

Only the german version of the module description as part of the study regulations is legally binding.

Module name	Machine Learning
Module number	INF-25-Ma-FVC-ML
Responsible lecturer	Prof. Dr. Bjoern Andres bjoern.andres@tu-dresden.de
Qualification objectives	Students know the problems of supervised, semi-supervised, unsupervised and structural machine learning in their formulation as mathematical optimization problems. They understand the complexity of these problems and are able to prove the complexity themselves using theoretical computer science methods. They know efficient local search algorithms for learning from decision trees, for logistic regression, for correlation clustering, for linear ordering as well as for inference and learning in graphical models with factor graphs and are able to implement and apply these algorithms themselves. They know the structure of simple artificial neural networks as well as the forward and backward propagation algorithm and are able to implement and apply these algorithms themselves. They are able to present technical results in English.
Content	Contents of the module are supervised machine learning as an optimization problem, regularized risk minimization, learning of decision trees, logistic regression, neural networks and basics of supervised deep learning, forward propagation and backward propagation algorithm, semi-supervised and unsupervised machine learning as an optimization problem, classification with more than two classes, correlation clustering, linear ordering, structural machine learning as an optimization problem, graphical models, factor graphs, Gibbs distribution and measurement age-passing algorithms.
Teaching and learning methods	The module comprises lectures of 2 SWS, exercises of 2 SWS, projects of 20 hours and self-study. The language of instruction for the lectures, exercises and projects is English.
Prerequisites for participation	In the Diploma degree course in Computer Science, the competences to be acquired in the modules INF-25-Ba-AuD Algorithms and Data Structures, INF-25-Ba-Ma1 Linear Algebra and Analysis and INF-25-Ba-Ma4 Probability Theory and Statistics are assumed. Knowledge of algorithms and data structures, fundamentals of theoretical computer science, analysis of univariate functions and multivariate functions, linear algebra, probability theory and statistics at Bachelor's level is required for the Master's degree course in Computer Science. The following literature is suitable for preparation: Algorithms and Data Structures, Kurt Mehlhorn, Peter Sanders. Springer Berlin Heidelberg, 2008. ISBN: 978-3-540-77977-3. DOI: 10.1007/978-3-540-77978-0, Analysis 1, Konrad Königsberger. Springer Berlin Heidelberg, 2004. ISBN: 978-3-540-40371-5. DOI: 10.1007/978-3-642-18490-1, Analysis 2, Konrad Königsberger. Springer Berlin Heidelberg, 2013. ISBN:

	978-3-662-05699-8. DOI: 10.1007/978-3-662-05699-8, Linear algebra, Gerd Fischer. Springer Spektrum Wiesbaden, 2014. ISBN: 978-3-658-03945-5. DOI 10.1007/978-3-658-03945-5, Introduction to probability theory and statistics, Ulrich Krengel. Vieweg+Teubner Wiesbaden, 2013. ISBN: 978-3-322-93581-6. DOI: 10.1007/978-3-322-93581-6, Theoretical Computer Science, Lutz Priese, Katrin Erk. Springer Vieweg Berlin Heidelberg, 2018. ISBN: 978-3-662-57408-9. DOI: 10.1007/978-3-662-57409-6.
Applicability	The module is a compulsory elective module in the Diplom degree program in Computer Science in the main course in the subject area Visual Computing and Machine Learning, which must be selected in accordance with Annex 2 to the examination regulations. In the Master's degree program in Computer Science, the module is a compulsory elective module in the open track in the subject area Visual Computing and Machine Learning as well as the supplement, which must be selected in accordance with Appendix 2 to the examination regulations. The module can only be chosen once in the Master's degree program in Computer Science. The module cannot be chosen in the Master's degree program in Computer Science if this module or a module with essentially the same content from a degree program with which the admission requirements according to § 3 of the study regulations were fulfilled has already been completed. The module creates the prerequisites for the modules listed under prerequisites for participation.
Requirements for earning credit points	The credit points are earned if the module examination is passed. The module examination consists of a written examination lasting 90 minutes. The examination language is English.
Credit points and grades	6 credit points can be earned through the module. The module grade corresponds to the grade of the examination.
Module frequency	The module is offered every winter semester.
Workload	The total workload is 180 hours.
Module duration	The module comprises one semester.