Module Number	**Module Name**	**Responsible Lecturer**
CMS-COR-MLD	Machine Learning and Data Mining	Prof. Dr. Björn Andres bjoern.andres@tu-dresden.de
Qualification Objectives	Upon completing the module, students master the basics and handling of forward problems and inverse problems in computer-aided science. They intuitively comprehend the meaning and definition of these two problem formulations, as well as the relationship with generative and discriminative approaches in Statistics. They know the theoretical connections between these two formulations, as given by the Theorem of Bayes and the Euler-Lagrange equations. For forward problems, students know what verification and validation mean, and can apply these in practice. For inverse problems, students are familiar with the basics of machine learning, in particular supervised and unsupervised approaches, as well as the concepts of overfitting and cross validation.	
Content	Mathematical formulation of forward problems and inverse problems, generative and discriminative modelling approaches, Bayes theorem, Euler-Lagrange equations of optimisation, verification and validation of models and simulations, basics of machine learning, supervised learning, unsupervised learning, overfitting, cross validation, learning as an optimisation problem, basics of neural networks.	
Teaching and Learning Methods	The module includes lectures amounting to 2 lecture hours per week, exercises amounting to 2 lecture hours per week plus independent study.	
Prerequisites for Participation	Knowledge in sequential computer programming, algorithms and data structures, analysis of functions of one and several variables, linear algebra (vector and matrix calculation), as well as probability calculation and Statistics at the Bachelor's level is required. With the following literature, students can prepare for the module: Harel: Algorithmics - The Spirit of Computing, Addison-Wesley, 2004 Schildt: C ++ from the ground up, McGraw-Hill, 2003 Abelson, Hal; Sussman, Gerald Jay: Structure and Interpretation of Computer Programs. MIT Press, 1985; Cormen, Leiserson, Rivest & Stein: Introduction to Algorithms, 2nd Edition, MIT Press 2001; Lax, Terrell: Multivariable Calculus with Applications (Undergraduate Texts in Mathematics), Springer, 2018 Hefferon, Jim: Linear Algebra, http://joshua.smcvt.edu/linearalgebra/, 2008.	
Usability	In the Computational Modelling and Simulation Master's programme, the module is one of ten compulsory elective modules (for students of Computational Life Science: nine), of which three must be chosen. This module fulfils the prerequisites for the CMS-EE-SCEE and CMS-EE-REEP modules.	
Requirements for the Awarding of Credit Points	The credit points are awarded if the module examination is passed. The module examination consists of a written examination lasting 90 minutes. If there are fewer than 10 students registered at the end of the registration period, the written examination may be replaced by an oral examination	

	as an individual examination lasting 30 minutes; if this is the case, this will be announced to the registered students at the end of the registration period.
Credit Points and Grades	5 credit points can be earned by completing the module. The module grade corresponds to the examination grade.
Frequency of the Module	The module is offered in each winter semester.
Workload	The total workload is 150 hours.
Duration of the Module	The module takes one semester to complete.