1.	Field of study	Biophysics
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2022/2023 (winter term), 2023/2024 (winter term), 2024/2025 (winter term), 2025/2026 (winter term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Machine Learning with Neural Networks

Module code: W4-2BF-MB-21-17

1. Number of the ECTS credits: 4

2. Learning outcomes of the module					
code	description	learning outcomes of the programme			
MB_17_1	students will be able to state the fundamental problem and complexity of Machine Learning, and acquire a global view of the	KBF_K10	3		
	different Machine Learning techniques	KBF_U02	3		
		KBF_U11	4		
		KBF_U14	5		
		KBF_W02	4		
MB_17_2	students will be able to understand and explain classical models of Neural Networks such as the Hopfield networks, Boltzmann	KBF_K10	3		
	Machines, Single- and Multi-layer Perceptrons, and Convolutional networks	KBF_U02	3		
		KBF_U11	4		
		KBF_U14	5		
		KBF_W02	4		
MB_17_3	Doon Loarning and its colution techniques	KBF_K10	3		
		KBF_U02	3		
		KBF_U11	4		
		KBF_U14	5		
		KBF_W02	4		

3. Module description			
Description			



	Course syllabus: (1) Introduction to Machine Learning (fundamental problem and its inherent complexity; general approaches for its solution) (2) Classic Neural Networks models (Hopfield model; recurrent Boltzmann Machines (BM) and Restricted Boltzmann Machines (RBM); learning with BM y RBM: gradient descent, Contrastive Divergence and its variants; single-layer perceptrons (SLP): lineal and logistic regression, Rosenblat perceptron; multi-layer perceptrons (MLP): learning with MLP, back-propagation; Convolutional Neural Networks (CNN): model, link to MLP, and learning) (3) Deep Learning: link with classical models and modern learning techniques.
Prerequisites	

4. Assessment	Assessment of the learning outcomes of the module					
code type		description	learning outcomes of the module			
MB_17_w_1	credit	The final mark for this course is computed as $0.2*M_1 + 0.2*M_2 + 0.6*M_3$, where M_n is the grade of each practical homework. For the latter, the students will be provided with a code structure, and they will have to implement specific functions and run virtual experiments in which different machine learning strategies will be employed	MB_17_1, MB_17_2, MB_17_3			

5. Forms of teaching							
	form of teaching		required hours of student's own work		assessment of the		
code	type	description (including teaching methods)	number of hours	description	number of hours	learning outcomes of the module	
MB_17_fs_1		Detailed discussion by the lecturer of the issues listed in the table "module description" using the table and/or multimedia presentations	1	Supplementary reading, working with the textbook	44	MB_17_w_1	
MB_17_fs_2	laboratory classes	Computer sessions	10		20	MB_17_w_1	