Course Big Data and Geoinformation

Module Name	Big Data and Geoinformation
Module No.	2595
Unit/s	Big Data and Geoinformation
Module Level	Master
Curriculum	Technology and Innovation Management
Credit Points (ECTS)	5 CP
Semester Working Hours	4 SWH Lectures
Workload	56h attendance, 69h self study
Module Responsible	Prof. Dr. Hardy Pundt
Lecturer	Prof. Dr. Hardy Pundt and Prof. Dr. Fabian Transchel
Objective of the Module	Candidates are well-versed in Data Analytics based on Big Data infrastructure and Big Data processing, especially in regards to Geoinformation. They know how to import, extract, manipulate, process and analyse spatial data as well as financial or industrial time series.
Prerequisites	Bachelor-level mathematics
Content	Big Data: • Definitions: What is Big Data, Data Science, Machine Learning and Artificial Intelligence? • Big Data • Map-Reduce • Spark, Hadoop, Kafka • Data Warehousing • Machine Learning • Supervised Learning • Unsupervised Learning • Pattern Recognition and Clustering • Dimensionality Reduction Techniques • Artificial Neural Nets • Data Analytics • The exponential function • Correlation vs. causation • Representation theory and scientific communication • Big Data Ethics • Data privacy, GDPR • The discrimination problem of ML • Ethics of autonomous decision making Geoinformation: • Ellipsoid models of the Earth • Spatial reference systems, scale • characteristics of spatial data: geometry, topology, attributes, time • raster and vector model • acquisition (digitalization from maps, GPS-supported field data collection, remote sensing) • storage and administration of spatial data (spatial databases) • introduction to GIS: QGIS and ArcGIS online • analysis methods, e. g. • distance- and area-based methods (sizes, centroids etc.) • overlay • buffering • Delauney triangulation • Thiessen polygons • spatial interpolation (e. g. IDW, Kriging) • visualisation • cartographic principles • 2D maps • 3D models (including 3D analysis methods) • interoperable GI services and Web Mapping • Web Mapping Services • Geography Markup Language • standards of the Open Geospatial Consortium (OGC) • exemplary open Web-Mapping tools • open, spatial data • guidelines and standards (from ISO, OGC, EU (e. g. INSPIRE)) • all themes are supported by exercises using QGIS, ArcGIS online and other tools
Literature	• Tibshirani, Hastie: Elements of Statistical Learning, Springer • Seehafer, Nörtemann: Acturial Data Science, De Gruyter • Longley, Goodchild, Maguire, Rhind: Geographic Information Systems and Science. Wiley & Sons. • Wegmann, Schwalb-Willmann: Introduction to Spatial Data Analysis. Pelagic Publishing

Media used	Script, projector, white board, exercises using various tools
Form of Examination	HA/RF/PA/MP
Language	English