

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	<p>Name: Dr. Krzysztof Kryszczuk Phone: +41 (0)58 934 53 37 Email: krysz@zhaw.ch Address: ZHAW Life Sciences und Facility Management, Einsiedlerstrasse 31a, 8820 Wädenswil</p>
Lecturers	Dr. Krzysztof Kryszczuk, ZHAW
Entry requirements	<p>The module requires a solid background in mathematics at Bachelor's level. Specifically, familiarity with:</p> <ul style="list-style-type: none"> • Statistics, • probability theory, and • basic linear algebra <p>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.</p> <p>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.</p>
Learning outcomes and competences	<p>After completing the module, students will be able to:</p> <ul style="list-style-type: none"> • 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, clustering and regression techniques • design and validate data science experiments • solve practical problems using machine learning techniques in the context of life sciences. <p>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 computational life sciences.</p>
Module contents	<p>The module covers the following topics:</p> <ol style="list-style-type: none"> 1. Bayesian decision theory and inference, 2. Parametric and non-parametric parameter estimation, Gaussian Mixture Models for classification and regression. Discriminant methods. 3. Nonmetric methods, tree-based methods 4. Clustering and cluster validation methods 5. Model selection and validation 6. Case studies in life sciences

Master in Life Sciences

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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 project results. The presentations and accompanying Matlab code will be graded.
Assessment of learning outcome	<ol style="list-style-type: none">1. Entry test, closed book, on day 1 of the module (10%)2. Seminar presentation in groups (40%)3. Final written exam, closed book (50%)
Format	7-weeks
Timing of the module	Autumn semester, CW 45-51
Venue	Olten
Bibliography	<p>Students will be provided with a script. The accompanying textbook of the course is: Bishop, Christopher M. <i>Pattern recognition and machine learning</i>. springer, 2006.</p> <p>The script, textbook link and important additional literature and supporting materials will be provided on Moodle in pdf format. No printed material will be provided..</p>
Language	English
Links to other modules	The module is coordinated with the specialisation module ZHAW "Neural Networks and Deep Learning".
Comments	
Last Update	13.04.2020