Study plan

Name of study plan: Medical electronics and bioinformatics

Faculty/Institute/Others: Faculty of Electrical Engineering

Department:

Branch of study guaranteed by the department: Welcome page

Garantor of the study branch:

Program of study: Medical Electronics and Bioinformatics

Type of study: Follow-up master full-time

Required credits: 114
Elective courses credits: 6
Sum of credits in the plan: 120

Note on the plan: Specializace Zpracování obrazu

Name of the block: Compulsory courses in the program

Minimal number of credits of the block: 60

The role of the block: P

Code of the group: 2018_MBIODIP Name of the group: Diploma Thesis

Requirement credits in the group: In this group you have to gain 30 credits Requirement courses in the group: In this group you have to complete 1 course

Credits in the group: 30 Note on the group:

Code	Name of the course / Name of the group of courses (in case of groups of courses the list of codes of their members) Tutors, authors and guarantors (gar.)	Completion	Credits	Scope	Semester	Role
BDIP30	Diploma Thesis	Z	30	22s	L	Р

Characteristics of the courses of this group of Study Plan: Code=2018_MBIODIP Name=Diploma Thesis

BDIP30	Diploma Thesis	Z	30			
Independent final comprehensive work for the Master's degree study programme. A student will choose a topic from a range of topics related to his or her branch of study, which will						
be enseified by brench	he appointed by branch department or branch departments. The diploma thesis will be defended in front of the heard of evaminers for the comprehensive final evamination					

Code of the group: 2018_MBIOP

Name of the group: Compulsory subjects of the programme

Requirement credits in the group: In this group you have to gain 30 credits

Requirement courses in the group: In this group you have to complete 5 courses

Credits in the group: 30

Note on the group:

Note on the g	. oap.					
Code	Name of the course / Name of the group of courses (in case of groups of courses the list of codes of their members) Tutors, authors and guarantors (gar.)	Completion	Credits	Scope	Semester	Role
BAM31BSG	Biological signals Roman mejla Roman mejla Roman mejla (Gar.)	Z,ZK	6	2P+2L	L	Р
BMPROJ6	Diploma Project Roman mejla, Jan Kybic, Vratislav Fabián, Petr Pošík Petr Pošík Roman mejla (Gar.)	Z	6	0p+6s	Z,L	Р
BAM31LET	Medical Instrumentation and Devices Jan Havlík Jan Havlík (Gar.)	Z,ZK	6	2P+2L	Z	Р
B4M36SAN	Statistical Data Analysis Ji í Kléma Ji í Kléma Ji í Kléma (Gar.)	Z,ZK	6	2P+2C	Z	Р
BAM33ZSL	Medical Imaging Systems Jan Kybic, Vít Herynek, André Sopczak Jan Kybic Jan Kybic (Gar.)	Z,ZK	6	2P+2C	L	Р

Characteristics of the courses of this group of Study Plan: Code=2018_MBIOP Name=Compulsory subjects of the programme

	<u> </u>		
BAM31BSG	Biological signals	Z,ZK	6
BMPROJ6	Diploma Project	Z	6

BAM31LET Medical Instrumentation and Devices

Students will study fundamental principles applied within the modern medical devices and systems, esp. from the point of view of functional blocks and electronic circuits of diagnostical and therapeutical medical equipments including electrocardiographs, electroencephalographs, bedside and central monitors, equipments for anestesiology, intensive and critical healthcare, equipments for clinical laboratory, electrostimulators, cardiostimulators and defibrilators, blood pressure and flow measurement (including dilution) and pulse oxymetry.

Statistical Data Analysis

This course builds on the skills developed in introductory statistics courses. It is practically oriented and gives an introduction to applied statistics. It mainly aims at multivariate statistical analysis and modelling, i.e., the methods that help to understand, interpret, visualize and model potentially high-dimensional data. It can be seen as a purely statistical counterpart to machine learning and data mining courses.

Medical Imaging Systems

The course covers the principles, design and properties of currently used medical imaging devices. We shall deal with 2D microscopic, X-ray and ultrasound imaging systems, including advanced topics such as Doppler ultrasound. We will also study tomographic (3D) imaging systems: computed tomography (CT), magnetic resonance imaging (MRI) including functional MRI (fMRI) and nuclear imaging methods (PET,SPECT). For more information see https://cw.fel.cvut.cz/wiki/courses/zsl

Name of the block: Compulsory courses in the specialization

Minimal number of credits of the block: 30

The role of the block: PS

Code of the group: 2018 MBIOPS3

Name of the group: Compulsory subjects of specialization

Requirement credits in the group: In this group you have to gain 30 credits

Requirement courses in the group: In this group you have to complete 5 courses

Credits in the group: 30 Note on the group:

Code	Name of the course / Name of the group of courses (in case of groups of courses the list of codes of their members) Tutors, authors and guarantors (gar.)	Completion	Credits	Scope	Semester	Role
B4M35KO	Combinatorial Optimization Zden k Hanzálek Zden k Hanzálek (Gar.)	Z,ZK	6	3P+2C	L	PS
B4M33MPV	Computer Vision Methods Georgios Tolias, Ji í Matas, Jan ech, Dmytro Mishkin Ond ej Drbohlav Ji í Matas (Gar.)	Z,ZK	6	2P+2C	٦	PS
B4M33PAL	Advanced algorithms Marko Genyk-Berezovskyj, Daniel Pr ša, Ond ej Drbohlav Daniel Pr ša Daniel Pr ša (Gar.)	Z,ZK	6	2P+2C	Z	PS
BE4M33SSU	Statistical Machine Learning Jan Drchal, Vojt ch Franc Vojt ch Franc (Gar.)	Z,ZK	6	2P+2C	Z	PS
BAM33ZMO	Medical Image Processing Jan Kybic, Oleksandr Shekhovtsov Jan Kybic Jan Kybic (Gar.)	Z,ZK	6	2P+2C	Z	PS

Characteristics of the courses of this group of Study Plan: Code=2018_MBIOPS3 Name=Compulsory subjects of specialization

B4M35KO Combinatorial Optimization

7.7K

The goal is to show the problems and algorithms of combinatorial optimization (often called discrete optimization; there is a strong overlap with the term operations research). Following the courses on linear algebra, graph theory, and basics of optimization, we show optimization techniques based on graphs, integer linear programming, heuristics, approximation algorithms and state space search methods. We focus on application of optimization in stores, ground transportation, flight transportation, logistics, planning of human resources, scheduling in production lines, message routing, scheduling in parallel computers.

Computer Vision Methods

The course covers selected computer vision problems: search for correspondences between images via interest point detection, description and matching, image stitching, detection, recognition and segmentation of objects in images and videos, image retrieval from large databases and tracking of objects in video seguences. This course is also part of the inter-university programme prg.ai Minor. It pools the best of Al education in Prague to provide students with a deeper and broader insight into the field of artificial intelligence. More information is available at https://prg.ai/minor.

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Basic graph algorithms ar	nd draph representation	Complinatorial algorithms	Application of formal	landuages theory in	-computer science - r
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Z,ZK

pattern matching

BE4M33SSU Statistical Machine Learning

Advanced algorithms

Z.ZK

The aim of statistical machine learning is to develop systems (models and algorithms) for learning to solve tasks given a set of examples and some prior knowledge about the task. This includes typical tasks in speech and image recognition. The course has the following two main objectives 1. to present fundamental learning concepts such as risk minimisation, maximum likelihood estimation and Bayesian learning including their theoretical aspects, 2. to consider important state-of-the-art models for classification and regression and to show how they can be learned by those concepts

This course covers the most used advanced image analysis methods, with emphasis on images from medical and biological modalities, from microscopy, to ultrasound, MRI, or CT,

Medical Image Processing

including time sequences.

B4M33PAL

Name of the block: Compulsory elective courses

Minimal number of credits of the block: 24

The role of the block: PV

Code of the group: 2018_MBIOPPV3

Name of the group: Compulsory subjects of the programme

Requirement credits in the group: In this group you have to gain 24 credits Requirement courses in the group: In this group you have to complete 4 courses Credits in the group: 24

Note on the group:

Code	Name of the course / Name of the group of courses (in case of groups of courses the list of codes of their members) Tutors, authors and guarantors (gar.)	Completion	Credits	Scope	Semester	Role
BAM31ADA	Adaptive signal processing Radoslav Bortel, Pavel Sovka Radoslav Bortel (Gar.)	Z,ZK	6	2P+2C	Z	PV
B2M31AEDA	Experimental Data Analysis Jan Rusz Jan Rusz Jan Rusz (Gar.)	Z,ZK	6	2P+2C	Z	PV
BAM17EPM	Applications of Electromagnetic Fields in Medicine Jan Vrba, Ladislav Oppl Jan Vrba Jan Vrba (Gar.)	Z,ZK	6	2P+2L	L	PV
BAM31AOL	Applied optoelectronics in medicine Jan Havlík Jan Havlík Jan Havlík (Gar.)	Z,ZK	6	2P+2L	L	PV
BAM36BIN	Bioinformatics Ji í Kléma Ji í Kléma Ji í Kléma (Gar.)	Z,ZK	6	2P+2C	L	PV
BAM02BIO	Biosensors Bohuslav Rezek Bohuslav Rezek (Gar.)	Z,ZK	6	2P+2L	Z	PV
BAM02FPT	Physics for Diagnostics and Therapy Vratislav Fabián, Jan Vrba, Ladislav Oppl Vratislav Fabián Vratislav Fabián (Gar.)	Z,ZK	6	2P+2L		PV
B0M37FAV	Physiology and modeling of hearing and vision Miloš Klíma, Václav Vencovský, Petr Maršálek, Karel Fliegel Karel Fliegel Václav Vencovský (Gar.)	Z,ZK	6	2P+2C+4C	Z	PV
BAM38KLS	Construction of Medical Systems Jan Holub Jan Holub Jan Holub (Gar.)	Z,ZK	6	2P+2L	Z	PV
BAM31MOA	Modeling and analysis of brain activity Jaroslav Hlinka Jaroslav Hlinka (Gar.)	Z,ZK	6	2P+2C	Z	PV
B4M36MBG	Molecular Biology and Genetics Martin Pospíšek Martin Pospíšek (Gar.)	Z,ZK	6	3P+1C	L	PV
BAM31NPG	Neurophysiology P emysl Jiruška, Helena Pivo ková P emysl Jiruška P emysl Jiruška (Gar.)	Z,ZK	6	2P+2C	Z	PV
BAM33NIN	Neuroinformatics Giulia D'Angelo, Ji í Hammer, Daniel Novák, Eduard Bakštein, Karla Št pánová, Ján Antolík, David Kala Daniel Novák Daniel Novák (Gar.)	Z,ZK	6	2P+2C	L	PV
B2M31DSP	Advanced DSP methods Pavel Sovka, Petr Pollák Pavel Sovka Pavel Sovka (Gar.)	Z,ZK	6	2P+2C	Z,L	PV
B4M36SMU	Symbolic Machine Learning Filip Železný, Ond ej Kuželka, Gustav Šír Ond ej Kuželka Ond ej Kuželka (Gar.)	Z,ZK	6	2P+2C	L	PV
BAM17EMC	Introduction to electromagnetic compatibility Tomáš Ko ínek Tomáš Ko ínek Tomáš Ko ínek (Gar.)	Z,ZK	6	2P+2L	Z	PV
BAM31ZAS	Analog Signal Processing Ji í Hospodka Ji í Hospodka Ji í Hospodka (Gar.)	Z,ZK	6	2P+2L	L	PV

BAM31ADA	Adaptive signal processing	Z,ZK	6
This course provide	es a basic discourse on adaptive algorithms for filtering, decorrelation, separation and beamforming.	·	
B2M31AEDA	Experimental Data Analysis	Z,ZK	6
n the course of sub	pject "Experimental Data Analysis", students will acquire knowledge regarding fundamental methods for data	a analysis and machine learning for eval	uation and
nterpretation of dat	ta. In the course of practical lectures, students will solve individual tasks using real data from signal processing	ng in neuroscience research. In the cours	se of semestr
project, student will	solve complex task and present obtained results. The aim of the subject is to introduce practical application	of fundamental statistical methods as w	ell as to teach
students to use criti	ical thinking and to acquire additional knowledge in solution of practical tasks.		
BAM17EPM	Applications of Electromagnetic Fields in Medicine	Z,ZK	6
he major aim of the	ese lectures is to give to students a basic overview of biophysical aspects of EM fields in different biological sy	stems, including an overview of microwa	ve application
n medicine. Safety	limits, clinical usage of EM field effects on biological systems, microwave hyperthermia, measurement of die	electric parameters of biological tissues,	EM exposure
of mobile phone use	ers, magnetic resonance imaging, interaction of optical radiation with biological tissue.		
BAM31AOL	Applied optoelectronics in medicine	Z,ZK	6
BAM36BIN	Bioinformatics	Z,ZK	6
BAM02BIO	Biosensors	Z,ZK	6
BAM02FPT	Physics for Diagnostics and Therapy	Z,ZK	6
In this course, stude	ents will be introduced to the problems of locomotive organs diseases and musculoskeletal pain in the first seve	an lactures. Great space is devoted to ele	ctrotheraneu

methods, therapeutic ultrasound and phototherapy. Furthermore, advanced neurorehabilitation methods, especially transcranial brain stimulation methods (repetitive transcranial magnetic stimulation of the brain - rTMS, transcranial electrical stimulation of the brain - tDCS and electroconvulsive therapy - ECT) are discussed. In the second half of the semester, attention is paid to the possibilities of using ionizing electromagnetic fields in medical diagnostics and therapy (eg X-ray, proton therapy, radiotherapy, etc.).

B0M37FAV	Physiology and modeling of hearing and vision	Z,ZK	6
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The primary aim of the course is to study the physiology of sensors and processes of perception of audio and visual information by human subjects as two central and most important communication channels, i.e., Human Auditory System (HAS) and Human Visual System (HVS). The course summarizes current knowledge in the field of human vision and hearing physiology and, at the same time, presents their description using mathematical models using the latest computational tools and procedures, including Machine Learning (ML), Deep Learning (DL) and Artificial Intelligence (AI). Emphasis is also placed on current and prospective applications of the mentioned knowledge. The main application area is the audiovisual technology related to human perception, but the direct employment of the acquired knowledge also includes the areas of multimedia technology, control systems, automation, robotics, safety and security technology, bioinspired systems, etc. At the same time, students gain a general overview of information processing in biological systems. A separate part is the objectification of audiovisual information perceived quality, i.e., Quality of Experience (QoE). The course is intended for students of master's degree in technical fields. The exercises will be devoted to fundamental experiments to determine the most important characteristics of HAS and HVS, including computational models and simulation of vision and hearing processes.

BAM38KLS	Construction of Medical Systems	Z,ZK	6
BAM31MOA	Modeling and analysis of brain activity	Z,ZK	6
B4M36MBG	Molecular Biology and Genetics	Z,ZK	6
BAM31NPG	Neurophysiology	Z,ZK	6
BAM33NIN	Neuroinformatics	Z,ZK	6

The Neuroinformatics Course concentrates on modelling of neurons, stochastic learning on cellular level, information coding and decoding in brain and single unit processing. Examples from clinical practices are provided throughout the course. The labs focus on signal neuron analysis from human and animal brain.

B2M31DSP Advanced DSP methods

Z,ZK 6 the methods of digital signals

The course follows the basic course in signal processing and introduces advanced methods of analysis and digital signal processing. Graduates will learn the methods of digital signals analysis and be able to practically use them. They learn to know the conditions of use of correlation, spectral and coherent analysis of random signals. They will became familiar with methods of signal decomposition and independent component analysis and the time-frequency transformations. Emphasis will be placed on an ability to interpret the results of signal analyses.

B4M36SMU Symbolic Machine Learning

Z,ZK

C 6

This course consists of four parts. The first part of the course will explain methods through which an intelligent agent can learn by interacting with its environment, also known as reinforcement learning. This will include deep reinforcement learning. The second part focuses on Bayesian networks, specifically methods for inference. The third part will cover fundamental topics from natural language learning, starting from the basics and ending with state-of-the-art architectures such as transformer. Finally, the last part will provide an introduction to several topics from the computational learning theory, including the online and batch learning settings.

BAM17EMC Introduction to electromagnetic compatibility

Z,ZK 6

The subject dwells on problems of electromagnetic compatibility. Students obtain the basic knowledges in the field of electromagnetic compatibility - electromagnetic interference, susceptibility and testing methods. The subject leads to gain professional skills in the field of electrical engineering.

BAM31ZAS Analog Signal Processing

Z,ZK

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6

The course deals with analog input-output blocks for signal transmission and processing. They discussed circuit solution of amplifiers and filters, including their design process, simulation and measurement. Students learn the circuit concepts and possibilities for solving the contemporary analogue structures. The second part of the course describes the design and implementation of analog filters, including discrete-time circuits. The conclusion is devoted to the possibilities of computer optimization of electronic circuits and filters.

Name of the block: Elective courses Minimal number of credits of the block: 0

The role of the block: V

Code of the group: 2018_MBIOH

Name of the group: Humanities subjects

Requirement credits in the group: Requirement courses in the group:

Requirement courses in the Credits in the group: 0

Note on the group:

Code	Name of the course / Name of the group of courses (in case of groups of courses the list of codes of their members) Tutors, authors and guarantors (gar.)	Completion	Credits	Scope	Semester	Role
B0M16FIL	Peter Zamarovský Peter Zamarovský Peter Zamarovský (Gar.)	Z,ZK	5	2P+2S	Z,L	V
B0M16HVT	History of science and technology 2 Marcela Efmertová, Jan Mikeš Marcela Efmertová Marcela Efmertová (Gar.)	Z,ZK	5	2P+2S	Z,L	V
B0M16HSD1	History of economy and social studies Marcela Efmertová	Z,ZK	5	2P+2S	Z,L	V
B0M16PSM	Psychology Jan Fiala Jan Fiala (Gar.)	Z,ZK	5	2P+2S	Z,L	V
B0M16TEO	Theology Vladimír Sláme ka Vladimír Sláme ka Vladimír Sláme ka (Gar.)	Z,ZK	5	2P+2S	Z,L	V

Characteristics of the courses of this group of Study Plan: Code=2018_MBIOH Name=Humanities subjects

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B0M16HVT	History of science and technology 2	Z,ZK	5			
This subject traces historical developments in electrical engineering branches in the world and in the Czech Lands. Its ultimate goal is to stimulate students' interest in the history and						
traditions of the subject, while highlighting the developments in technical education and professional organizations, the process of shaping scientific life and the influence of technical						
engineers						
B0M16HSD1	History of economy and social studies	Z,ZK	5			
This subject deals with the history of the Czech society in the 19th - 21th centuries. It follows the forming of the Czech political representation, its aims and achieved results as well as						
the social and cultural development and coexistence of the various ethnical groups in the Czech countries.						
the social and cultural d	evelopment and coexistence of the various ethnical groups in the Czech countries.					

Theology B0M16TEO

This subject provides to students the basic orientation in christian theology and requires no special previous education. After short philosophic lecture the basic theologic disciplines are gone through. The subject is determined not only to believer students who want to know the reliable theologic grounding but also above all to ones who want to get know Christianity - religion from which graws our civilization up.

Code of the group: 2018_MBIOVOL Name of the group: Elective subjects Requirement credits in the group: Requirement courses in the group:

Credits in the group: 0

Note on the group:

B4M36MBG

~Nabídku volitelných předmětů uspořádaných podle kateder najdete na webových stránkách http://www.fel.cvut.cz/cz/education/volitelne-predmety.html\\

Code	Name of the course	Completion	Credits
B0M16FIL		Z,ZK	5
B0M16HSD1	History of economy and social studies	Z,ZK	5
	with the history of the Czech society in the 19th - 21th centuries. It follows the forming of the Czech political representation, its aims a the social and cultural development and coexistence of the various ethnical groups in the Czech countries.		s as well as
DOMACLI)/T		7 71/	_
B0M16HVT	History of science and technology 2	Z,ZK	5
•	historical developments in electrical engineering branches in the world and in the Czech Lands. Its ultimate goal is to stimulate studio oject, while highlighting the developments in technical education and professional organizations, the process of shaping scientific life engineers		
B0M16PSM	Psychology	Z,ZK	5
B0M16TEO	Theology	Z,ZK	5
	les to students the basic orientation in christian theology and requires no special previous education. After short philosophic lecture		l
	he subject is determined not only to believer students who want to know the reliable theologic grounding but also above all to ones wh	-	-
	- religion from which graws our civilization up.	· ·	
B0M37FAV	Physiology and modeling of hearing and vision	Z.ZK	6
	the course is to study the physiology of sensors and processes of perception of audio and visual information by human subjects as t	,	_
	annels, i.e., Human Auditory System (HAS) and Human Visual System (HVS). The course summarizes current knowledge in the field		-
			•
	the same time, presents their description using mathematical models using the latest computational tools and procedures, including	J	
• ,	Artificial Intelligence (AI). Emphasis is also placed on current and prospective applications of the mentioned knowledge. The main app		
technology related	to human perception, but the direct employment of the acquired knowledge also includes the areas of multimedia technology, control	systems, automatic	on, robotics
safety and securi	y technology, bioinspired systems, etc. At the same time, students gain a general overview of information processing in biological sy	stems. A separate	part is the
objectification of a	udiovisual information perceived quality, i.e., Quality of Experience (QoE). The course is intended for students of master's degree in	technical fields. The	e exercises
will be devoted to	fundamental experiments to determine the most important characteristics of HAS and HVS, including computational models and sin	nulation of vision a	nd hearing
	processes.		
B2M31AEDA	Experimental Data Analysis	Z,ZK	6
In the course of s	subject "Experimental Data Analysis", students will acquire knowledge regarding fundamental methods for data analysis and machin	1	ation and
interpretation of da	a. In the course of practical lectures, students will solve individual tasks using real data from signal processing in neuroscience resea	arch. In the course	of semestra
project, student wil	solve complex task and present obtained results. The aim of the subject is to introduce practical application of fundamental statistic	al methods as well	as to teach
, ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	students to use critical thinking and to acquire additional knowledge in solution of practical tasks.		
B2M31DSP	Advanced DSP methods	Z.ZK	6
	the basic course in signal processing and introduces advanced methods of analysis and digital signal processing. Graduates will learn	,	_
	le to practically use them. They learn to know the conditions of use of correlation, spectral and coherent analysis of random signals.		
•		•	
methods of signal (decomposition and independent component analysis and the time-frequency transformations. Emphasis will be placed on an ability to	o interpret the resu	ilis oi signa
	analyses.		_
B4M33MPV	Computer Vision Methods	Z,ZK	6
The course covers	selected computer vision problems: search for correspondences between images via interest point detection, description and match	ing, image stitching	g, detection
recognition and	segmentation of objects in images and videos, image retrieval from large databases and tracking of objects in video sequences. This	s course is also pa	rt of the
inter-university pro	ogramme prg.ai Minor. It pools the best of Al education in Prague to provide students with a deeper and broader insight into the field	of artificial intellige	ence. More
	information is available at https://prg.ai/minor.		
B4M33PAL	Advanced algorithms	Z,ZK	6
	graph algorithms and graph representation. Combinatorial algorithms. Application of formal languages theory in computer science -	,	· -
B4M35KO	Combinatorial Optimization	Z,ZK	6
	the problems and algorithms of combinatorial optimization (often called discrete optimization; there is a strong overlap with the term of the problems and algorithms of combinatorial optimization (often called discrete optimization; there is a strong overlap with the term of the problems and algorithms of combinatorial optimization (often called discrete optimization; there is a strong overlap with the term of the problems and algorithms of combinatorial optimization (often called discrete optimization; there is a strong overlap with the term of the problems and algorithms of combinatorial optimization (often called discrete optimization; there is a strong overlap with the term of the problems.	1	_
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	near algebra, graph theory, and basics of optimization, we show optimization techniques based on graphs, integer linear programmir		
aigorithms and s	tate space search methods. We focus on application of optimization in stores, ground transportation, flight transportation, logistics, pl	aririing of numan r	esources,
	scheduling in production lines, message routing, scheduling in parallel computers.		

Molecular Biology and Genetics

Z,ZK

B4M36SAN	Statistical Data Analysis	Z,ZK	6
his course builds o	on the skills developed in introductory statistics courses. It is practically oriented and gives an introduction to applied statistics. It mainly	aims at multivaria	te statistical
nalysis and model	ling, i.e., the methods that help to understand, interpret, visualize and model potentially high-dimensional data. It can be seen as a p	urely statistical co	unterpart to
	machine learning and data mining courses.		
B4M36SMU	Symbolic Machine Learning	Z,ZK	6
This course cons	ists of four parts. The first part of the course will explain methods through which an intelligent agent can learn by interacting with its e	environment, also	known as
	arning. This will include deep reinforcement learning. The second part focuses on Bayesian networks, specifically methods for inferen	•	
fundamental topic	es from natural language learning, starting from the basics and ending with state-of-the-art architectures such as transformer. Finally, introduction to several topics from the computational learning theory, including the online and batch learning settings.	the last part will p	orovide an
BAM02BIO	Biosensors	Z,ZK	6
BAM02FPT	Physics for Diagnostics and Therapy	Z,ZK	6
	ints will be introduced to the problems of locomotive organs diseases and musculoskeletal pain in the first seven lectures. Great space is	•	otherapeutic
	eutic ultrasound and phototherapy. Furthermore, advanced neurorehabilitation methods, especially transcranial brain stimulation methods.		
agnetic stimulation	n of the brain - rTMS, transcranial electrical stimulation of the brain - tDCS and electroconvulsive therapy - ECT) are discussed. In the	e second half of th	ne semester
	ion is paid to the possibilities of using ionizing electromagnetic fields in medical diagnostics and therapy (eg X-ray, proton therapy, rac		
BAM17EMC	Introduction to electromagnetic compatibility	Z,ZK	6
	s on problems of electromagnetic compatibility. Students obtain the basic knowledges in the field of electromagnetic compatibility - el	,	erference,
	susceptibility and testing methods. The subject leads to gain professional skills in the field of electrical engineering.	-	
BAM17EPM	Applications of Electromagnetic Fields in Medicine	Z.ZK	6
	ese lectures is to give to students a basic overview of biophysical aspects of EM fields in different biological systems, including an overv	view of microwave	applications
medicine. Safety	limits, clinical usage of EM field effects on biological systems, microwave hyperthermia, measurement of dielectric parameters of bio	ological tissues, El	M exposure
	of mobile phone users, magnetic resonance imaging, interaction of optical radiation with biological tissue.		
BAM31ADA	Adaptive signal processing	Z,ZK	6
- 1	This course provides a basic discourse on adaptive algorithms for filtering, decorrelation, separation and beamforming.	,	
BAM31AOL	Applied optoelectronics in medicine	Z,ZK	6
	11 22 21 22 22 22 22 22 22	,	-
⊰AM31BSG	Riological signals	7 7K	6
	Biological signals Medical Instrumentation and Devices	Z,ZK	6
BAM31LET	Medical Instrumentation and Devices	Z,ZK	6
BAM31LET tudents will study f	Medical Instrumentation and Devices fundamental principles applied within the modern medical devices and systems, esp. from the point of view of functional blocks and ele	Z,ZK ectronic circuits of	6 diagnostica
BAM31LET sudents will study f and therapeutical	Medical Instrumentation and Devices fundamental principles applied within the modern medical devices and systems, esp. from the point of view of functional blocks and ele I medical equipments including electrocardiographs, electroencephalographs, bedside and central monitors, equipments for anestesi	Z,ZK ectronic circuits of iology, intensive a	6 diagnostica
BAM31LET udents will study f and therapeutical healthcare, equipr	Medical Instrumentation and Devices fundamental principles applied within the modern medical devices and systems, esp. from the point of view of functional blocks and ele I medical equipments including electrocardiographs, electroencephalographs, bedside and central monitors, equipments for anestesi ments for clinical laboratory, electrostimulators, cardiostimulators and defibrilators, blood pressure and flow measurement (including or	Z,ZK ectronic circuits of iology, intensive a dilution) and pulse	6 diagnostica nd critical coxymetry.
BAM31LET audents will study for and therapeutical healthcare, equipring BAM31MOA	Medical Instrumentation and Devices fundamental principles applied within the modern medical devices and systems, esp. from the point of view of functional blocks and elected leading and equipments including electrocardiographs, electroencephalographs, bedside and central monitors, equipments for anestesiments for clinical laboratory, electrostimulators, cardiostimulators and defibrilators, blood pressure and flow measurement (including of Modeling and analysis of brain activity	Z,ZK ectronic circuits of iology, intensive a dilution) and pulse Z,ZK	6 diagnostica nd critical e oxymetry.
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This includes typical tasks in speech and image recognition. The course has the following two main objectives 1. to present fundamental learning concepts such as risk minimisation, maximum likelihood estimation and Bayesian learning including their theoretical aspects, 2. to consider important state-of-the-art models for classification and regression and to show

how they can be learned by those concepts.

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