level/ category	Master (category: 2)
Which semester (winter/ summer term)	summer term
Which semester during the programme	2
Requirements for attendance, necessary knowledge	Basic knowledge of structured programming, preferably but not required in Python
Assessment (written/ oral test, paper, etc.)	<p>written examination (90 minutes)</p> <p>course achievement: successful attendance of practical course</p>
ECTS credits	6
Work load in:	<p>180 h of total work load, therefrom</p> <ul style="list-style-type: none"> ▪ 60 h of presence at university ▪ 120 h of self-study
Usability of this module	Scientific instruments generate a large amount of data. This module

	conveys basic competences to interpret, assess, and learn from data.
Frequency of offer	Every study year
Duration of module	1 semester
Place/ room	Ernst-Abbe-Hochschule Jena - University of Applied Sciences Jena
Time	According to schedule
Language(s)	English