Module title	**Machine Learning and Pattern Recognition**
Code	BECS2
Degree Programme	Master of Science in Life Sciences
Group	BECS (Biomedical Engineering and Computational Science)
Workload	3 ECTS (90 student working hours: 42 lessons contact = 32 h; 58 h self-study)
Module Coordinator	**Name**: Dr. Krzysztof Kryszczuk **Phone**: +41 (0)58 934 53 37 **Email**: krys@zhaw.ch **Address**: ZHAW Life Sciences und Facility Management, Einsiedlerstrasse 31a, 8820 Wädenswil
Lecturers	Dr. Krzysztof Kryszczuk, ZHAW
Entry requirements	The module requires a solid background in mathematics at Bachelor's level. Specifically, familiarity with: • Statistics, • probability theory, and • basic linear algebra is required and will be tested in a written test on the first day of the module. The students will be provided with preparatory material, including a self-test on Moodle. The course textbook provides the scope of the required mathematical foundations in Appendices B, C and D of the course textbook. Familiarity with basic programming is required (data input/output, data structures, control structures).The module and associated practical exercises will be taught using Matlab. Familiarity with Matlab is required, including basics of plotting and visualization. Students will be provided with preparatory material on Moodle.
Learning outcomes and competences	After completing the module, students will be able to: • use Bayesian inference as a basis of machine learning • understand the advantages and drawbacks of individual machine learning techniques, and make informed decisions about their application • apply classification and regression techniques beyond linear models • design and validate data experiments using machine learning techniques • solve practical problems using machine learning techniques in a context of life sciences. The objective of the module is to provide the students with the knowledge of the state of the art machine learning techniques and apply them to problems of life sciences and biomedical engineering.
Module contents	The module covers the following topics: 1. Bayesian decision theory and inference, 2. Parametric and non-parametric parameter estimation, Gaussian Mixture Models for classification and regression.Discriminant methods, linear models. 3. Nonmetric methods, tree-based methods 4. Model selection and validation 5. Case studies in life sciences

Teaching / learning methods	The module will consist of lectures and practical exercises. In addition to lectures, students will be required to self-study selected topics assigned at the beginning of the module and present the results, in a seminar style. The presentations will be graded.
Assessment of learning outcome	1. Entry test, closed book, on day 1 of the module (10%) 2. Seminar presentation in groups (20%) 3. Final written exam, closed book (70%)
Format	7-weeks
Timing of the module	Autumn semester, CW 45-51
Venue	Olten
Bibliography	The main textbook of the course is: Bishop, Christopher M. *Pattern recognition and machine learning*. springer, 2006. Secondary reading is Duda, Richard O., Peter E. Hart, and David G. Stork. *Pattern classification*. John Wiley & Sons, 2012. The textbooks and important additional literature and supporting materials will be provided on Moodle in pdf format. No printed material will be provided. Please note that this module has no lecture notes or script.
Language	English
Links to other modules	The module is coordinated with the specialisation module ZHAW “Neural Networks and Deep Learning”.
Comments	
Last Update	06.05.2019