Study plan

Name of study plan: Master specialization Computer Science, in Czech, 2018-2019

Faculty/Institute/Others:

Department:

Branch of study guaranteed by the department: Welcome page

Garantor of the study branch: Program of study: Informatika

Type of study: Follow-up master full-time

Required credits: 97

Elective courses credits: 23 Sum of credits in the plan: 120

Note on the plan: Garant: prof. Ing. Jan Holub, PhD., email: jan.holub@fit.cvut.cz

Name of the block: Compulsory courses in the program

Minimal number of credits of the block: 62

The role of the block: PP

Code of the group: NI-PP.2018

Name of the group: Compulsory Courses of Master Study Program, Version 2018, in Czech

Requirement credits in the group: In this group you have to gain 62 credits

Requirement courses in the group: In this group you have to complete 6 courses

Credits in the group: 62 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
MI-KOP	Combinatorial optimization Jan Schmidt	Z,ZK	5	2P+2C	Z	PP
NI-DIP	Diploma Project Zden k Muziká Zden k Muziká Zden k Muziká (Gar.)	Z	30		L,Z	PP
MI-MPR	Master Project Zden k Muziká	Z	7		Z,L	PP
MI-MPI	Mathematics for Informatics Št pán Starosta	Z,ZK	7	3P+2C	Z	PP
MI-PDP.16	Parallel and Distributed Programming	Z,ZK	5	2P+2C	L	PP
MI-VSM	Selected statistical methods	Z,ZK	8	4P+2C	L	PP

Characteristics of the courses of this group of Study Plan: Code=NI-PP.2018 Name=Compulsory Courses of Master Study Program, Version 2018, in Czech

MI-KOP	Combinatorial optimization	Z,ZK	5					
The students will gain	The students will gain knowledge and understanding necessary deployment of combinatorial heuristics at a professional level. They will be able not only to select and implement but							
also to apply and eval	uate heuristics for practical problems.							
NI-DIP Diploma Project Z 30								
MI-MPR	Master Project	Z	7					

1. At the beginning of the semester, a student reserves her/his final thesis topic and gets together with its supervisor. Together they decide on partial tasks that should be carried out during the semester. If the requirements they agreed upon are met, the supervisor awards the student an assessment for the course MI-MPR at the end of the semester. 2. External Master these (MT) supervisor fills his/her assessment into the paper "Form to award assessment by an external Final theses (FT) supervisor" (for the courses BIE-BAP, MIE-MPR, MIE-DIP). Students, then, ensure that the assessment is registered into the information system (IS) by asking their internal FT opponent to award the assessment to the IS based on the confirmation of the external MT supervisor. In the case the FT opponent is external as well, the assessment will be registered to the IS by the head of the department responsible for the topic of the MT. 3. If the FT topic that the student has reserved is rather general, the immediate tasks the supervisor assigns to the student for the upcoming semester should aim at fine-tuning the FT topic so that the FTT will be complete and approvable at the end of the semester.

MI-MPI Mathematics for Informatics Z,ZK

The course comprises topics from general algebra with focus on finite structures used in computer science. It includes topics from multi-variate analysis, smooth optimization and multi-variate integration. The third large topic is computer arithmetics and number representation in a computer along with error manipulation. The last topic includes selected numerical algorithm and their stability analysis. The topics are completed with demonstration of applications in computer science. The course focuses on clear presentation and argumentation.

MI-PDP.16 Parallel and Distributed Programming Z,ZK 5

Due to the development of cloud, web, and communication technologies and due to the shift of the Moore law into multicore and manycore CPUs, parallel and distributed applications are becoming ubiquitous. Students get acquainted with architectures of parallel and distributed computing systems, their models, theory of interconnection networks, and languages and environments for parallel programming of shared and distributed memory computers. On selected problems, they will learn the techniques of design of efficient and scalable parallel algorithms and methods of performance evaluation of their implementations.

MI-VSM Selected statistical methods

Summary of probability theory; Multivariate normal distribution; Entropy and its application to coding; Statistical tests: T-tests, goodness of fit tests, independence test; Random processes - stacionarity; Markov chains and limiting properties; Queuing theory

Name of the block: Povinné p edm ty specializace

Minimal number of credits of the block: 35

The role of the block: PS

Code of the group: NI-PS-TI.2018

Name of the group: Compulsory Courses of Master Specialization Computer Science, Presented in Czech,

Version 2018

Requirement credits in the group: In this group you have to gain 35 credits

Requirement courses in the group: In this group you have to complete 7 courses

Credits in the group: 35 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
NI-ADM	Data Mining Algorithms Rodrigo Augusto Da Silva Alves, Pavel Kordík, Daniel Vašata Daniel Vašata Pavel Kordík (Gar.)	Z,ZK	5	2P+1C	L	PS
MI-EVY.16	Efficient Text Pattern Matching	Z,ZK	5	2P+1C	Z	PS
MI-GAK	Graph theory and combinatorics St pán Starosta	Z,ZK	5	2P+2C	L	PS
MI-KOD.16	Data Compression	Z,ZK	5	2P+1C	L	PS
NI-MVI	Computational Intelligence Methods Pavel Kordík Pavel Kordík Pavel Kordík (Gar.)	Z,ZK	5	2P+1C	Z	PS
MI-NON.16	Nonlinear Continuous Optimization and Numerical Methods	Z,ZK	5	2P+1C	Z	PS
NI-SYP	Parsing and Compilers Jan Janoušek Jan Janoušek (Gar.)	Z,ZK	5	2P+1C	Z	PS

Characteristics of the courses of this group of Study Plan: Code=NI-PS-TI.2018 Name=Compulsory Courses of Master Specialization Computer Science, Presented in Czech, Version 2018

NI-ADM	Data Mining Algorithms	Z,ZK	5			
The course focuses on	algorithms used in the fields of machine learning and data mining. However, this is not an introductory course, and the stude	nts should know n	nachine learning			
basics. The emphasis is	pasics. The emphasis is put on advanced algorithms (e.g., gradient boosting) and non-basic kinds of machine learning tasks (e.g., recommendation systems) and models (e.g., kernel					
methods).			ŀ			

MI-EVY.16 Efficient Text Pattern Matching

Z,ZK 5 Students get knowledge of efficient algorithms for text pattern matching. They learn to use so called succinct data structures that are efficient in both access time and memory complexity.

They will be able to use the knowledge in design of applications that utilize pattern matching.

MI-GAK Graph theory and combinatorics

The goal of the class is to introduce the most important topics in graph theory, combinatorics, combinatorial structures, discrete models and algorithms. The emphasis will be not only on undestanding the basic principles but also on applications in problem solving and algorithm design. The topics include: generating functions, selected topics from graph and hypergraph coloring, Ramsey theory, introduction to probabilistic method, properties of various special classes of graphs and combinatorial structures. The theory will be also applied in the fields of combinatorics on words, formal languages and bioinformatics.

MI-KOD.16 **Data Compression**

Z,ZK Students are introduced to the basic principles of data compression. They will learn the necessary theoretical background and get an overview of data compression methods being used in practice. The overview covers principles of integer coding and of statistical, dictionary, and context data compression methods. In addition, students learn the fundamentals of

Z.ZK

Z.ZK

5

lossy data compression methods used in image, audio, and video compression. NI-MVI Computational Intelligence Methods

Students will understand methods and techniques of computational intelligence that are mostly nature-inspired, parallel by nature, and applicable to many problems. They will learn how these methods work and how to apply them to problems related to data mining, control, intelligen games, optimizations, etc.

MI-NON.16 Nonlinear Continuous Optimization and Numerical Methods Z,ZK

Students will be introduced to nonlinear continuous optimization, principles of the most popular methods of optimization and applications of such methods to real-world problems. They will also learn the finite element method and the finite difference method used for solving ordinary and partial differential equations in engineering. They will learn to solve systems of linear algebraic equations that arise from discretization of the continuous problems by direct and iterative algorithms. They will also learn to implement these algorithms sequentially as well as in parallel.

NI-SYP Parsing and Compilers

The module builds upon the knowledge of fundamentals of automata theory, formal language and formal translation theories. Students gain knowledge of various variants and applications of LR parsing and are introduced to special applications of parsers, such as incremental and parallel parsing.

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

The role of the block: V

Code of the group: NI-V.2018

Name of the group: Purely Elective Master Courses, Version 2018

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

Credits in the group: 0

Note on the group:

In addition to the courses listed here, you can enroll as an elective any course that is offered within your study program and form of study that you did not enroll as a compulsory subject in the program/branch/specialization or a compulsory elective course. Courses of this group that a student

has completed in the bachelor study at CTU cannot be re-completed.

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		Scope	Semester	Role
MI-IKM	Internet and Classification Methods Martin Hole a	Z,ZK	4	1P+1C	L	V
MI-AFP	Applied Functional Programming Robert Pergl	KZ	5	2P+1C	L	V
MI-APH	Architecture of computer games Adam Vesecký	Z,ZK	4	2P+1C	Z	V
MI-BML	Bayesian Methods for Machine Learning Ond ej Tichý	KZ	5	2P+1C	L	V
MI-BPS	Wireless Computer Networks Alexandru Moucha	Z,ZK	4	2P+1C	L	V
MI-DSP	Database Systems in Practes	Z,ZK	4	2P+1C	L	V
NI-DPH	Game Design Adam Vesecký Adam Vesecký (Gar.)	Z,ZK	5	2P+1C	L	V
NI-PSD	Public Services Design David Pešek, Ond ej Brém David Pešek David Pešek (Gar.)	KZ	4	1P+2C		V
MI-DZO	Digital Image Processing	Z,ZK	4	2P+1C	L	V
MI-DDM	Distributed Data Mining	KZ	4	3C	L	V
MI-PAM	Efficient Preprocessing and Parameterized Algorithms	Z,ZK	4	2P+1C	L	V
MI-GLR	Games and reinforcement learning	Z,ZK	4	2P+2C	L	V
NI-GNN	Graph Neural Networks Miroslav epek Miroslav epek (Gar.)	Z,ZK	4	1P+1C	L	V
NI-GRI	Grid Computing André Sopczak, Petr Fiedler André Sopczak (Gar.)	Z,ZK	5	2P+1C	Z	V
NI-HCM	Mind Hacking Marcel Ji ina, Josef Holý Marcel Ji ina Marcel Ji ina (Gar.)	ZK	5	2P+1C	Z	V
MI-HMI2	History of Mathematics and Informatics	ZK	3	2P+1C	Z	V
MI-IBE	Information Security	ZK	2	2P	Z	V
MI-IVS	Intelligent embedded systems Miroslav Skrbek	KZ	4	1P+3C	L	V
NI-IAM	Internet and Multimedia	Z,ZK	4	2P+1C	L	V
MI-IOT	Internet of Things	Z,ZK	4	2P+1C	L	V
MI-ATH	Combinatorial Theories of Games	Z,ZK	4	2P+2C	L	V
NI-FMT	Finite model theory Tomáš Jakl Tomáš Jakl Tomáš Jakl (Gar.)	Z,ZK	4	2P+1C	L	V
NI-CCC	Creative Coding and Computational Art Josef Kortán, Radek Richtr Radek Richtr Radek Richtr (Gar.)	KZ	4	1P+2C	Z,L	V
MI-KYB.16	Cybernality	ZK	5	2P	Z	V
NI-LSM2	Statistical Modelling Lab Kamil Dedecius Kamil Dedecius (Gar.)	KZ	5	3C	Z,L	V
NI-LSM	Statistical Modelling Lab Kamil Dedecius Kamil Dedecius Kamil Dedecius (Gar.)	KZ	5	3C	L	V
MI-LOM.16	Linear Optimization and Methods	Z,ZK	5	2P+1C	Z	V
MI-MPX	Management practice David Buchtela	Z	4	5XD	Z,L	V
FI-MPL	Managerial Psychology	ZK	2	2+0	Z,L	V
MI-MSI	Mathematical Structures in Computer Science	Z,ZK	4	2P+1C	L	V
MI-MZI	Mathematics for data science Daniel Vašata	Z,ZK	4	2P+1C	L	V
NI-MOP	Modern Object-Oriented Programming in Pharo Marek Skotnica, Jan Blizni enko Robert Pergl Robert Pergl (Gar.)	KZ	4	3C	Z	V
MI-MPC	Modern programming in C ++ Daniel Langr	Z,ZK	5	2P+1C	Z	V
MI-MAI	Multimedia and Internet	Z,ZK	3	2P+1C	L	V

MI-OLI	Linux Drivers Miroslav Skrbek	Z,ZK	4	2P+2C	L	V
NIE-PML	Personalized Machine Learning Rodrigo Augusto Da Silva Alves Karel Klouda Rodrigo Augusto Da Silva Alves (Gar.)	Z,ZK	5	2P+1C	Z	V
MI-ARI	Computer arithmetic Alois Pluhá ek	Z,ZK	4	2P+1C	Z,L	V
NI-PG1	Computer Grafics 1 Radek Richtr Radek Richtr (Gar.)	ZK	4	2P+1C	L	V
MI-PVR	Advanced Virtual Reality	KZ	4	2P+1C	Z	V
NI-AML	Advanced machine learning Rodrigo Augusto Da Silva Alves, Miroslav epek, Petr Šimánek, Vojt ch Rybá, Zden k Buk Miroslav epek Miroslav epek (Gar.)	Z,ZK	5	2P + 1C	L	V
MI-IOS	Advanced techniques in iOS applications	KZ	4	2P+2C	L	V
MI-PVS	Advanced embedded systems Miroslav Skrbek	Z,ZK	4	2P+2C	Z	V
MI-DNP	Advanced .NET	Z,ZK	4	2P+1C	Z	V
MI-PYT	Advanced Python	KZ	4	3C	Z	V
NIE-PDL	Practical Deep Learning Martin Barus, Yauhen Babakhin Karel Klouda Martin Barus (Gar.)	KZ	5	2P+1C	Z	V
MI-PRC	Programming in CUDA	Z,ZK	4	2P+1C	L	V
MI-PSL	Ivan Šime ek Programming in Scala	Z,ZK	4	2P+1C	L	V
MI-RUB	Programming in Ruby	KZ	4	3C		V
MI-PCM.16	Project And Change Management	KZ	3	1P+2C	Z,L	V
MI-ROZ.16	Petra Pavlí ková Pattern Recognition	Z,ZK	5	2P+1C	Z	V
MI-RRI	Risk Management in Informatics	ZK	3	2P	L	V
MI-SCE2	Computer Engineering Seminar Master II	Z	4	2C	L,Z	V
MI-SZ1	Knowledge Engineering Seminar Master I Karel Klouda	Z	4	2C	L,Z	V
PI-SCN	Seminars on Digital Design Petr Fišer Petr Fišer Petr Fišer (Gar.)	ZK	4	2P+1C	Z,L	V
BI-SOJ	Machine Oriented Languages	Z,ZK	4	2P+2C	L	V
NI-MLP	Machine Learning in Practice Jan Hu in Daniel Vašata Jan Hu in (Gar.)	Z,ZK	5	2P+1C	Z	V
BI-SVZ	Machine vision and image processing Marcel Ji ina, Lukáš Brchl, Jakub Novák Marcel Ji ina Marcel Ji ina (Gar.)	Z,ZK	5	2P+2C	L,Z	V
MI-SEP	World Economy and Business	Z,ZK	4	2P+1C	Z	V
MI-TS1	Theoretical Seminar Master I	Z	4	2C	Z	V
MI-TS2	Theoretical Seminar Master II	Z	4	2C	L	V
MI-TS3	Theoretical Seminar Master III	Z	4	2C	Z	V
MI-TS4	Theoretical Seminar Master IV	Z	4	2C	L	V
MI-TNN	Theory of Neural Networks Daniel Vašata	Z,ZK	4	1P+1C	L	V
NI-TNN	Theory of Neural Networks Martin Hole a Martin Hole a Martin Hole a (Gar.)	Z,ZK	5	2P+1C	L	V
FI-KSA	Cultural and Social Anthropology	ZK	2	2P	L,Z	V
FI-ULI	Introduction to Linguistics for Computer	ZK	2	2P	L	V
MI-VEM	Scientific thinking	KZ	2	1P+1C	L	V
MI-MCS	Multicore Systems	KZ	4	1P+2C	Z	V
BI-VMM	Selected Mathematical Methods Tomáš Kalvoda Tomáš Kalvoda (Gar.)	Z,ZK	4	2P+2C	L	V
MI-VYC	Computability	Z,ZK	4	2P+2C	L	V
NI-VPR	Research Project Št pán Starosta Št pán Starosta (Gar.)	Z	5		Z,L	V
MI-ZS10	Master internship abroad for 10 credits Zden k Muziká	Z	10		Z,L	V
MI-ZS20	Master internship abroad for 20 credits Zden k Muziká	Z	20		Z,L	V
	Master internship abroad for 30 credits		1	+		

Characteristics of the courses of this group of Study Plan: Code=NI-V.2018 Name=Purely Elective Master Courses, Version 2018

MI-IKM	Internet and Classification Methods	Z,ZK	4					
	nts get acquainted with classification methods used in four important internet, or generally network applications: in spam filte	_						
-	in malware detection systems and in intrusion detection systems. However, they will learn more than only how classification is performed when solving these four kinds of problems. On the background of these applications, they get an overview of the fundamentals of classification methods. The course is taught in a 2-weeks cycle with 2-hour lectures and 2-hour							
-	ercises, the students on the one hand implement simple examples to topics from the lectures, on the other hand consult the		ires and 2-nour					
MI-AFP	Applied Functional Programming	KZ	5					
	d in Czech. Functional programming represents one of the traditional programming paradigms. Traditional and novel function							
the rise nowadays and t	he functional paradigm becomes an important construct of traditionally imperative languages (C++, C#, Java). As such, mas	tering this paradig	m becomes a					
necessary competence	of a software engineer: the theory and especially the practice.							
MI-APH	Architecture of computer games	Z,ZK	4					
-	ic understanding of the various issues in the field of computer game development, from both the technical and creative point	=						
-	hitecture, game mechanics, and game AI that form an integral part of most games. They will also understand the basics of pat	hfinding, networkir	ng, and scripting					
and apply them in practi	Bayesian Methods for Machine Learning	KZ	5					
	n practical use of basic Bayesian modeling methods in the dynamically evolving machine learning theory. In particular, it stud		-					
=	ption of real phenomena, as well as their subsequent use, e.g., for forecasting of future evolution or learning about the hidde							
	etc.). The emphasis is put on understanding of explained principles and methods and their practical adoption. For this purpose							
	presented to students, for instance, 2D/3D object tracking, radiation source term estimation, or separation in medical imagin	g. The students wi	Il try to solve					
some of them.								
MI-BPS	Wireless Computer Networks	Z,ZK	4					
	t the modern technologies, protocols, and standards for wireless networks. They will understand the routing mechanisms in							
	and data flow control mechanisms. They will also learn about principles of communication in sensor networks. They get kno ad get skills of configuration of wireless network elements and simulation of wireless networks using suitable tools.	wieage of security	mecnanisms					
MI-DSP		Z,ZK	4					
This course is presented	Database Systems in Practes	Z,Zr\	4					
NI-DPH	Game Design	Z.ZK	5					
	ts the NI-APH (Architecture of Computer Games) and BI-VHS (Virtual gaming worlds) course, while focusing primarily on gar	ı , ı	-					
=	whedge of the principles used for games design, such as: level design, gameplay design, character design, game mechanics	_						
development cycle. The	students will get an overview of game development from the designer's perspective, from theoretical concepts to practical im	plementation appl	ied to semestral					
projects.								
NI-PSD	Public Services Design	KZ	4					
	e students to specifics of UX, Service design and development for public sector. We will look into the design and development	-						
	ignesr) as well as clients. In small teams students will work on projects from partner organizations and will try out collaborati	on with client repre	esentatives.					
	ents-designers as well as clients.	7.71						
MI-DZO	Digital Image Processing	Z,ZK	4					
·	comprehensive overview of modern methods for interactive editing of digital images and video. It mainly deals with practical interesting theoretical basis. Visually attractive applications provide better understanding of basic theoretical background that i	-	-					
•	ing. This course will introduce algorithms solving the following practical applications: edge-aware editing, tone mapping, HDF							
	raction, hybrid images, gradient domain editing, seamless image stitching and cloning, digital photo-montage, color-to-gray of	-	-					
interactive as-rigid-as-po	ossible image deformation, free-form image registration, texture synthesis, interactive segmentation, colorization, painting, and	dding depth, alpha	matting.					
MI-DDM	Distributed Data Mining	KZ	4					
	e-of-the-art approaches for distributed data mining and parallelization of machine learning algorithms. Students will gain hand	•	-					
	ork Apache Spark and with existing distributed DM / ML algorithms. They will learn principles of their parallel implementation	is and will be capa	ble to propose					
	e other algorithms. The course is prezented in czech language.	7.71						
MI-PAM	Efficient Preprocessing and Parameterized Algorithms ation problems for which no polynomial time algorithms are known (e.g. NP-complete problems). Despite that it is often nece	Z,ZK	4					
= = =	vill demonstrate that many problems can be solved much more effectively than by naively trying all possible solutions. Often	-						
	s from practice-e.g., all solutions are relatively small. Parameterized algorithms exploit that by limiting the time complexity exp							
and polynomially in the	input size (which can be huge). Parameterized algorithms also represent a way to formalize the notion of effective polynomia	Il time preprocessi	ng of the input,					
which is not possible in	the classical complexity. Such a polynomial time preprocessing is then a suitable first step, whatever is the subsequent solut	ion method. We wi	Il present a					
	ed algorithm design methods and we will also show how to prove that for some problem (and parameter) such an algorithm (presumably) does	not exist. We					
	e relations to other approaches to hard problems such as moderately exponential algorithms or approximation schemes.							
MI-GLR	Games and reinforcement learning	Z,ZK	4					
	nt learning is very hot recently, because of advances in deep learning, recurrent neural networks and general artificial intellig	gence. This course	is intended to					
NI-GNN	I and practical background so you can participate in related research activities. Presented in English. Graph Noural Networks	Z,ZK	4					
	Graph Neural Networks students to advanced artificial intelligence techniques for working with graphs. Lectures will focus on the latest graph neural r							
	s, edges and entire graphs. The techniques discussed cover various types of graphs, including time-varying graphs. The last		-					
•	terpretability of graph neural networks. In the exercises, students will try out selected techniques and problems.	p						
NI-GRI	Grid Computing	Z,ZK	5					
Grid computing and gair	n knowledge about the world-wide network and computing infrastructure.	, ,						
NI-HCM	Mind Hacking	ZK	5					
Cognitive security is an	emerging discipline that is closely related to cyber security. While the domain of cyber security is the protection of networks,	information syster	ms and assets,					
-	security is the protection of the human mind from intentional and unintentional digital manipulation. The topic of cognitive security is the protection of the human mind from intentional and unintentional digital manipulation. The topic of cognitive security is the protection of the human mind from intentional and unintentional digital manipulation.							
	n warfare, increasing digital dependence and the development of artificial intelligence, where these phenomena from the Inter-	net environment h	ave real societal					
	ion of social cohesion, threats to democracy or war.	71/						
MI-HMI2	History of Mathematics and Informatics	ZK	3					
	simal calculus, probability, number theory, general algebra, different examples of algorithms, transformations, recursive funct ons of some mathematical methods in informatics and its development.	ions, eliptic curves	o, etc.) note on					
MI-IBE	Information Security	ZK	2					
	on and IS/ICT security management systems (ISMS), methods for information access control, and basic norms and internat							
	management of internal and external security threats, for IS/IT security audits, and for application security testing (e.g., pen		,					

MI-IVS	Intelligent embedded systems	KZ	4
-	vstems course for master's degree is focused on high-level technology embedded systems integrating artificial intelligence. T		
•	ded system fundamentals course for the bachelor degree. The aim of the course is to teach students humanoid robot progra provide basis of motion control, sensor reading, application interfaces, robot navigation and development tools. In labs, stude	ŭ	
•	f various courses like nature inspired algorithms, data mining algorithms, image recognition and web technologies	nts develop advan	ced applications
NI-IAM	Internet and Multimedia	Z,ZK	4
The NI-IAM course is fo	icused on principles and modern technologies for network transmissions of audiovisual (AV) signals. The syllabus includes a	1 ' 1	gnals (input),
· -	als (output), network communication protocols, device interfaces, codecs, data formats and stereoscopy. We will look at practic		
	ns. Within the labs, students will practically assemble AV transmission chains using HW and SW technologies and verify the		
for audience.	of AV transmissions. Students will learn how to build Internet infrastructure for end-to-end AV transmissions from the recordin	ig the scene up to	the presentation
MI-IOT	Internet of Things	Z,ZK	4
-	on the area of hardware and software technologies for the strongly growing computer support of various devices. Its goal is f	1 ' 1	
development elements	(Raspberry Pi, Arduino Due) and with the language for efficient application development and modification (GNU Forth).		
MI-ATH	Combinatorial Theories of Games	Z,ZK	4
This course is presente			
NI-FMT	Finite model theory	Z,ZK	4
	s to introduce students to the basics of finite model theory. The original motivation is the questions expressibility and verifiabilion in the 1970s, the course has evolved rapidly and touched on many other areas of theoretical computer science, such as		
	Problem (CSP), the theory of algorithmic meta-theorems and combinatorics.	s descriptive comp	lexity trieory, trie
NI-CCC	Creative Coding and Computational Art	KZ	4
	cal tasks, get acquainted with creative and yet proven methods of visualizing various types of data. The course freely follows	the basic graphics	s courses (MGA,
	students to suitable visualization methods for traditional as well as for open data. It combines well-known visualization technology	•	٠ ا
•	he aim is to create an interesting visualization project. It is planned to work closely with IPR CAMP (Center of Architecture a	nd Metropolitan Pl	anning) and IIM
(Institute of Intermedia		71/	
MI-KYB.16	Cybernality d with the fundamentals of legislation and international activities in the area of fighting cybercrime. Students will understand	ZK the classification of	5 of attacks and
	tems for computer surveillance and traffic monitoring in the cyberspace. Students will also familiarize themselves with hacker		
-	operation of the state agencies and subjects dealing with defence of the cyberspace (especially CSIRT and CERT teams).		
NI-LSM2	Statistical Modelling Lab	KZ	5
The topic of LSM2 is ac	vanced multiple target tracking (MTT). This domain covers simultaneous tracking of multiple targets using radar under the pre	esence of clutter, c	or video tracking.
	he-art filters, in particular the PHD (Probability Hypothesis Density) and PMBM (Poisson Multi-Bernoulli) filters.		
NI-LSM	Statistical Modelling Lab	KZ	5
	on a single and multi-target tracking. The student both learns the existing methods and tries to implement them. The stress is ad its modeling using numpy and scipy. The second half of the semester is focused on the design of methods and algorithms,	-	
	t is on the border of own research and may result in the topic of final work (diploma or bachelor thesis).	, and analyses of t	neli properties.
MI-LOM.16			
IVII-LUIVI. 10	Linear Optimization and Methods	l Z.ZK l	5
= =	Linear Optimization and Methods ications of optimization methods in computer science, economics, and industry. They are aware of practical importance of line	1 ' 1	-
Students learn the appl are able to work with or	ications of optimization methods in computer science, economics, and industry. They are aware of practical importance of line of interesting interesting and are familiar with languages used in programming of that software. They get skills in formalization of of the contraction of the contraction of the contraction in the contraction of the contraction o	ear and integer pro	ogramming. They ems in computer
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Students learn the applare able to work with opscience (such as schedissues from economics in linear programming. MI-MPX The Student can once, level of management (tycourse guarantor. In the member of the top man FI-MPL MI-MSI Mathematical semantic MI-MZI In this course, students include mainly: linear all selected notions from p NI-MOP Object-oriented program is used to build complex of object systems in modadition to deepening of technologies in terms of MI-MPC Students learn how to use and efficiency in the for MI-MAI The course will cover prapplication areas of net	cations of optimization methods in computer science, economics, and industry. They are aware of practical importance of line bitmization software and are familiar with languages used in programming of that software. They get skills in formalization of valuing of tasks to processors, analysis of network flows), distribution and allocation of resources (transportation problems, trained modelling of conflicts via the game theory. They get an overview of computational complexity of optimization problems. Management practice within its master's degree graduate (to apply) management practices in the selected subject of practice (business subject) on the position of project manager, middle or top manager). The selected subject of practice and professional filling is selected subject of practice may not have a substantial ownership interest or substantial decision-making influence of the reagement). Managerial Psychology Mathematical Structures in Computer Science so programming languages. Mathematics for data science are introduced to those fields of mathematics that are necessary for understanding standard methods and algorithms used gebra (matrix factorisations, eigenvalues, diagonalization), continuous optimisation (optimisation with constraints, duality prinobability theory and statistics. Modern Object-Oriented Programming in Pharo numing is currently one of the most widespread paradigms of software creation, especially enterprise information systems, who modern applications. In this course, we build on the knowledge acquired in the course BI-OOP and aim to further deepen the expective programming skills, which are generally applicable in other OO languages, students will also gain the opportunity to we feemesteral work with the possibility of cooperation with practice and related bachelor, diploma, postgraduate our direct involuded reportance of contemporary versions of the C++ programming language for software development. The course form of writing maintainable and portable source code and creating correc	ar and integer proportion and integer proport	gramming. They ams in computer problems, etc.), on in algorithms 4 ctical or strategic advance the lent (e.g. as a lent (e.g.
Students learn the applare able to work with opscience (such as schedissues from economics in linear programming. MI-MPX The Student can once, level of management (tycourse guarantor. In the member of the top man FI-MPL MI-MSI Mathematical semantic MI-MZI In this course, students include mainly: linear al selected notions from p NI-MOP Object-oriented program is used to build complex of object systems in modadition to deepening of technologies in terms of MI-MPC Students learn how to use and efficiency in the for MI-MAI The course will cover prapplication areas of nettand distributed collabor	cations of optimization methods in computer science, economics, and industry. They are aware of practical importance of line intrinzation software and are familiar with languages used in programming of that software. They get skills in formalization of rulling of tasks to processors, analysis of network flows), distribution and allocation of resources (transportation problems, tra, and modelling of conflicts via the game theory. They get an overview of computational complexity of optimization problems. Management practice within its master's degree graduate (to apply) management practices in the selected subject of practice (business subject) on typically at the position of project manager, middle or top manager). The selected subject of practice and professional filling is selected subject of practice may not have a substantial ownership interest or substantial decision-making influence of the reagement). Managerial Psychology Mathematical Structures in Computer Science are introduced to those fields of mathematics that are necessary for understanding standard methods and algorithms used gebra (matrix factorisations, eigenvalues, diagonalization), continuous optimisation (optimisation with constraints, duality prirobability	ar and integer proportimization problevelling salesman problem studies of the studies of the studies of the studies and areas problem salesman problem salesm	gramming. They ems in computer problems, etc.), on in algorithms 4 ctical or strategic advance the lent (e.g. as a lent (e.g.
Students learn the applare able to work with opscience (such as schedissues from economics in linear programming. MI-MPX The Student can once, level of management (tycourse guarantor. In the member of the top man FI-MPL MI-MSI Mathematical semantic MI-MZI In this course, students include mainly: linear all selected notions from p NI-MOP Object-oriented program is used to build complex of object systems in moded addition to deepening of technologies in terms of MI-MPC Students learn how to use and efficiency in the for MI-MAI The course will cover prapplication areas of netter and distributed collabor MI-OLI	cations of optimization methods in computer science, economics, and industry. They are aware of practical importance of line bitmization software and are familiar with languages used in programming of that software. They get skills in formalization of valuing of tasks to processors, analysis of network flows), distribution and allocation of resources (transportation problems, trained modelling of conflicts via the game theory. They get an overview of computational complexity of optimization problems. Management practice within its master's degree graduate (to apply) management practices in the selected subject of practice (business subject) on the position of project manager, middle or top manager). The selected subject of practice and professional filling is selected subject of practice may not have a substantial ownership interest or substantial decision-making influence of the reagement). Managerial Psychology Mathematical Structures in Computer Science so programming languages. Mathematics for data science are introduced to those fields of mathematics that are necessary for understanding standard methods and algorithms used gebra (matrix factorisations, eigenvalues, diagonalization), continuous optimisation (optimisation with constraints, duality prinobability theory and statistics. Modern Object-Oriented Programming in Pharo numing is currently one of the most widespread paradigms of software creation, especially enterprise information systems, who modern applications. In this course, we build on the knowledge acquired in the course BI-OOP and aim to further deepen the expective programming skills, which are generally applicable in other OO languages, students will also gain the opportunity to we feemesteral work with the possibility of cooperation with practice and related bachelor, diploma, postgraduate our direct involuded reportance of contemporary versions of the C++ programming language for software development. The course form of writing maintainable and portable source code and creating correc	ar and integer proportion and integer proportion.	agramming. They ams in computer problems, etc.), on in algorithms 4 ctical or strategic advance the lent (e.g. as a lent (e.g
Students learn the applare able to work with opscience (such as schedissues from economics in linear programming. MI-MPX The Student can once, level of management (tycourse guarantor. In the member of the top man FI-MPL MI-MSI Mathematical semantic MI-MZI In this course, students include mainly: linear all selected notions from p NI-MOP Object-oriented program is used to build complex of object systems in moded addition to deepening of technologies in terms of MI-MPC Students learn how to use and efficiency in the for MI-MAI The course will cover propaplication areas of netter and distributed collabor MI-OLI The Linux operating systemicrease the variability.	cations of optimization methods in computer science, economics, and industry. They are aware of practical importance of line intrinzation software and are familiar with languages used in programming of that software. They get skills in formalization of valing of tasks to processors, analysis of network flows), distribution and allocation of resources (transportation problems, tra and modelling of conflicts via the game theory. They get an overview of computational complexity of optimization problems. Management practice within its master's degree graduate (to apply) management practices in the selected subject of practice (business subject) on the problems. The selected subject of practice and professional filling is selected subject of practice and professional filling is selected subject of practice may not have a substantial ownership interest or substantial decision-making influence of the reagement). Managerial Psychology Mathematical Structures in Computer Science are introduced to those fields of mathematics that are necessary for understanding standard methods and algorithms used gebra (matrix factorisations, eigenvalues, diagonalization), continuous optimisation (optimisation with constraints, duality prin robability theory and statistics. Modern Object-Oriented Programming in Pharo numing is currently one of the most widespread paradigms of software creation, especially enterprise information systems, who are applications. In this course, we build on the knowledge acquired in the course Bi-OOP and aim to further deepen the idem pure object system Pharo (https://pharo.org). The course focuses on individual approach to students, their development bject programming skills, which are generally applicable in other OO languages, students will also gain the opportunity to we for semestral work with the possibility of cooperation with practice and related bachelor, diploma, postgraduate our direct involved for semestral work with the possibility of cooperation with practice and related bachelor, diploma,	ar and integer proportion and integer proportion. Value Val	gramming. They ems in computer problems, etc.), on in algorithms 4 ctical or strategic advance the lent (e.g. as a lent (e.g.
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NIE-PML	Personalized Machine Learning	Z,ZK	5
	earning (PML) is a sub-field of machine learning that aims to create models and predictions based on the unique characteris		
	ommonly used in applications such as recommender systems, which recommend items to users based on their personal inte		
-	fields, including education, medicine, and chemical engineering. In this course, we will explore the latest PML methods from the ly, we will focus on cutting-edge models that are of interest to both the research and commercial communities.	eretical, algorithm	nic, and practical
MI-ARI	Computer arithmetic	Z,ZK	4
	bus data representations used in digital devices and will be able to design arithmetic operations implementation units.	2,21	7
NI-PG1	Computer Grafics 1	ZK	4
_	aphic courses (mainly BI-PGA and BI-PGR) and the knowledge from these courses is deepened by state-of-the-art knowledge	1 1	signed for those
interested in advanced	computer graphics. Students will gain practical knowledge with realistic texturing and raytracing methods. An integral part of t	he course is the s	tudy of scientific
	quent implementation. The course will be followed by a course PG2 supplementing the knowledge of PG1 on other areas and	d topics of comput	ter graphics.
MI-PVR	Advanced Virtual Reality	KZ	4
	advanced parts of the virtual reality. It is a continuation of the already running graphic objects, especially the creation of 3D mo		-
-	tents to their application in virtual reality. Lectures will focus on virtual reality technology, its use in various applications and will a (mainly Unity3D). The course is freely connected with the subject VHS (virtual game worlds), students will be able to apply the		
-	the create a complex game for VR.	s knowledge gairle	ed iii tiiis subject
		7 7K	5
			-
MI-IOS	Advanced techniques in iOS applications	KZ	4
Students will learn the la	atest trends in mobile development technologies for iOS platform. Class covers advanced topics, students need to know all th	e basics from the	beginners class
BI-IOS.			
MI-PVS	ı	1 ' 1	
		•	
-	age devices, motor control, system control and industrial communication. The students obtain both theoretical and also practi	cai experiences w	ntri embedded
	Advanced NET	7 7K	1
		1 ' 1	
Advanced machine learning he course introduces students to selected advanced topics of machine learning and artificial intelligence. The topics present techniques in the field of recommendation systems, image rocessing, control and interconnection of physical laws with the field of machine learning. The aim of the exercise is to familiarize students with the methods discussed. MI-IOS Advanced techniques in iOS applications KZ 4 students will learn the latest trends in mobile development technologies for iOS platform. Class covers advanced topics, students need to know all the basics from the beginners class iI-IOS. MI-PVS Advanced embedded systems The course is focused on ARM processors and microcontrollers and their usage in wide range of applications. The course includes a series of advanced topics like security support, vorking with mass storage devices, motor control, system control and industrial communication. The students obtain both theoretical and also practical experiences with embedded systems. MI-DNP Advanced .NET Tutudents acquire a knowledge about advanced desgin of applicatios on a .NET platform. They gain skills of WPF (Windows Presentation Foundation), WCF/WebAPI (Windows Presentation Foundation) and Entity Framework. They are able to apply these skills on a development and desgin of advanced .NET applications. MI-PYT Advanced Python Advanced Inserting Python Python Python Python Python			
MI-PYT	Advanced Python	KZ	4
The goal of this course	is to learn various advanced techniques and methods in Python. The course indirectly continues where Programming in Pyth	ion (BI-PYT) left o	f. The course is
-	s only tutorials, everything is demonstrated on examples. Classification is based on work in class as well as semestral coursew	ork. The course is	lead by external
NIE-PDL			_
-		_	-
	r develop practical skills in building and training deep fiedral fietworks, using Fy forch to solve real-world problems in fields so	cir as computer vi	ision and natural
MI-PRC	Programming in CUDA	7 7K	4
_		1 1	•
MI-PSL			4
The course introduces t		tures - e.g.pattern	matching and
advance standard librar	y. Scala enables to use of applications functional patterns e.g. H-List, Monads, etc. Scala is used by many powerful frameworks	and libraries e.g. F	Play, Cassandra,
Scalaz, etc.	Advanced embedded systems e course is focused on ARM processors and microcontrollers and their usage in wide range of applications. The course includes a series of advanced topics like security support, witking with mass storage devices, motor control, system control and industrial communication. The students obtain both theoretical and also practical experiences with embedded stems. I-DNP Advanced .NET Z.ZK 4 udents acquire a knowledge about advanced desgin of applicatios on a .NET platform. They gain skills of WPF (Windows Presentation Foundation), WCF.WebAPI (Windows mmunication Foundation) and Entity Framework. They are able to apply these skills on a development and desgin of advanced .NET applications. I-PYT Advanced Python KZ 4 e goal of this course is to learn various advanced techniques and methods in Python. The course indirectly continues where Programming in Python (BI-PYT) left of. The course is ry hands-on and it has only tutorials, everything is demonstrated on examples. Classification is based on work in class as well as semestral coursework. The course is lead by external achieves from Red Hat. IE-PDL Practical Deep Learning is course is designed to provide students with a comprehensive understanding of Deep Learning using PyTorch, a popular open-source machine learning framework. Throughout a course, students will develop practical skills in building and training deep neural networks, using PyTorch to solve real-world problems in fields such as computer vision and natural guage processing. I-PRC Programming in CUDA Z,ZK 4 e students gain a good overview of present parallel architectures in GPUs. Students also get hands-on experience with programming these systems. I-PSL Programming in Scala Z,ZK 4 e course introduces the modern programming language Scala which exploits object-functional paradigm. Scala comprises advance language features - e.g.pattern matching and vance standard library. Scala enables to use of applications functional patterns e.g. H-		
MI-RUB		KZ	4
<u> </u>		1.7	
		KZ	3
		7.71/	
	-	1	
			•
MI-RRI			
		1	_
IT systems against virus	ses, malware etc. very often means misunderstanding and underestimating of real threats which are around us and which are	more dangerous t	then viruses and
- ·			sible to see
		1	4
		1 1	
· ·	ually within the subject. Each student or group of students solves some interesting topic with the selected supervisor. Part of t		
• • •	ssional literature and/or work in K N laboratories. The capacity of the subject is limited by the possibilities of the seminar teachers.	•	
semester.		•	
MI-SZ1	Knowledge Engineering Seminar Master I	Z	4
	present a research paper from a top institute / research group to your peers. You will learn what is being cooked in top research	arch labs around t	he world.
	rn how to properly present and read scientific papers. The work in the seminar will prepare you to attend (and profit from) top ma	chine learning and	d AI conferences
	s well as FIT's own Summer Research Program (VyLet).		
PI-SCN	Seminars on Digital Design	ZK	4
	problems of realization and implementation of digital circuits - both combinational and sequential. Basic means of description ion algorithms are described. Basics of EDA (Electronic Design Automation) systems are given, together with combinatorial processing the strength of the combinatorial processing the strength of the strength	_	-
BI-SOJ	Machine Oriented Languages	Z,ZK	4
	rividentifie Otterfled Larrydages will gain an ability to create their own programs in the assembly language of the most common PC platform focusing on optima	1 ' 1	-
	n of software with hardware. Next, there will be discussed x86 specifics of the majority of OSes from the application point of vie	=	
	used during reverse engineering, optimization, and evaluation of code security.		

NI-MLP	Machine Learning in Practice	Z,ZK	5
	ng methods to real projects in practice involves many other necessary tasks - from understanding the intentions of the client to, ents through all phases of a project according to the standard CRISP-DM methodology, not only theoretically but also practic		
	erits through all phases of a project according to the standard CRISF-DM methodology, not only theoretically but also practic Irn how to describe the whole process from exploration to evaluation of the model performance in the form of a clear and und		
BI-SVZ	Machine vision and image processing	Z,ZK	5
	coming a common part of life by being universally available. Related to this phenomenon is the need to process and evaluate	′	
introduces students to d	ifferent types of camera systems and a variety of methods for image and video processing. The course is focused on practical	use of camera sys	stems for solving
	tt the graduates may encounter.		
MI-SEP	World Economy and Business	Z,ZK	4
•	d in Czech. However, there is an English variant in the program Informatics (N1801 / 4793). The course introduces students of t does that predominantly by comparing individual countries and key regions of world economy. Students get to know about o		-
	iness in diverse societies as well as indexes of economic freedom, corruption and economic development, which are needed	_	
· · · · · · · · ·	ve on the knowledge in the form of discussions based on individual readings. It is advised to take bachelor level of this course	_	
MI-TS1	Theoretical Seminar Master I	Z	4
	ntended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a class		•
•	and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course is	a work with scier	ntific papers and
	e. The capacity is limited by the the potentials of the teachers of the seminar. Theoretical Seminar Master II	Z	4
MI-TS2 Theoretical seminar is in	theoretical Seminal Master II attended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a class	= !	•
	and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course is		
other scholarly literature	e. The capacity is limited by the the potentials of the teachers of the seminar.		
MI-TS3	Theoretical Seminar Master III	Z	4
	ntended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a class		
=	and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course is	a work with scier	ntific papers and
MI-TS4	e. The capacity is limited by the the potentials of the teachers of the seminar. The capacities I Seminar Moster IV	Z	4
	Theoretical Seminar Master IV attended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a class	- !	
	and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course is		•
=	e. The capacity is limited by the the potentials of the teachers of the seminar.		
MI-TNN	Theory of Neural Networks	Z,ZK	4
· · · · · · · · · · · · · · · · · · ·	neural networks from the point of view of the theory of function approximation and from the point of view of probability theory		
	eural Networks, such as neurons and connections between them, types of neurons from the point of view of signal transmission	•	-
	work training, and the role of time in neural networks. In connection with network topology, we get acquainted with its transfor comatic and synaptic mappings, with their composition into mappings computed by the Network, Finally in connection with tra		
	and to the fact that training is actually a specific optimization task, recalling the most typical objective functions and the most		
employed for neural net	work training. We will see the meaninig of all these concepts in the context of common kinds of forward neural networks. Within	the topic approxin	nation approach
	irst notice the connection of neural networks to expressing functions of many variables using functions of fewer variables (Ko	-	
•	e will see how the universal approximation capacity of neural networks can be mathematically formalized as the sets of mappi		
-	nt Banach spaces of functions, in particular in the spaces of continuous functions, spaces of functions integrable with respect Is derivatives, and Sobolev spaces. Within the topic probabilistic approach, we first get acquainted with training based on exp		•
	h probabilistic assumptions about training data with which those two kinds of neural networks can be employed. We will see he		- 1
of the conditional expec	tancy of network outputs conditioned by its inputs using the expectancy based learning. We recall the strong and the weak la	w of large numbe	rs and get
•	ogy of the strong law of large numbers for neural networks and with the assumptions for its validity. Finally, we recall the cent		
	al networks, with the assumptions for its validity and with the hypothesis tests based on it. We will see how those tests can be	employed to sea	arch for the
topology of the network		7 71/	5
NI-TNN In this course, we study	Theory of Neural Networks neural networks from the point of view of the theory of function approximation and from the point of view of probability theory	Z,ZK	-
· · · · · · · · · · · · · · · · · · ·	eural Networks, such as neurons and connections between them, types of neurons from the point of view of signal transmission		
	work training, and the role of time in neural networks. In connection with network topology, we get acquainted with its transfor	•	-
	somatic and synaptic mappings, with their composition into mappings computed by the Network, Finally in connection with tra-		
	and to the fact that training is actually a specific optimization task, recalling the most typical objective functions and the most		
	work training. We will see the meaninig of all these concepts in the context of common kinds of forward neural networks. Within irst notice the connection of neural networks to expressing functions of many variables using functions of fewer variables (Ko		
	e will see how the universal approximation capacity of neural networks can be mathematically formalized as the sets of mappi	ŭ	
being dense in importar	nt Banach spaces of functions, in particular in the spaces of continuous functions, spaces of functions integrable with respect	to a finite measur	re, spaces of
	is derivatives, and Sobolev spaces. Within the topic probabilistic approach, we first get acquainted with training based on exp		- 1
· · · · · · · · · · · · · · · · · · ·	h probabilistic assumptions about training data with which those two kinds of neural networks can be employed. We will see he	•	
•	tancy of network outputs conditioned by its inputs using the expectancy based learning. We recall the strong and the weak la ogy of the strong law of large numbers for neural networks and with the assumptions for its validity. Finally, we recall the cent	_	- 1
•	al networks, with the assumptions for its validity and with the hypothesis tests based on it. We will see how those tests can be		- '
topology of the network		. ,	
FI-KSA	Cultural and Social Anthropology	ZK	2
	se aims to acquaint students with the basics of social and cultural anthropology as a scientific discipline dealing with the dive	•	•
· -	h from our "exotic" cultures (topics: kinship, religion, social exclusion, migration, globalization, , material culture, language, he	alth, history, deat	h, etc) will be
	n interesting alternative to other humanities, taught at FIT.	7V	
FI-ULI This course is presented	Introduction to Linguistics for Computer	ZK	2
MI-VEM	Scientific thinking	KZ	2
	rse is to get acquainted with scientific methods and discovery of order and laws of the universe, including the aspects of hum		
	tural sciences, mathematics, computer science and humanities. Another aim is to introduce rules and requirements of scienti		
papers and posters.			

MI-MCS Multicore Systems KZ 4
Students understand architecture of systems based on multicore processors with multiple threads per core structure and usage of cache hierarchy with shared last level. They let

Students understand architecture of systems based on multicore processors with multiple threads per core, structure and usage of cache hierarchy with shared last level. They learn parallel algorithm classification, parallel programming technics, simulation and monitoring tools for measurement and optimization of parallel algorithms. After this course, students can design MTMD programs (Multiple Threads Multiple Data), measure and analyze latency and throughput of parallel algorithms and optimize them for contemporary multicore systems.

BI-VMM Selected Mathematical Methods

Z,ZK

We start reviewing geometric properties of linear spaces with inner product. Next, we introduce and analyze the discrete Fourier transform (DFT) and its fast implementation (FFT). Further we deal with differential calculus of functions involving multiple variables. We present methods for the localization of extreme values of functions. For this purposes, we study normed linear spaces and quadratic forms. In addition, we introduce the least square method. The last part of the course is devoted to optimization and duality. The linear programming and the Simplex method is analyzed in more detail.

	MI-VYC	Computability	Z 5			
	Classical theory of recu	lassical theory of recursive functions and effective computability, with applications in provability theory.				
Classical theory of recursive functions and effective computability, with applications in provability theory. NI-VPR Research Project Z 5 Student obtains the credits for published scientific outputs. The details are at https://courses.fit.cvut.cz/NI-VPR/en.	5					
	Student obtains the cred	•	·			
	MI-ZS10					

Each student can once within his / her master's degree have a foreign internship at a foreign university or other foreign scientific and/or research institution. Before the internship the Dean of the FIT, or the vice-dean for study affairs assesses the professional content. The student must provide evidence of the professional content and extent of the internship. Auxiliary courses MI-ZS10, MI-ZS20, MI-ZS30 are used used for the evidence and evaluation of the internship in IS KOS. Every 10 credits correspond to 4 weeks of full-time employment with a foreign institution. The maximum number of credits a student can earn for one internship is 30 credits. This amount can be divided into two subjects if the internship exceeds the academic year's dead-line.

MI-ZS20 Master internship abroad for 20 credits

20

Each student can once within his / her master's degree have a foreign internship at a foreign university or other foreign scientific and/or research institution. Before the internship the Dean of the FIT, or the vice-dean for study affairs assesses the professional content. The student must provide evidence of the professional content and extent of the internship. Auxiliary courses MI-ZS10, MI-ZS20, MI-ZS30 are used used for the evidence and evaluation of the internship in IS KOS. Every 10 credits correspond to 4 weeks of full-time employment with a foreign institution. The maximum number of credits a student can earn for one internship is 30 credits. This amount can be divided into two subjects if the internship exceeds the academic year's dead-line.

MI-ZS30 Master internship abroad for 30 credits

Each student can once within his / her master's degree have a foreign internship at a foreign university or other foreign scientific and/or research institution. Before the internship the Dean of the FIT, or the vice-dean for study affairs assesses the professional content. The student must provide evidence of the professional content and extent of the internship. Auxiliary courses MI-ZS10, MI-ZS20, MI-ZS30 are used used for the evidence and evaluation of the internship in IS KOS. Every 10 credits correspond to 4 weeks of full-time employment with a foreign institution. The maximum number of credits a student can earn for one internship is 30 credits. This amount can be divided into two subjects if the internship exceeds the academic year's dead-line.

Code of the group: NI-TI-VS.2018

Name of the group: Elective Vocational Courses for Master Specialization Computer Science

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

Credits in the group: 0

Note on the group:

All compulsory subjects of specializations with the exception of this specialization

Note on the group): All compulsory subjects of special	iizalions wili	the exc	eption o	i iilis speci	ialization
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
NI-AIB	Algorithms of Information Security Röbert Lórencz, Martin Jure ek, Olha Jure ková Róbert Lórencz Róbert Lórencz (Gar.)	Z,ZK	5	2P+1C	Z	V
NI-ADP	Architecture and Design patterns Jan Zimolka, Ji í Borský, Filip K ikava, Tomáš Chvosta Filip K ikava Filip K ikava (Gar.)	Z,ZK	5	2P+1C	Z	V
NI-AM1	Middleware Architectures 1 Tomáš Vitvar, Jaroslav Kucha Jaroslav Kucha Tomáš Vitvar (Gar.)	Z,ZK	5	2P+1C	Z	V
NI-AM2	Middleware Architectures 2 Tomáš Vitvar, Jaroslav Kucha Jaroslav Kucha Tomáš Vitvar (Gar.)	Z,ZK	5	2P+1C	L	V
NI-BML	Bayesian Methods for Machine Learning Kamil Dedecius, Ond ej Tichý Ond ej Tichý Kamil Dedecius (Gar.)	KZ	5	2P+1C	L	V
MI-BPR.16	Security and Secure Programming	Z,ZK	5	2P+1C	Z	V
MI-BHW.16	Security and Hardware Martin Novotný	Z,ZK	5	2P+2C	L	V
NI-BVS	Embedded Security Martin Novotný Martin Novotný (Gar.)	Z,ZK	5	2P+2C	L	V
NI-BKO	Error Control Codes Pavel Kubalík, Alois Pluhá ek Alois Pluhá ek (Gar.)	Z,ZK	5	2P+1C	L	V
MI-DSV.16	Distributed Systems and Computing	Z,ZK	5	2P+1C	Z	V
MI-DDW.16	Web Data Mining Jaroslav Kucha	Z,ZK	5	2P+1C	L	V
NI-EPC	Effective C++ programming Daniel Langr Daniel Langr (Gar.)	Z,ZK	5	2P+1C	Z	V
MI-FME.16	Formal Methods and Specifications	Z,ZK	5	2P+1C	L	V
MI-FLP	Functional and Logical Programming	Z,ZK	4	2P+1C	L	V
MI-GEN	Code Generators Jan Janoušek	Z,ZK	4	2P+1C	L	V

MI-HWB.16	Hardware Security	Z,ZK	5	2P+2C	L	V
MI-MKY.16	Mathematics for Cryptology Martin Jure ek	Z,ZK	5	3P+1C	L	V
NI-MVI	Computational Intelligence Methods Pavel Kordík Pavel Kordík Pavel Kordík (Gar.)	Z,ZK	5	2P+1C	Z	V
MI-MEP.16	Modelling of Business Processes Robert Pergl	Z,ZK	5	2P+1C	Z	V
NI-MPJ	Modelling of Programming Languages	Z,ZK	5	2P+1C	Z	V
NI-MTI	Modern Internet Technologies Alexandru Moucha, Viktor erný Alexandru Moucha Alexandru Moucha (Gar.)	Z,ZK	5	2P+1C	Z	V
MI-NFA.16	Design for the FPGA and ASIC Technology Jan Schmidt	Z,ZK	5	2P+1C	Z	V
NI-NUR	User Interface Design Josef Pavli ek Josef Pavli ek (Gar.)	Z,ZK	5	2P+1C	Z	٧
MI-NSS.16	Normalized Software Systems Robert Pergl	ZK	5	2P	L	V
NI-OSY	Operating Systems and Systems Programming Petr Zemánek, Tomáš Martinec Petr Zemánek Petr Zemánek (Gar.)	Z,ZK	5	2P+1C	Z	V
MI-PAP.16	Parallel Computer Architectures Ivan Sime ek	Z,ZK	5	2P+1C	L	V
NI-BUI	Business Informatics Petra Pavlí ková Petra Pavlí ková (Gar.)	Z,ZK	5	2P+2C	L	V
MI-EDW.16	Enterprise Data Warehouse Systems	Z,ZK	5	2P+1C	L	V
MI-KRY.16	Advanced Cryptology	Z,ZK	5	2P+2C	Z	V
MI-POA.16	Advanced Computer System Architectures	Z,ZK	5	2P+1C	L	V
NI-PAS	Advanced Aspects of Business Zden k Ku era, David Buchtela David Buchtela Zden k Ku era (Gar.)	Z,ZK	4	2P+1C	Z	V
NI-PDB	Advanced Database Systems Michal Valenta, Yelena Trofimova Michal Valenta Michal Valenta (Gar.)	Z,ZK	5	2P+1C	Z	V
MI-PIS.16	Advanced Information Systems	Z,ZK	5	2P+1C	L	V
NI-GPU	GPU Architectures and Programming Van Šime ek Van Šime ek Van Šime ek Gar.)	Z,ZK	5	2P+1C	L	V
MI-PCM.16	Project And Change Management Petra Pavlí ková	KZ	3	1P+2C	Z,L	V
NI-PDD	Data Preprocessing Marcel Ji ina Marcel Ji ina Marcel Ji ina (Gar.)	Z,ZK	5	2P+1C	Z	V
MI-REV.16	Reverse Engineering	Z,ZK	5	1P+2C	Z	V
MI-RUN.16	Runtime Systems	Z,ZK	5	2P+1C	Z	V
MI-MBI.16	Management of Business Informatics	Z,ZK	5	3P+1C	L	V
MI-SWE.16	Semantic Web	Z,ZK	5	2P+1C	Z	V
MI-SIM.16	Digital Circuit Simulation	Z,ZK	5	2P+1C	L,Z	V
MI-SIB.16	Network Security	Z,ZK	5	2P+1C	L	V
MI-SMI.16	Strategic Management of Informatics Petra Paylí koyá	Z,ZK	5	3P+1C	Z	V
MI-SYP.16	Parsing and Compilers	Z,ZK	5	2P+1C	Z	V
MI-SYB.16	Jan Janoušek System Security	Z,ZK	5	2P+2C	L	V
NI-SBF	Simona Forn sek System Security and Forensics	Z,ZK	5	2P+1C	Z	V
MI-SOC.16	Simona Forn sek, Marián Svetlík Simona Forn sek Systems on Chip	Z,ZK	5	2P+1C	Z	V
NI-DSS	Hana Kubátová Decision Support Systems Petra Pavlí ková, Robert Pergl, David Buchtela Robert	z,zk	5	2P+1C	Z	V
MI-TES.16	Pergl (Gar.)	Z,ZK	5	2P+1C	Z	V
MI-TSP.16	Systems Theory Testing and Reliability	Z,ZK	5	2P+2C	Z	V
NI-TSW	Petr Fišer Software Product Development	KZ	4	1P+2C	Z	V
NI-EHW	Petra Pavlí ková Ond ej Pluha Petra Pavlí ková (Gar.) Embedded Hardware	Z,ZK	5	2P+1C	Z	V
NI-ESW	Jan Schmidt Jan Schmidt Jan Schmidt (Gar.) Embedded Software	Z,ZK	5	2P+1C	Z	V
NI-VCC	Miroslav Skrbek, Hana Kubátová Miroslav Skrbek Hana Kubátová (Gar.) Virtualization and Cloud Computing	Z,ZK	5	2P+1C	L L	V
	Jan Fesl, Tomáš Vondra Tomáš Vondra Tomáš Vondra (Gar.) Selected Methods for Program Analysis					
NI-APR	Filip K ikava Filip K ikava Filip K ikava (Gar.)	Z,ZK	5	2P+1C	L	V

NI-VMM	Retrieva Tomáš Sk		Jaroslav Kucha	Tomáš Skopal (Gar.) ~	ZK	5	2P+10	C Z	\ \ \
NI-MCC	Multico	e CPU Comp	uting	Ivan Šime ek (Gar.)		ZK	5	2P+10	c z	V
MI-W20.16	Web 2.0	-			Z	ZK	5	2P+10	C L	V
MI-MDW.16		vices and Mi	iddleware		Z	ZK	5	2P+10	c z	V
haractoristics of			of Study Plan	n: Code=NI-TI-VS.	2018 Name-Ele	otivo \	/ocation	al Cours	ses for M	lastor
pecialization Cor			or olday i lai	ii. 00de=i4i-11-40.	ZUTU Maine-Lik	Clive	ocation	ai oouis	363 101 14	iastei
II-M∨I		al Intelligence							Z,ZK	5
			•	ce that are mostly nature			and applicat	ble to many	y problems.	They will lea
II-PCM.16		Change Mana		mining, control, intelligen	garnes, optimization	s, etc.			KZ	3
his course is presented		onange mana	igenient					I	IXΔ	3
II-AIB	Algorithms o	Information S	Security						Z,ZK	5
				cryptographic error (not o	nly biometric) data p	ocessing	. Furthermo	ore, studen		the mathem
	_			ure schemes). Another p		_				
arning in detection sys	stems. The last to	ic includes practi	ical steganographic	methods and attacks of	n steganographic sys	tems.				
II-ADP	Architecture	and Design pa	atterns						Z,ZK	5
ne objective of this cou	urse is to provide	students with both	n work knowledge a	about the underlying four	ndations of object-or	ented de	sign and an	nalysis as v	well as with	understandi
e challenges, issues,	and tradeoffs of a	dvanced software	design. In the first	part of the course, the s	tudents will refresh a	nd deepe	en their kno	wledge of	object-orien	ted program
nd get familiar with the	commonly used	bject-oriented des	sign patterns that re	epresent the best practic	es for solving commo	n softwa	re design pr	roblems. In	the second	part the stu
II be introduced to the	principles of softw	are architecture c	lesign and analysis	. This includes the classi	cal architectural style	s, compo	nent based	l systems, a	and some a	dvanced sof
chitectures used in lar	rge-scale distribu	ed systems.								
I-AM1	Middleware	rchitectures '	1						Z,ZK	5
udents will study new	trends, concepts	and technologies	s in the area of serv	vice-oriented architecture	es. The will gain an o	verview o	of information	on system a	architecture	, web servic
chitecture and aplicati	ion servers. The w	l also study princi	ples and technolog	ies for middleware focuse	ed on application inte	grations,	asynchrono	ous commu	ınications ar	nd high availa
applications.										
I-AM2	Middleware A	rchitectures 2	2						Z,ZK	5
udents will learn new	1								,	1
			b including theoret	ical foundations. They wi	Il gain an overview o	f Web ap	plication are	chitectures	s, concepts a	and technologic
i illiorocci vicco, aloti a	ubuleu cacile allu	_	-	ical foundations. They wi e communication and we	-	f Web ap	plication are	chitectures	s, concepts a	and technolo
		databases, smart	contracts, realtime	-	-	f Web ap	plication are	chitectures		,
II-BML	Bayesian Me	databases, smart thods for Mac	contracts, realtime	e communication and we	b security.				KZ	5
II-BML he subject is focused o	Bayesian Me	databases, smart thods for Mac basic Bayesian m	contracts, realtime chine Learning nodeling methods in	e communication and we	b security. g machine learning t	heory. In	particular, it	t studies th	KZ ne constructi	5
II-BML he subject is focused o odels providing descri	Bayesian Me on practical use of iption of real pher	databases, smart thods for Mac basic Bayesian m omena, as well as	contracts, realtime chine Learning nodeling methods in s their subsequent	n the dynamically evolvin use, e.g., for forecasting	b security. g machine learning to future evolution of	heory. In	particular, it	t studies th hidden var	KZ ne constructi	5 on of approposit
II-BML ne subject is focused o odels providing descri om noisy observations	Bayesian Me on practical use of iption of real pher s etc.). The empha	databases, smart thods for Mac basic Bayesian m omena, as well as is is put on under	contracts, realtime chine Learning nodeling methods in s their subsequent estanding of explain	n the dynamically evolvin use, e.g., for forecasting led principles and method	b security. g machine learning to future evolution of sand their practical	heory. In r learning adoption	particular, it g about the . For this pu	t studies th hidden var irpose, a nu	KZ ne constructi riables (true umber of rea	5 on of approposition object positial world example.
II-BML the subject is focused of codels providing description of the code is provided in the code is	Bayesian Me on practical use of iption of real pher s etc.). The empha	databases, smart thods for Mac basic Bayesian m omena, as well as is is put on under	contracts, realtime chine Learning nodeling methods in s their subsequent estanding of explain	n the dynamically evolvin use, e.g., for forecasting	b security. g machine learning to future evolution of sand their practical	heory. In r learning adoption	particular, it g about the . For this pu	t studies th hidden var irpose, a nu	KZ ne constructi riables (true umber of rea	5 on of approposition object positial world example.
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II-BML he subject is focused of coordels providing descriptions om noisy observations	Bayesian Me on practical use of iption of real pher s etc.). The empha presented to stud	databases, smart thods for Mac basic Bayesian m omena, as well as is is put on under	contracts, realtime chine Learning nodeling methods in s their subsequent standing of explain , 2D/3D object trac	n the dynamically evolvin use, e.g., for forecasting led principles and method	b security. g machine learning to future evolution of sand their practical	heory. In r learning adoption	particular, it g about the . For this pu	t studies th hidden var irpose, a nu	KZ ne constructi riables (true umber of rea	5 on of approposition object positial world example.
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II-BML he subject is focused of loodels providing description on noisy observations and applications will be some of them. II-BPR.16 he students will learn beory, students gain provided to subject to the students gain provided to students gain gain gain gain gain gain gain gain	Bayesian Me on practical use of iption of real pher is etc.). The empha is presented to study Security and how to assess secretical experience	databases, smart thods for Mac basic Bayesian m basic Bayesian m basic is sput on under ents, for instance Secure Progr urity risks and how with running program	contracts, realtime chine Learning nodeling methods in s their subsequent standing of explain , 2D/3D object trac ramming v to take them into a grams with reduced	e communication and we in the dynamically evolvin use, e.g., for forecasting led principles and method king, radiation source te account in the design ph d privileges and methods	b security. g machine learning to future evolution ods and their practical rm estimation, or separate of their own codes of specifying these	heory. In r learning adoption paration in and solu privileges	particular, it g about the . For this pu n medical in tions. After s, since not	t studies th hidden var irpose, a nu maging. The getting fan every prog	KZ se construction in the	5 son of appropropriet position al world example try to sol 5 e threat most to run with
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II-BML the subject is focused of codels providing description noisy observations and applications will be ome of them. II-BPR.16 the students will learn beory, students gain prodministrator privileges.	Bayesian Me on practical use of iption of real pher is etc.). The empha is presented to study Security and how to assess secractical experiences. Dangers inherer	databases, smart thods for Mac basic Bayesian m omena, as well as is is put on under ents, for instance Secure Progr urity risks and how with running prog- in buffer overflow	contracts, realtime chine Learning modeling methods in stheir subsequent standing of explain , 2D/3D object trace ramming w to take them into a grams with reduced ws will be practically	e communication and we in the dynamically evolvin use, e.g., for forecasting led principles and method king, radiation source te account in the design ph d privileges and methods	b security. g machine learning to future evolution ods and their practical rm estimation, or separate of their own codes of specifying these is will be introduced to	heory. In r learning adoption paration in and solu privileges o the prir	particular, it g about the . For this pu n medical in itions. After s, since not nciples of se	t studies th hidden var urpose, a nu maging. The getting fan every prog	KZ se constructive constructive constructive constructive construction in the construction of the construc	5 ion of approposite al world exar will try to sol
II-BML ne subject is focused of odels providing description noisy observations and applications will be ome of them. II-BPR.16 ne students will learn heory, students gain prodministrator privileges.	Bayesian Me on practical use of iption of real pher is etc.). The empha is presented to study Security and how to assess secractical experiences. Dangers inherer	databases, smart thods for Mac basic Bayesian m omena, as well as sis is put on under ents, for instance Secure Progr urity risks and how with running progr in buffer overflow ote procedure ca	contracts, realtime chine Learning modeling methods in stheir subsequent standing of explain , 2D/3D object trace ramming w to take them into a grams with reduced ws will be practically	e communication and we in the dynamically evolvin use, e.g., for forecasting led principles and method king, radiation source te account in the design ph d privileges and methods y demonstrated. Student	b security. g machine learning to future evolution ods and their practical rm estimation, or separate of their own codes of specifying these is will be introduced to	heory. In r learning adoption paration in and solu privileges o the prir	particular, it g about the . For this pu n medical in itions. After s, since not nciples of se	t studies th hidden var urpose, a nu maging. The getting fan every prog	KZ se constructive constructive constructive constructive construction in the construction of the construc	5 ion of approposite al world exar will try to sol
II-BML ne subject is focused of odels providing description noisy observations and applications will be ome of them. II-BPR.16 ne students will learn heory, students gain prodministrator privileges, security and database sill-BHW.16	Bayesian Me on practical use of iption of real pher is etc.). The empha is presented to study Security and how to assess secretical experiences. Dangers inherer systems, web, ren	databases, smart thods for Mac basic Bayesian m omena, as well as is is put on under ents, for instance Secure Progr urity risks and how with running pro- in buffer overflow ote procedure ca Hardware	contracts, realtime chine Learning modeling methods in s their subsequent standing of explain , 2D/3D object trace ramming w to take them into a grams with reduced vs will be practically lls, and sockets in g	e communication and we in the dynamically evolvin use, e.g., for forecasting led principles and method king, radiation source te account in the design ph d privileges and methods y demonstrated. Student	b security. g machine learning to future evolution ods and their practical rm estimation, or separate of their own codes of specifying these is will be introduced cludes with Denial of	heory. In r learning adoption aration in and solu privileges o the prir f Service	particular, it g about the . For this pu n medical in ations. After s, since not noiples of se attacks and	t studies th hidden var irpose, a nu maging. The getting fan every progecuring dat d the defen	KZ the construction is a construction of read to the students of the students	5 ion of approposite al world exar will try to sol 5 e threat mooto run with elationships them.
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II-BML he subject is focused of codels providing description on noisy observations and applications will be ome of them. III-BPR.16 he students will learn before, students gain produinistrator privileges, ecurity and databases of the students gain a basic known of the students gain a basic known of the students gain basic known of the students gain basic known of software (in embedded from the students gain basic known of software (in embedded from the students gain basic known of software (in embedded from the students gain basic known of software (in embedded from the students gain basic known of software (in embedded from the students gain basic known of software (in embedded from the students gain basic known of software (in embedded from the students are introduced from the students will learn lates except developments in the students learn how to under the students are able to desasic properties of software.	Bayesian Me on practical use of iption of real pher is etc.). The emphase presented to study a presented to study and thow to assess sectractical experience. Dangers inherer systems, web, render Students gain a grown property systems. Embedded Study and the study and safety in case of the study and search, the field of social effective C+-use the modern ferm of writing mainted Study and the study and the study and the study and the study and search, the field of social effective C+-use the modern ferm of writing mainted study and the s	databases, smart thods for Mac basic Bayesian in omena, as well as sis is put on under ents, for instance Secure Progr urity risks and how with running pro- in buffer overflow ote procedure ca Hardware ed topics of cryptog dents gain a good Codes us ways to detect ystems and C ordination of proce t assure correctne allures. ning hnologies for We Web structure and web and recomm programmine tures of contemp ainable and porta ods and Spec of sof functional and	contracts, realtime chine Learning modeling methods in their subsequent standing of explain and provided in the standing of explain and provided in the standing of explain and provided in the standing of explain and sockets in the standing of explain and sockets in the standing of the	a communication and we in the dynamically evolving use, e.g., for forecasting and principles and methods account in the design phase of the design	b security. g machine learning to future evolution of sand their practical rm estimation, or separate of their own codes of specifying these is will be introduced accludes with Denial of cludes wit	heory. In relearning adoption paration in and soluprivileges of the print of Service elliptic cunumber of time respectively and provided evelopment of the print	particular, it g about the an interest particular, it g about the an interest particular in medical in a medical interest particular i	t studies the hidden variarpose, a numaging. The getting fame every progecuring dated the defendance of the defendance o	kZ the construction in the	5 on of approposition of approposition of approposition of approposition of a proposition o

Students will become acquainted with both theoretical and practical aspects of back-end of an optimizing programming language compiler.

Code Generators

MI-HWB.16 Hardware Security The course provides the knowledge needed for the analysis and design of computer systems security solutions. Students get an overview of safeguards against abuse of the system using hardware means. They will be able to safely use and integrate hardware components into systems and test them for resistance to attacks. Students will gain knowledge about the cryptographic accelerators, PUF, random number generators, smart cards, biometric devices, and devices for internal security functions of the computer. Mathematics for Cryptology Students become familiar with parts of mathematics necessary for deeper understanding of the methods used in symmetric and asymmetric cryptography. They learn the mathematical principles on which security of encryption systems, cryptanalysis methods, cryptography over elliptic curves, and quantum cryptography are based. MI-MEP.16 Modelling of Business Processes The subject is focused on introduction to the discipline of Enterprise Engineering. Students learn the importance of a proper methodological approach for (re)engineering and implementation of processes, organisation structures and information support in big enterprises and institutions. Modelling of Programming Languages Z,ZK 5 The analysis, transformation, and code generation processes depend on the semantics of the language; in particular, they are correct if they preserve the semantics of the language. This course explores the semantics of programming languages. The students will learn the language models with emphasis on functional languages, students are expected to understand the basics of the lambda calculus and here get acquainted with the advanced lambda calculus. The students also get hands-on-experience with semantic modeling and execution tools. NI-MTI Modern Internet Technologies SYNOPSIS The subject "Modern Internet Technologies" is designed on four major pillars of networking: 1. Unified Communication and Collaboration - A single network, oriented on TCP/IP is able to carry whatever types of protocols for whatever purposes. This architecture is able to be protocol independent and carries voice, video and data to achieve seamless integrated services, 2. Design of Extremely Scalable Networks - This provides the insights of network architectures which can accommodate hundreds of millions of users and billions of devices. Thus, there is a paradigm switch from LANs (Local Area Networks) to SPs (Service Providers). 3. Traffic Segregation, Traffic Matching and Traffic Prioritisation - These technologies allow service providers to create private channels of communication between customers, with guaranteed parameters (bandwidth, delay, jitter, type of protocol). 4. Acceleration Technologies - They allow traffic to be carried at the optimal speed and allow for graceful degradation of service parameters in case of failures. Design for the FPGA and ASIC Technology Students gain the basic knowledge needed to start a career in a design house. They will understand the FPGA and ASIC implementation technologies and the limitations that the technologies impose on the design. They are able to perform and to manage typical workflows, their analytic and synthetic steps, with an emphasis on basic verification. They know the structure and demands of software tools, as well as what to expect from them. NI-NUR User Interface Design Z.ZK 5 Students will understand the theorical background of human-computer interaction and user interface (UI) design, will learn formal description of UIs, formal user models, the fundamental notions and procesures. They get acquainted with graphical, speech, and multimodal UIs. Thanks to the gained knowledge, the students will be able to design advanced UIs Normalized Software Systems ZK Students will learn the foundations of Normalized Systems theory, which studies the evolvability of modular structures based on concepts from engineering such as stability from systems theory and entropy from thermodynamics. Initially, the theory was developed at the level of software architectures, where the concept of stability was translated into the definition of so-called combinatorial effects. These effects occur when the impact of a change to the software architecture is dependent on the change itself, as well as on the size of the system. The latter is highly undesirable, as it will cause even a simple change to incur an ever-increasing impact as the size of the system grows over time. As such, combinatorial effects can be considered as a main cause of Lehman?s Law of Increasing Complexity (see, e.g., http://en.wikipedia.org/wiki/Lehman's_laws_of_software_evolution). Additionally, the concept of entropy was used in the study of which micro-states in a modular structure correspond with a given macro-state. This is related mainly to issues such as testing in software architectures. Normalized Systems theory consists first of a set of principles which indicate where violations of stability and entropy-related issues occur in any given software architecture. These principles indicate that very fine-grained modular structures are required in order to control them. In the second part of the theoretical framework, it is shown how software architectures can be constructed based on a set of 5 design patterns called elements. These elements provide the core functionality of information systems in terms of storing data, executing actions, workflows, connectors and triggers, while controlling for violations of the stability and entropy-related principles, allowing them to realize new levels of evolvability in software architectures. Recently, Normalized Systems theory was also applied to the modular structures in business processes and enterprise architectures, with the goal of constructing a foundational theory for Enterprise Engineering. NI-OSY Operating Systems and Systems Programming Z.ZK The course covers system programming in UNIX environment. Emphasis is given on kernel development with focus on kernel architecture and kernel data structures. Key topics are: process management, memory management, file operations and architecture of modern file systems, device drivers and network programming. The course also addresses kernel development process, upgrades of existing kernels, kernel booting, debugging using dynamic instrumentation, and techniques to guarantee portability. Specifics of kernel architecture in embedded and real-time operating systems are also discussed. Theoretical and general principles are demonstrated on the LINUX kernel. Within labs, students will work on projects focused on development of LINUX kernel modules. MI-PAP.16 Parallel Computer Architectures Z.ZK 5 The students gain a good overview of present parallel architectures and processors parallel (ILP) microarchitectures, multithreaded and multicore processors, SoCs and MPSoCs, GPUs, and neural processors. Students also get hands-on experience with programming these systems. NI-BUI **Business Informatics** The aim of the course is to focus on operational, tactical and strategic management of business informatics. Students will gain knowledge in the areas of business process management, ICT services and architectures in enterprise informatics. They will also learn about the principles, models and standards (ITIL, COBIT) in IT management, and lifecycle management of ICT services and resource management (sourcing). Students will learn the process of creating and implementing information strategy, IT Governance, the importance of ICT for business and the context of information strategy with global business strategy. They will also gain knowledge in the areas of economic IT management, revenue and investment management, IT investment evaluation and human resources management in IT (roles CIO, CEO, CFO). **Enterprise Data Warehouse Systems** The Enterprise Data Warehouses course focuses on the area of business intelligence. Students will be introduced to business intelligence methods and will gain practical knowledge not only in designing warehouses and various architectures, but also their deployment and maintenance. This course also includes an introduction to the area of reporting and data visualization. MI-KRY 16 Advanced Cryptology Students will learn the essentials of cryptanalysis and the mathematical principles of constructing symmetric and asymmetric ciphers. They will know the mathematical principles of random number generators. They will have an overview of cryptanalysis methods, elliptic curve cryptography and quantum cryptography, which they can apply to the integration of their own systems or to the creation of their own software solutions. MI-POA.16 **Advanced Computer System Architectures** Z,ZK The student will learn the current trends in infrastructure architecture of complex business computer systems. After completion of the module, the student will be able to design a complex system infrastructure that meets availability and scalability requirements given by the business environment. NI-PAS 4 **Advanced Aspects of Business** 7.7K The aim of the course is to provide students with advanced (compared to the bachelor's degree) knowledge and skills needed to establish and run their own business or business management, especially in law, administration (necessary steps and documents), business economics, foreign trade and related aspects. NI-PDB Advanced Database Systems Z,ZK 5 Students orient themselves in problems of evaluation and optimization of SQL queries. The next part of the course deals with new concepts of database machines (so called NoSQL databases), with the related new data models (XML, graph databases, column databases) and languages for working with them (XQuery, XPath, CYPHER, Gremlin). The last part of the course deals with performance evaluation of database machines.

MI-PIS.16 Advanced Information Systems	Z,ZK	5
Students learn the notion of business process logic and its formalization, with business process roles, business rules, and data processing, with the renterprise services and service solution of business logic. They get acquainted with these notions also for the other types of ISs. They learn about a		
artificial intelligence methods for implementation of these ideas in ISs. They understand modern object-oriented methodologies for modelling of bus		
processed data, and enterprise ISs. They will get the rules and technologies for successful implementation of IS.		
NI-GPU GPU Architectures and Programming	Z,ZK	5
Students will gain knowledge of the internal architecture of modern massively parallel GPU processors. They will learn to program them mainly in the		-
which is already a widespread programming technology of GPU processors. As an integral part of the effective computational use of these hierarchical will also learn optimization programming techniques and methods of programming multiprocessor GPU systems.	computational stru	ictures, students
NI-PDD Data Preprocessing	Z.ZK	5
Students learn to prepare raw data for further processing and analysis. They learn what algorithms can be used to extract information from various data for further processing and analysis.	1 ' 1	-
time series, etc., and learn the skills to apply these theoretical concepts to solve specific problems in individual projects - e.g., extraction of characters	ristics from image	s or from web
pages.		
MI-REV.16 Reverse Engineering	Z,ZK	5
Students will get acquainted with the essentials of reverse engineering of computer software. They will learn how processes start and what happens is called. Students will understand how executable files are organized and how they interact with 3rd party libraries. Another part of the course is de		
applications written in C++. Students will also understand principles of disassemblers and obfuscation techniques. A part of the course will also be on the course will also be only the course will be only the		
debuggers and debugging work and which methods can be used to detect it. One of the lectures will be dedicated to the latest trends on the compu	ter malware scene	e. The focus of
the course is on the seminars, where students will solve practically oriented tasks from the real world.	7.71/	
MI-RUN.16 Runtime Systems Student become familiar - theoretically and practically - with runtime systems and virtual machines for various programming languages.	Z,ZK	5
MI-MBI.16 Management of Business Informatics	Z,ZK	5
This course is presented in Czech.	2,210	Ü
MI-SWE.16 Semantic Web	Z,ZK	5
Students learn standards used for processing and sharing knowledge mainly in the area of web. They get used to designing and using knowledge named to design and using knowled	nodels, knowledge	representation,
and practical aspects as publishing, sharing, exchange, and acquisition of knowledge on the web. The presentation is based on the idea of the semi-	antic web, includin	g its standards
and technologies (RDF, RDFS, OWL) and formal models. MI-SIM.16 Digital Circuit Simulation	Z.ZK	5
MI-SIM.16 Digital Circuit Simulation Students gain information regarding the usage of basic tools for the design and simulation of VLSI (very large scale integration) digital circuits (VHD	1 ' 1	_
knowledge about advanced tools System Verilog & Date tools of the design and simulation of 1251 (161) harge scale integration, arguer stream (111) knowledge about advanced tools System Verilog & Date tools of the design and simulation of 1251 (161) harge scale integration, arguer stream (111) and the design and simulation of 1251 (161) harge scale integration, arguer stream (111) and the design and the desig	_, roog/oy a	.00 got 000
MI-SIB.16 Network Security	Z,ZK	5
The students will gain theoretical and practical knowledge and experience in the area of current security threats in computer networks, specifically a		
course explains basic pricipals of security monitoring, packet-based and flow-based analysis, in order to detect anomalies and suspicious network t explanation and practical examples of various mechanisms of securing network infrastructure and detection in real time. The course covers general		
security events (i.e. incident handling and incident response).	principals of flarid	iing detected
MI-SMI.16 Strategic Management of Informatics	Z,ZK	5
The course focuses on the strategic management of information systems. Students will learn the process of creation and implementation of an information systems.	mation strategy, IT	governance,
the importance of ICT for business and interrelations between information strategies and lobal business strategies. Furthermore, they gain the know	_	
management of IS/IT, management of investments and ROI, assessment of IT investments and management of human resources in IT (the role of course is the role of project management, risk management and quality assessment of informatics.	310, CEO, CFO). I	ne part of the
MI-SYP.16 Parsing and Compilers	Z,ZK	5
The module builds upon the knowledge of fundamentals of automata theory, formal language and formal translation theories. Students gain knowledge	1 ' 1	_
of LR parsing and are introduced to special applications of parsers, such as incremental and parallel parsing.		
MI-SYB.16 System Security	Z,ZK	5
Students will familiarize themselves with the actual ICT security needs in all ICT disciplines. Students will gain knowledge of typical network attacks an with essential communication encryption techniques. They will learn how to work with certain aspects of encryption techniques - passwords and cer		
learn the basics of anti-virus, anti-spam and heuristic analyses used in modern anti-virus solutions or Unified Threat Management (UTM) based sol		
principles of securing websites, web applications and databases. Upon completion of the module, students will have a broad overview of IT security	•	
integration of various software systems and applications.		
NI-SBF System Security and Forensics	Z,ZK	5
Students will get familiar with aspects of system security (principles of end station security, principles of security policies, security models, authentic students will get familiar with forensic analysis as a tool for investigating security incidents (techniques used by malicious software/attackers and for	• '	
importance of operating system/operating system artifacts or file system for attack analysis and detection).	oriolo arialyolo tool	inquos ana mo
MI-SOC.16 Systems on Chip	Z,ZK	5
Students gain key knowledge and skills in the design of large-scale digital systems. They will be familiar with architectures of such systems and common com	•	
will use an appropriate workflow to design these architectures, their hardware and software. They will also have knowledge of contemporary method	is of large systems	verification and
fault-tolerant systems design. NI-DSS Decision Support Systems	Z,ZK	5
NI-DSS Decision Support Systems The aim of the course is to provide students with knowledge and skills in decision support systems, their classification (Powerova), selected principle	1	
and knowledge-oriented decision support systems. Students will also gain knowledge of multicriterial decision-making methods and game theory. They		
of conceptually and ontologically oriented decision support systems and the basics of distribution, optimization and evolution methods and algorithm		
MI-TES.16 Systems Theory	Z,ZK	5
Today, humankind has the ability to develop systems of incredible complexity (e.g., trains, microprocessors, airplanes, nuclear power plants). However complexity and of ensuring the correct behavior of a given system have become critical. A key technique for mastering this complexity is the usage		
aspects of the systems that are important for the task at hand, and automated tools for analyzing those models. This subject will present theory and		=
the modeling and analysis of complex systems.		
MI-TSP.16 Testing and Reliability	Z,ZK	5
Students gain knowledge about circuit testing and about methods for increasing reliability and security. They will get practical skills to be able to pre-	•	
intuitive path sensitization and to use an ATPG for automatic test generation. They will be able to design easy testable circuits and systems with build be able to analyze and control reliability and availability of the designed circuits.	t-m-sem-test equip	ment. They will
NI-TSW Software Product Development	KZ	4
The course is presented in Czech.	' '	
	<u></u>	

NI-EHW **Embedded Hardware** The course brings basic laws that govern digital design and basic techniques to use them. It deals with both large and small scale systems. This is the base of advanced embedded systems, that profit from their specialized structure for effective computation and acceleration. Design of fast custom computing machines is discussed, including standardized means of internal communication, parallelism extraction and utilization in special structures and system architectures. **Embedded Software** Embedded software course acquainted students with the specifics of software development for embedded systems. The course covers the areas from the basic techniques of programming in C language and code optimizations, through typical areas as the reliable software development, embedded operating systems, signal processing, up to sophisticated techniques combined with artificial intelligence. NI-VCC Virtualization and Cloud Computing Students will gain knowledge of architectures of large computer systems that are used in data centers and computer infrastructure of companies and organizations. They will get acquainted with virtualization principles, tools and technologies that serve to facilitate and automate configuration, testing and monitoring, and to efficiently operate and optimize the performance parameters of modern computer systems. Theoretically and practically, they will get acquainted with containerization as the most effective technology today for the management of complex computer systems and with specific technologies of cloud systems. Finally, they will learn the principles and gain practical skills in the use of modern integration and development tools (Continuous integration and development). NI-APR Selected Methods for Program Analysis Z.ZK 5 Program analysis studies program behavior with the aim of code optimization and error detection. Students will learn static program analysis, which approximates program behavior without the need to actually run the program, as well as dynamic program analysis which analyse programs at runtime. Students will be introduced to the common techniques and algorithms and use them on some classical problems. Z.ZK Retrieval from Multimedia The student obtains general knowledge regarding interfaces of portals providing multimedia content, the principles of similarity search, the methods of feature extraction from multimedia objects, indexing, and structure of distributed search engines. Multicore CPU Computing Students will get acquainted in detail with hardware support and programming technologies for the creation of parallel multithreaded computations on multicore processors with shared and virtually shared memories, which are today the most common computing nodes of powerful (super)computer systems. Students will gain knowledge of architecturally specific optimization techniques used to reduce the performance drop due to the widening gap between the computational requirements of multi-core CPUs and memory interface throughput. On specific non-trivial multithreaded programs, students will also learn the basics of the art of creating these applications. MI-W20.16 Web 2.0 Students will learn new trends and technologies on the Web including theoretical foundations. Students will gain an overview about Web applications architectures, concepts and technologies about programmable Web (REST Architectures, Mashups), basic mechanisms for knowledge representation on the Web (microformats, meta-data, ontologies, open linked data, etc.), mechanisms about collective intelligence (collaborative filtering, predictions of users' behaviours), social networks, and security. Web Services and Middleware

List of courses of this pass:

Completion

Credits

Name of the course

Code

Students learn new trends and technologies in the area of service-oriented architectures, web services, middleware, and cloud computing, including their theoretical background.

BI-SOJ	Machine Oriented Languages	Z,ZK	4
Students of the co	urse will gain an ability to create their own programs in the assembly language of the most common PC platform focusing on optimal us	se of microprocess	or's features
and efficient coope	eration of software with hardware. Next, there will be discussed x86 specifics of the majority of OSes from the application point of view li	nked to higher leve	el languages.
	This knowledge will be used during reverse engineering, optimization, and evaluation of code security.		
BI-SVZ	Machine vision and image processing	Z,ZK	5
Camera systems	are becoming a common part of life by being universally available. Related to this phenomenon is the need to process and evaluate i	mage information.	The course
introduces student	s to different types of camera systems and a variety of methods for image and video processing. The course is focused on practical use	of camera system	ns for solving
	problems of practice that the graduates may encounter.		
BI-VMM	Selected Mathematical Methods	Z,ZK	4
We start reviewing	g geometric properties of linear spaces with inner product. Next, we introduce and analyze the discrete Fourier transform (DFT) and	its fast implementa	ation (FFT).
Further we deal w	rith differential calculus of functions involving multiple variables. We present methods for the localization of extreme values of function	s. For this purpose	es, we study
normed linear spa	ces and quadratic forms. In addition, we introduce the least square method. The last part of the course is devoted to optimization and o	duality. The linear p	orogramming
	and the Simplex method is analyzed in more detail.		
FI-KSA	Cultural and Social Anthropology	ZK	2
The one-semester	course aims to acquaint students with the basics of social and cultural anthropology as a scientific discipline dealing with the diversit	y of the world - ex	amples from
anthropological re	search from our "exotic" cultures (topics: kinship, religion, social exclusion, migration, globalization, , material culture, language, healt	h, history, death, ϵ	etc) will be
	shown. The course is an interesting alternative to other humanities, taught at FIT.		
FI-MPL	Managerial Psychology	ZK	2
FI-ULI	Introduction to Linguistics for Computer	ZK	2
	This course is presented in Czech.	1	Ţ
MI-AFP	Applied Functional Programming	KZ	5
This course is pre-	zented in Czech. Functional programming represents one of the traditional programming paradigms. Traditional and novel functional p	rogramming langu	uages are on
the rise nowaday	s and the functional paradigm becomes an important construct of traditionally imperative languages (C++, C#, Java). As such, maste	ring this paradigm	becomes a
	necessary competence of a software engineer: the theory and especially the practice.		
MI-APH	Architecture of computer games	Z,ZK	4
Students will gain	a basic understanding of the various issues in the field of computer game development, from both the technical and creative points o	f view. They will ge	∍t a grasp on
component-oriente	ed architecture, game mechanics, and game AI that form an integral part of most games. They will also understand the basics of pathfin	iding, networking,	and scripting
	and apply them in practical exercises (labs).		
MI-ARI	Computer arithmetic	Z,ZK	4
		1, 1	1

Students will learn various data representations used in digital devices and will be able to design arithmetic operations implementation units.

MI-ATH	Combinatorial Theories of Games This course is presented in Czech.	Z,ZK	4
MI-BHW.16	Security and Hardware	Z,ZK	5
•	sic knowledge in selected topics of cryptography and cruptanalysis. The module focuses particularly on elliptic curve cryptography, ar ons. Students gain a good overview of the functionality of (hardware) cryptographic accelerators, random number generators, smart cal of internal functions of computer systems.		•
MI-BML	Bayesian Methods for Machine Learning	KZ	5
The subject is focus models providing of rom noisy observations	sed on practical use of basic Bayesian modeling methods in the dynamically evolving machine learning theory. In particular, it studies in description of real phenomena, as well as their subsequent use, e.g., for forecasting of future evolution or learning about the hidden be tions etc.). The emphasis is put on understanding of explained principles and methods and their practical adoption. For this purpose, a will be presented to students, for instance, 2D/3D object tracking, radiation source term estimation, or separation in medical imaging. some of them.	he construction of ariables (true objuumber of real wo	appropriate ect position d example
MI-BPR.16	Security and Secure Programming	Z,ZK	5
theory, students administrator privi security and o	arn how to assess security risks and how to take them into account in the design phase of their own code and solutions. After getting far gain practical experience with running programs with reduced privileges and methods of specifying these privileges, since not every ileges. Dangers inherent in buffer overflows will be practically demonstrated. Students will be introduced to the principles of securing database systems, web, remote procedure calls, and sockets in general. The module concludes with Denial of Service attacks and the	program needs to data and the relat e defense against	run with ionships of them.
MI-BPS	Wireless Computer Networks	Z,ZK	4
	n about the modern technologies, protocols, and standards for wireless networks. They will understand the routing mechanisms in ad nisms, and data flow control mechanisms. They will also learn about principles of communication in sensor networks. They get knowled for wireless networks and get skills of configuration of wireless network elements and simulation of wireless networks using suitable.	edge of security m	
MI-DDM	Distributed Data Mining	KZ	4
	state-of-the-art approaches for distributed data mining and parallelization of machine learning algorithms. Students will gain hands of amework Apache Spark and with existing distributed DM / ML algorithms. They will learn principles of their parallel implementations a approaches to parallelize other algorithms. The course is prezented in czech language.	•	-
MI-DDW.16	Web Data Mining	Z,ZK	5
	rn latest methods and technologies for Web data acquisition, analysis and utilization of the discovered knowledge. Students will gain be crawling and search, Web structure analysis, Web usage analysis, Web content mining and information extraction. Students will al recent developments in the field of social web and recommendation systems.		
•	Advanced .NET e a knowledge about advanced desgin of applicatios on a .NET platform. They gain skills of WPF (Windows Presentation Foundation mmunication Foundation) and Entity Framework. They are able to apply these skills on a development and desgin of advanced .NET		4 Windows
MI-DSP	Database Systems in Practes This course is presented in Czech.	Z,ZK	4
MI-DSV.16	Distributed Systems and Computing	Z,ZK	5
Students are introdu	uced to methods for coordination of processes in distributed environment characterised by nondeterministic time responses of computing on basic algorithms that assure correctness of computations realized by a group of loosely coupled processes and mechanisms that s	•	
,	data and services, and safety in case of failures.		,
MI-DZO	Digital Image Processing	Z,ZK	4
mplement and have of digital image prequency domain, interactive as-rig MI-EDW.16 The Enterprise Date	nts a comprehensive overview of modern methods for interactive editing of digital images and video. It mainly deals with practical algorithms are an interesting theoretical basis. Visually attractive applications provide better understanding of basic theoretical background that is also processing. This course will introduce algorithms solving the following practical applications: edge-aware editing, tone mapping, HDR abstraction, hybrid images, gradient domain editing, seamless image stitching and cloning, digital photo-montage, color-to-gray convergid-as-possible image deformation, free-form image registration, texture synthesis, interactive segmentation, colorization, painting, as a Enterprise Data Warehouse Systems at Warehouses course focuses on the area of business intelligence. Students will be introduced to business intelligence methods and ing warehouses and various architectures, but also their deployment and maintenance. This course also includes an introduction to the visualization.	so valuable outside compression, de- ersion, context er dding depth, alpha Z,ZK I will gain practica	e the domain blurring in hancement matting. 5 I knowledge
MI-EVY.16	Efficient Text Pattern Matching	Z,ZK	5
tudents get knowle	edge of efficient algorithms for text pattern matching. They learn to use so called succinct data structures that are efficient in both access. They will be able to use the knowledge in design of applications that utilize pattern matching.	s time and memor	y complexity
MI-FLP Students w	Functional and Logical Programming vill be acquainted with principles of functional and logic programming. They will be able to write their programs in Lisp and Prolog pro	Z,ZK gramming langua	d ges.
MI-FME.16	Formal Methods and Specifications	Z,ZK	5
Students are able to	o describe semantics of software formally and to use sound reasoning for construction of correct software. They learn to use some so basic properties of software.	ftware tools that a	llow to prov
MI-GAK	Graph theory and combinatorics	Z,ZK	5
n undestanding the	ss is to introduce the most important topics in graph theory, combinatorics, combinatorial structures, discrete models and algorithms. e basic principles but also on applications in problem solving and algorithm design. The topics include: generating functions, selected top theory, introduction to probabilistic method, properties of various special classes of graphs and combinatorial structures. The theory we have the probabilistic method, properties of various special classes of graphs and combinatorial structures. The theory we have the properties of various and probabilistic method, properties of various special classes of graphs and combinatorial structures.	ics from graph and	d hypergrap
MI-GEN	of combinatorics on words, formal languages and bioinformatics. Code Generators Students will become acquainted with both theoretical and practical aspects of back-end of an optimizing programming language of the company of the c	Z,ZK	4
MI-GLR	Games and reinforcement learning	Z,ZK	4
	cement learning is very hot recently, because of advances in deep learning, recurrent neural networks and general artificial intelligen give you both theoretical and practical background so you can participate in related research activities. Presented in Englis	ce. This course is	1
MI-HMI2	History of Mathematics and Informatics	ZK	3
	finitesimal calculus, probability, number theory, general algebra, different examples of algorithms, transformations, recursive function possibilities of applications of some mathematical methods in informatics and its development.	s, eliptic curves, e	

MI-HWB.16	Hardware Security	Z,ZK	5
	es the knowledge needed for the analysis and design of computer systems security solutions. Students get an overview of safeguards	-	- 1
-	neans. They will be able to safely use and integrate hardware components into systems and test them for resistance to attacks. Studer	<u>-</u>	dge about
	yptographic accelerators, PUF, random number generators, smart cards, biometric devices, and devices for internal security functions		
MI-IBE	Information Security	ZK	2
	primation and IS/ICT security management systems (ISMS), methods for information access control, and basic norms and international		, ,
	nd methods for management of internal and external security threats, for IS/IT security audits, and for application security testing (e.g.		
MI-IKM	Internet and Classification Methods	Z,ZK	4
	students get acquainted with classification methods used in four important internet, or generally network applications: in spam filtering		- 1
	ion systems and in intrusion detection systems. However, they will learn more than only how classification is performed when solving		
	d of these applications, they get an overview of the fundamentals of classification methods. The course is taught in a 2-weeks cycle w During the exercises, the students on the one hand implement simple examples to topics from the lectures, on the other hand consult		
MI-IOS	Advanced techniques in iOS applications	KZ	4
	the latest trends in mobile development technologies for iOS platform. Class covers advanced topics, students need to know all the base	ı	
Otacino Wili Icam	BI-IOS.	asies from the begi	inicio diass
MI-IOT	Internet of Things	Z,ZK	4
	focused on the area of hardware and software technologies for the strongly growing computer support of various devices. Its goal is fa	'	
,	development elements (Raspberry Pi, Arduino Due) and with the language for efficient application development and modification (G		
MI-IVS	Intelligent embedded systems	KZ	4
	ded systems course for master's degree is focused on high-level technology embedded systems integrating artificial intelligence. The		
	embedded system fundamentals course for the bachelor degree. The aim of the course is to teach students humanoid robot programn		
development. Lect	ures provide basis of motion control, sensor reading, application interfaces, robot navigation and development tools. In labs, students of	develop advanced a	applications
	combining knowledge of various courses like nature inspired algorithms, data mining algorithms, image recognition and web technology	nologies	
MI-KOD.16	Data Compression	Z,ZK	5
Students are intre	oduced to the basic principles of data compression. They will learn the necessary theoretical background and get an overview of data	compression meth	ods being
used in practice. T	he overview covers principles of integer coding and of statistical, dictionary, and context data compression methods. In addition, stude	ents learn the funda	amentals of
	lossy data compression methods used in image, audio, and video compression.	T.	
MI-KOP	Combinatorial optimization	Z,ZK	5
The students will	gain knowledge and understanding necessary deployment of combinatorial heuristics at a professional level. They will be able not only	y to select and imp	lement but
	also to apply and evaluate heuristics for practical problems.		
MI-KRY.16	Advanced Cryptology	Z,ZK	5
	n the essentials of cryptanalysis and the mathematical principles of constructing symmetric and asymmetric ciphers. They will know the	· · · · · · · · · · · · · · · · · · ·	
random number	generators. They will have an overview of cryptanalysis methods, elliptic curve cryptography and quantum cryptography, which they can be in a continuous solutions.	an apply to the inte	gration of
MLKVD 40	their own systems or to the creation of their own software solutions.	ZK	5
MI-KYB.16	Cybernality uainted with the fundamentals of legislation and international activities in the area of fighting cybercrime. Students will understand the		_
-	of systems for computer surveillance and traffic monitoring in the cyberspace. Students will also familiarize themselves with hacker active		
	will also discuss the cooperation of the state agencies and subjects dealing with defence of the cyberspace (especially CSIRT and CE		
MI-LOM.16	Linear Optimization and Methods	Z.ZK	5
	applications of optimization methods in computer science, economics, and industry. They are aware of practical importance of linear a	,	_
are able to work w	ith optimization software and are familiar with languages used in programming of that software. They get skills in formalization of optimization optimization of optimization o	nization problems i	n computer
science (such as	scheduling of tasks to processors, analysis of network flows), distribution and allocation of resources (transportation problems, travelli	ng salesman probl	ems, etc.),
issues from econo	mics, and modelling of conflicts via the game theory. They get an overview of computational complexity of optimization problems. The	y get orientation in	algorithms
	in linear programming.		
MI-MAI	Multimedia and Internet	Z,ZK	3
	ver principles and technologies for processing and network transmissions of multimedia signals, stereoscopy and visualizations in high		
application areas	of networked multimedia, transmission formats, interfaces, codecs, technologies for acquisition and reproduction of multimedia data and	technologies for vis	sualizations
	and distributed collaboration using networking and immersive environments.		
MI-MBI.16	Management of Business Informatics	Z,ZK	5
	This course is presented in Czech.		
MI-MCS	Multicore Systems	KZ	_ 4
	and architecture of systems based on multicore processors with multiple threads per core, structure and usage of cache hierarchy with		- 1
-	classification, parallel programming technics, simulation and monitoring tools for measurement and optimization of parallel algorithms.		
	grams (Multiple Threads Multiple Data), measure and analyze latency and throughput of parallel algorithms and optimize them for con		
MI-MDW.16	Web Services and Middleware	Z,ZK	5
	new trends and technologies in the area of service-oriented architectures, web services, middleware, and cloud computing, including t	T	
MI-MEP.16	Modelling of Business Processes	Z,ZK	5
The subject is	focused on introduction to the discipline of Enterprise Engineering. Students learn the importance of a proper methodological approa implementation of processes, organisation structures and information support in big enterprises and institutions.	ch for (re)engineen	ng and
MI-MKY.16	Mathematics for Cryptology	Z,ZK	5
	inathernatics for Cryptology familiar with parts of mathematics necessary for deeper understanding of the methods used in symmetric and asymmetric cryptograph		
	rinciples on which security of encryption systems, cryptanalysis methods, cryptography over elliptic curves, and quantum cryptograph		an on latical
MI-MPC	Modern programming in C ++	Z,ZK	5
	v to use the modern features of contemporary versions of the C++ programming language for software development. The course focus		
	ficiency in the form of writing maintainable and portable source code and creating correct programs with low memory and processor t		J J G VILY
MI-MPI	Mathematics for Informatics	Z,ZK	7
	prises topics from general algebra with focus on finite structures used in computer science. It includes topics from multi-variate analys	,	
	ation. The third large topic is computer arithmetics and number representation in a computer along with error manipulation. The last top	=	
_	r stability analysis. The topics are completed with demonstration of applications in computer science. The course focuses on clear pre		
	<u> </u>		

MI-MPR			
1 At the beginning	Master Project	Z	7
	of the semester, a student reserves her/his final thesis topic and gets together with its supervisor. Together they decide on partial ta		
-	r. If the requirements they agreed upon are met, the supervisor awards the student an assessment for the course MI-MPR at the en		
	supervisor fills his/her assessment into the paper "Form to award assessment by an external Final theses (FT) supervisor" (for the then, ensure that the assessment is registered into the information system (IS) by asking their internal FT opponent to award the a		
, ,	then, ensure that the assessment is registered into the information system (is) by asking their internal F1 opponent to award the a		
	AT. 3. If the FT topic that the student has reserved is rather general, the immediate tasks the supervisor assigns to the student for the	•	
•	aim at fine-tuning the FT topic so that the FTT will be complete and approvable at the end of the semester.		
MI-MPX	Management practice	Z	4
The Student can onc	e, within its master's degree graduate (to apply) management practices in the selected subject of practice (business subject) on the c	perational, tactical	or strategic
-	ent (typically at the position of project manager, middle or top manager). The selected subject of practice and professional filling is a		
course guarantor. In	n the selected subject of practice may not have a substantial ownership interest or substantial decision-making influence of the relative members of the ten management).	tives of the student	(e.g. as a
MI-MSI	member of the top management). Mathematical Structures in Computer Science	7 7V	1
IVII-IVISI	Mathematical Structures in Computer Science Mathematical semantics of programming languages.	Z,ZK	4
MI-MZI	Mathematics for data science	Z,ZK	4
	nts are introduced to those fields of mathematics that are necessary for understanding standard methods and algorithms used in da		•
	ear algebra (matrix factorisations, eigenvalues, diagonalization), continuous optimisation (optimisation with constraints, duality princ		
	selected notions from probability theory and statistics.		
MI-NFA.16	Design for the FPGA and ASIC Technology	Z,ZK	5
-	basic knowledge needed to start a career in a design house. They will understand the FPGA and ASIC implementation technologies		
technologies impos	e on the design. They are able to perform and to manage typical workflows, their analytic and synthetic steps, with an emphasis on	basic verification.	They know
MI NON 16	the structure and demands of software tools, as well as what to expect from them.	Z,ZK	5
MI-NON.16	Nonlinear Continuous Optimization and Numerical Methods duced to nonlinear continuous optimization, principles of the most popular methods of optimization and applications of such method	' '	-
	nite element method and the finite difference method used for solving ordinary and partial differential equations in engineering. They	•	, ,
	ations that arise from discretization of the continuous problems by direct and iterative algorithms. They will also learn to implement		
	as well as in parallel.		
MI-NSS.16	Normalized Software Systems	ZK	5
	the foundations of Normalized Systems theory, which studies the evolvability of modular structures based on concepts from engine	-	-
	entropy from thermodynamics. Initially, the theory was developed at the level of software architectures, where the concept of stability w		
	torial effects. These effects occur when the impact of a change to the software architecture is dependent on the change itself, as we ndesirable, as it will cause even a simple change to incur an ever-increasing impact as the size of the system grows over time. As s		-
	main cause of Lehman?s Law of Increasing Complexity (see, e.g., http://en.wikipedia.org/wiki/Lehman's_laws_of_software_evolutio		
	the study of which micro-states in a modular structure correspond with a given macro-state. This is related mainly to issues such as te	•	
Normalized System	is theory consists first of a set of principles which indicate where violations of stability and entropy-related issues occur in any given	software architect	ure. These
•	at very fine-grained modular structures are required in order to control them. In the second part of the theoretical framework, it is sho		
	eased on a set of 5 design patterns called elements. These elements provide the core functionality of information systems in terms of s is and triggers, while controlling for violations of the stability and entropy-related principles, allowing them to realize new levels of evolva	•	
	s and triggers, write controlling for violations of the stability and entropy-related principles, allowing them to realize new levels of evolved Systems theory was also applied to the modular structures in business processes and enterprise architectures, with the goal of con	-	
,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	for Enterprise Engineering.		
MI-OLI			•
	Linux Drivers	Z,ZK	4
	Linux Drivers system is an important operating system for personal computer and also for embedded systems. Systems on chip and combining po		
The Linux operating increase the varial	system is an important operating system for personal computer and also for embedded systems. Systems on chip and combining pob bility of peripheral subsystems requiring specific software drivers. This course is an advanced course in the Linux driver developmen	werful processors nt for master's stud	and FPGAs
The Linux operating increase the varial cour	system is an important operating system for personal computer and also for embedded systems. Systems on chip and combining pobility of peripheral subsystems requiring specific software drivers. This course is an advanced course in the Linux driver developments provides knowledge of Linux operating system architecture, principles of development of various types drivers, including practical	werful processors nt for master's stud al experience.	and FPGAs ents. The
The Linux operating increase the varial cour	system is an important operating system for personal computer and also for embedded systems. Systems on chip and combining pobility of peripheral subsystems requiring specific software drivers. This course is an advanced course in the Linux driver development respectively. This course is an advanced course in the Linux driver development see provides knowledge of Linux operating system architecture, principles of development of various types drivers, including practice. Efficient Preprocessing and Parameterized Algorithms	werful processors nt for master's stud al experience. Z,ZK	and FPGAs ents. The
The Linux operating increase the varial coul MI-PAM There are many op	system is an important operating system for personal computer and also for embedded systems. Systems on chip and combining poblility of peripheral subsystems requiring specific software drivers. This course is an advanced course in the Linux driver development see provides knowledge of Linux operating system architecture, principles of development of various types drivers, including practications. Efficient Preprocessing and Parameterized Algorithms otimization problems for which no polynomial time algorithms are known (e.g. NP-complete problems). Despite that it is often necessing.	werful processors nt for master's stud al experience. Z,ZK sary to solve these	and FPGAs ents. The 4 problems
The Linux operating increase the varial court MI-PAM There are many operactive. V	system is an important operating system for personal computer and also for embedded systems. Systems on chip and combining pobility of peripheral subsystems requiring specific software drivers. This course is an advanced course in the Linux driver development respectively. This course is an advanced course in the Linux driver development see provides knowledge of Linux operating system architecture, principles of development of various types drivers, including practice. Efficient Preprocessing and Parameterized Algorithms	werful processors int for master's studial experience. Z,ZK sary to solve these e can find a commo	and FPGAs ents. The 4 problems on property
The Linux operating increase the varial cour MI-PAM There are many opexactly in practice. V (parameter) of the inj	system is an important operating system for personal computer and also for embedded systems. Systems on chip and combining pobility of peripheral subsystems requiring specific software drivers. This course is an advanced course in the Linux driver development are provides knowledge of Linux operating system architecture, principles of development of various types drivers, including practications. Efficient Preprocessing and Parameterized Algorithms otimization problems for which no polynomial time algorithms are known (e.g. NP-complete problems). Despite that it is often necessary will demonstrate that many problems can be solved much more effectively than by naively trying all possible solutions. Often one	werful processors on for master's studial experience. Z,ZK sary to solve these e can find a commontally in this (small	and FPGAs ents. The 4 problems on property) parameter
The Linux operating increase the varial cour MI-PAM There are many opexactly in practice. V (parameter) of the injury and polynomially in the course of the injury and polynomially in the course of the course of the injury and polynomially in the course of the course	system is an important operating system for personal computer and also for embedded systems. Systems on chip and combining poblity of peripheral subsystems requiring specific software drivers. This course is an advanced course in the Linux driver development are provides knowledge of Linux operating system architecture, principles of development of various types drivers, including practice Efficient Preprocessing and Parameterized Algorithms otimization problems for which no polynomial time algorithms are known (e.g. NP-complete problems). Despite that it is often necess We will demonstrate that many problems can be solved much more effectively than by naively trying all possible solutions. Often one puts from practice-e.g., all solutions are relatively small. Parameterized algorithms exploit that by limiting the time complexity exponents.	werful processors in for master's studial experience. Z,ZK sary to solve these is can find a commonitially in this (small me preprocessing of	and FPGAs ents. The 4 problems on property parameter of the input,
The Linux operating increase the varial cour MI-PAM There are many operactly in practice. V (parameter) of the injury and polynomially in which is not possible plethora of parameter.	system is an important operating system for personal computer and also for embedded systems. Systems on chip and combining politity of peripheral subsystems requiring specific software drivers. This course is an advanced course in the Linux driver development rise provides knowledge of Linux operating system architecture, principles of development of various types drivers, including practice Efficient Preprocessing and Parameterized Algorithms Determine the properties of the properties of development of various types drivers, including practice of the properties of development of various types drivers, including practice of the properties of development of various types drivers, including practice of the properties of the linux driver development of various types drivers, including practice of the properties of the properties of development of various types drivers, including practice of the linux driver development of the linux driver d	werful processors on the formaster's studial experience. Z,ZK sary to solve these of can find a common on tially in this (small me preprocessing on method. We will esumably) does no	and FPGAs ents. The 4 problems on property of the input, present a
The Linux operating increase the varial cour MI-PAM There are many operactly in practice. V (parameter) of the injury and polynomially in which is not possible plethora of parameter w	system is an important operating system for personal computer and also for embedded systems. Systems on chip and combining politity of peripheral subsystems requiring specific software drivers. This course is an advanced course in the Linux driver development are provides knowledge of Linux operating system architecture, principles of development of various types drivers, including practice. Efficient Preprocessing and Parameterized Algorithms betimization problems for which no polynomial time algorithms are known (e.g. NP-complete problems). Despite that it is often necessing will demonstrate that many problems can be solved much more effectively than by naively trying all possible solutions. Often one puts from practice-e.g., all solutions are relatively small. Parameterized algorithms exploit that by limiting the time complexity exponent the input size (which can be huge). Parameterized algorithms also represent a way to formalize the notion of effective polynomial time lein the classical complexity. Such a polynomial time preprocessing is then a suitable first step, whatever is the subsequent solution terized algorithm design methods and we will also show how to prove that for some problem (and parameter) such an algorithm (preside algorithm that problems such as moderately exponential algorithms or approximation.	werful processors nt for master's studial experience. Z,ZK sary to solve these e can find a common ntially in this (small me preprocessing on method. We will esumably) does no schemes.	and FPGAs ents. The 4 problems on property of parameter of the input, present a t exist. We
The Linux operating increase the varial cour MI-PAM There are many opexactly in practice. V (parameter) of the injudy and polynomially in which is not possible plethora of parameter w MI-PAP.16	system is an important operating system for personal computer and also for embedded systems. Systems on chip and combining politity of peripheral subsystems requiring specific software drivers. This course is an advanced course in the Linux driver development are provides knowledge of Linux operating system architecture, principles of development of various types drivers, including practice. Efficient Preprocessing and Parameterized Algorithms betimization problems for which no polynomial time algorithms are known (e.g. NP-complete problems). Despite that it is often necess two will demonstrate that many problems can be solved much more effectively than by naively trying all possible solutions. Often one puts from practice-e.g., all solutions are relatively small. Parameterized algorithms exploit that by limiting the time complexity exponent the input size (which can be huge). Parameterized algorithms also represent a way to formalize the notion of effective polynomial time lein the classical complexity. Such a polynomial time preprocessing is then a suitable first step, whatever is the subsequent solution terized algorithm design methods and we will also show how to prove that for some problem (and parameter) such an algorithm (president of the relations to other approaches to hard problems such as moderately exponential algorithms or approximation and parallel Computer Architectures	werful processors of for master's studial experience. Z,ZK sary to solve these of can find a common ontially in this (small me preprocessing of method. We will esumably) does not schemes. Z,ZK	and FPGAs ents. The 4 problems on property of parameter of the input, present a t exist. We
The Linux operating increase the varial cour MI-PAM There are many opexactly in practice. V (parameter) of the injudy and polynomially in which is not possible plethora of parameter w MI-PAP.16	system is an important operating system for personal computer and also for embedded systems. Systems on chip and combining politity of peripheral subsystems requiring specific software drivers. This course is an advanced course in the Linux driver development are provides knowledge of Linux operating system architecture, principles of development of various types drivers, including practice. Efficient Preprocessing and Parameterized Algorithms stimization problems for which no polynomial time algorithms are known (e.g. NP-complete problems). Despite that it is often necessive will demonstrate that many problems can be solved much more effectively than by naively trying all possible solutions. Often one puts from practice-e.g., all solutions are relatively small. Parameterized algorithms exploit that by limiting the time complexity exponent the input size (which can be huge). Parameterized algorithms also represent a way to formalize the notion of effective polynomial time le in the classical complexity. Such a polynomial time preprocessing is then a suitable first step, whatever is the subsequent solution terized algorithm design methods and we will also show how to prove that for some problem (and parameter) such an algorithm (preside algorithm design methods and we will also show how to prove that for some problem (and parameter) such an algorithm (preside algorithm design methods and we will also show how to prove that for some problem (and parameter) such an algorithm (preside algorithm design methods and we will also show how to prove that for some problem (and parameter) such an algorithm (preside algorithm design methods and we will also show how to prove that for some problem (and parameter) such an algorithm (preside algorithm design methods and we will also show how to prove that for some problems are designed and multicore proved to present parallel architectures and processors:parallel (ILP) microarchitectures, multithreaded and multicore processing algorithm and problems are developed to prove th	werful processors of for master's studial experience. Z,ZK sary to solve these of can find a common ontially in this (small me preprocessing of method. We will esumably) does not schemes. Z,ZK	and FPGAs ents. The 4 problems on property of parameter of the input, present a t exist. We
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The Linux operating increase the varial cour MI-PAM There are many opexactly in practice. V (parameter) of the injudy and polynomially in which is not possible plethora of parameter w MI-PAP.16	system is an important operating system for personal computer and also for embedded systems. Systems on chip and combining politity of peripheral subsystems requiring specific software drivers. This course is an advanced course in the Linux driver development are provides knowledge of Linux operating system architecture, principles of development of various types drivers, including practice. Efficient Preprocessing and Parameterized Algorithms stimization problems for which no polynomial time algorithms are known (e.g. NP-complete problems). Despite that it is often necessive will demonstrate that many problems can be solved much more effectively than by naively trying all possible solutions. Often one puts from practice-e.g., all solutions are relatively small. Parameterized algorithms exploit that by limiting the time complexity exponent the input size (which can be huge). Parameterized algorithms also represent a way to formalize the notion of effective polynomial time le in the classical complexity. Such a polynomial time preprocessing is then a suitable first step, whatever is the subsequent solution terized algorithm design methods and we will also show how to prove that for some problem (and parameter) such an algorithm (preside algorithm design methods and we will also show how to prove that for some problem (and parameter) such an algorithm (preside algorithm design methods and we will also show how to prove that for some problem (and parameter) such an algorithm (preside algorithm design methods and we will also show how to prove that for some problem (and parameter) such an algorithm (preside algorithm design methods and we will also show how to prove that for some problem (and parameter) such an algorithm (preside algorithm design methods and we will also show how to prove that for some problems are designed and multicore proved to present parallel architectures and processors:parallel (ILP) microarchitectures, multithreaded and multicore processing algorithm and problems are developed to prove th	werful processors of for master's studial experience. Z,ZK sary to solve these of can find a common ontially in this (small me preprocessing of method. We will esumably) does not schemes. Z,ZK	and FPGAs ents. The 4 problems on property of parameter of the input, present a t exist. We
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MI-PRC	Programming in CUDA	Z,ZK	4
	students gain a good overview of present parallel architectures in GPUs. Students also get hands-on experience with programming		
MI-PSL	Programming in Scala	Z,ZK	4
	uces the modern programming language Scala which exploits object-functional paradigm. Scala comprises advance language feature		_
advance standard li	brary. Scala enables to use of applications functional patterns e.g. H-List, Monads, etc. Scala is used by many powerful frameworks and Scalaz, etc.	d libraries e.g. Play,	Cassandra,
MI-PVR	Advanced Virtual Reality	KZ	4
	ces advanced parts of the virtual reality. It is a continuation of the already running graphic objects, especially the creation of 3D mode	I	1
	students to their application in virtual reality. Lectures will focus on virtual reality technology, its use in various applications and will also		_
_	ines (mainly Unity3D). The course is freely connected with the subject VHS (virtual game worlds), students will be able to apply the kr	_	
ŭ	in virtual reality, or directly create a complex game for VR.	0 0	,
MI-PVS	Advanced embedded systems	Z,ZK	4
	sed on ARM processors and microcontrollers and their usage in wide range of applications. The course includes a series of advance		
		•	
working with mass	storage devices, motor control, system control and industrial communication. The students obtain both theoretical and also practica	i experiences with	embedded
M D T	systems.	147	
MI-PYT	Advanced Python	KZ	4
-	urse is to learn various advanced techniques and methods in Python. The course indirectly continues where Programming in Python		
very hands-on and	it has only tutorials, everything is demonstrated on examples. Classification is based on work in class as well as semestral coursework	.The course is lead	d by external
	teachers from Red Hat.		
MI-REV.16	Reverse Engineering	Z,ZK	5
Students will get ac	quainted with the essentials of reverse engineering of computer software. They will learn how processes start and what happens bef	ore and after the m	nain function
is called. Students	will understand how executable files are organized and how they interact with 3rd party libraries. Another part of the course is dedicated and how they interact with 3rd party libraries.	ated to reverse en	gineering of
applications writ	ten in C++. Students will also understand principles of disassemblers and obfuscation techniques. A part of the course will also be di	edicated to debug	gers: how
debuggers and de	bugging work and which methods can be used to detect it. One of the lectures will be dedicated to the latest trends on the computer	malware scene. T	he focus of
	the course is on the seminars, where students will solve practically oriented tasks from the real world.		
MI-ROZ.16	Pattern Recognition	Z,ZK	5
	reduction recognition. In different recognition with emphasis on problems and applications of the st		
	dents will learn the fundamental concepts and methods of pattern recognition, including probability models, parameter estimation, a		-
MI-RRI	Risk Management in Informatics	ZK	3
	y is very often considered as one of main objectives to secure targets of information processing. However, to focus on this info secur	-	
	viruses, malware etc. very often means misunderstanding and underestimating of real threats which are around us and which are mo	-	
	e necessity to continue with business after disaster is also slightly ignored. International standards which are focused on informatics		
	started to anticipate necessity of risk management. There is no commonly accepted methodology used for this task. Threats which a	= =	ble to see
	ldwide, invoke pressures to prepare plans for business continuity management even in the case of dramatic political changes, natura	al disasters etc.	
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learn the basics of anti-virus, anti-spam and heuristic analyses used in modern anti-virus solutions or Unified Threat Management (UTM) based solutions. They will also learn the principles of securing websites, web applications and databases. Upon completion of the module, students will have a broad overview of IT security and will be able to apply it to the integration of various software systems and applications. MI-SYP.16 Parsing and Compilers The module builds upon the knowledge of fundamentals of automata theory, formal language and formal translation theories. Students gain knowledge of various variants and applications of LR parsing and are introduced to special applications of parsers, such as incremental and parallel parsing. MI-SZ1 Knowledge Engineering Seminar Master I 7 On this seminar you will present a research paper from a top institute / research group to your peers. You will learn what is being cooked in top research labs around the world. Additionally, you will learn how to properly present and read scientific papers. The work in the seminar will prepare you to attend (and profit from) top machine learning and Al conferences and summer schools, as well as FIT's own Summer Research Program (VyLet). MI-TES.16 Systems Theory Today, humankind has the ability to develop systems of incredible complexity (e.g., trains, microprocessors, airplanes, nuclear power plants). However, the costs of managing this complexity and of ensuring the correct behavior of a given system have become critical. A key technique for mastering this complexity is the usage of models that describe only those aspects of the systems that are important for the task at hand, and automated tools for analyzing those models. This subject will present theory and algorithms that form the basis for the modeling and analysis of complex systems. MI-TNN Theory of Neural Networks Z,ZK 4 In this course, we study neural networks from the point of view of the theory of function approximation and from the point of view of probability theory. At first, we recall basic concepts pertaining to artificial neural Networks, such as neurons and connections between them, types of neurons from the point of view of signal transmission, network topology, somatic and synaptic mappings, network training, and the role of time in neural networks. In connection with network topology, we get acquainted with its transformation into a canonical topology, and in connection with somatic and synaptic mappings, with their composition into mappings computed by the Network, Finally in connection with training, we pay attention to the problem of overtraining and to the fact that training is actually a specific optimization task, recalling the most typical objective functions and the most important optimization methods employed for neural network training. We will see the meaninig of all these concepts in the context of common kinds of forward neural networks. Within the topic approximation approach to neural networks, we first notice the connection of neural networks to expressing functions of many variables using functions of fewer variables (Kolmogorov theorem, Vituškin theorem). Afterwards, we will see how the universal approximation capacity of neural networks can be mathematically formalized as the sets of mappings computed by neural networks being dense in important Banach spaces of functions, in particular in the spaces of continuous functions, spaces of functions integrable with respect to a finite measure, spaces of functions with continuous derivatives, and Sobolev spaces. Within the topic probabilistic approach, we first get acquainted with training based on expectation and training based on a random sample, and with probabilistic assumptions about training data with which those two kinds of neural networks can be employed. We will see how it is possible to get an estimate of the conditional expectancy of network outputs conditioned by its inputs using the expectancy based learning. We recall the strong and the weak law of large numbers and get acquainted with an analogy of the strong law of large numbers for neural networks and with the assumptions for its validity. Finally, we recall the central limit theorem, get acquinted with its analogy for neural networks, with the assumptions for its validity and with the hypothesis tests based on it. We will see how those tests can be employed to search for the topology of the network. MI-TS1 Theoretical Seminar Master I Theoretical seminar is intended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a classical reading group. The students are treated individually and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course is a work with scientific papers and other scholarly literature. The capacity is limited by the the potentials of the teachers of the seminar. MI-TS2 Theoretical Seminar Master II 7 Theoretical seminar is intended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a classical reading group. The students are treated individually and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course is a work with scientific papers and other scholarly literature. The capacity is limited by the the potentials of the teachers of the seminar. MI-TS3 Theoretical Seminar Master III Ζ Theoretical seminar is intended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a classical reading group. The students are treated individually and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course is a work with scientific papers and other scholarly literature. The capacity is limited by the the potentials of the teachers of the seminar. MI-TS4 Theoretical Seminar Master IV Z Theoretical seminar is intended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a classical reading group. The students are treated individually and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course is a work with scientific papers and other scholarly literature. The capacity is limited by the the potentials of the teachers of the seminar. MI-TSP.16 Testing and Reliability Z,ZK Students gain knowledge about circuit testing and about methods for increasing reliability and security. They will get practical skills to be able to prepare a test set with the help of the intuitive path sensitization and to use an ATPG for automatic test generation. They will be able to design easy testable circuits and systems with built-in-self-test equipment. They will be able to analyze and control reliability and availability of the designed circuits. MI-VEM Scientific thinking K7 2 The objective of the course is to get acquainted with scientific methods and discovery of order and laws of the universe, including the aspects of human life. The subject combines scientific methods in natural sciences, mathematics, computer science and humanities. Another aim is to introduce rules and requirements of scientific communication via research papers and posters Selected statistical methods 8 Summary of probability theory; Multivariate normal distribution; Entropy and its application to coding; Statistical tests: T-tests, goodness of fit tests, independence test; Random processes - stacionarity; Markov chains and limiting properties; Queuing theory MI-VYC Z,ZK 4 Computability Classical theory of recursive functions and effective computability, with applications in provability theory. MI-W20.16 Z.ZK 5 Web 2.0 Students will learn new trends and technologies on the Web including theoretical foundations. Students will gain an overview about Web applications architectures, concepts and technologies about programmable Web (REST Architectures, Mashups), basic mechanisms for knowledge representation on the Web (microformats, meta-data, ontologies, open linked data, etc.), mechanisms about collective intelligence (collaborative filtering, predictions of users' behaviours), social networks, and security. MI-ZS10 Master internship abroad for 10 credits 10 Each student can once within his / her master's degree have a foreign internship at a foreign university or other foreign scientific and/or research institution. Before the internship the Dean of the FIT, or the vice-dean for study affairs assesses the professional content. The student must provide evidence of the professional content and extent of the internship. Auxiliary courses MI-ZS10, MI-ZS20, MI-ZS30 are used used for the evidence and evaluation of the internship in IS KOS. Every 10 credits correspond to 4 weeks of full-time employment with a foreign institution. The maximum number of credits a student can earn for one internship is 30 credits. This amount can be divided into two subjects if the internship exceeds the academic year's dead-line.

N. 41 7000	1 1 1 10 11		2-
MI-ZS20	Master internship abroad for 20 credits	Z	20
	once within his / her master's degree have a foreign internship at a foreign university or other foreign scientific and/or research institut		
	the vice-dean for study affairs assesses the professional content. The student must provide evidence of the professional content and eximilar MI-ZS20, MI-ZS30 are used used for the evidence and evaluation of the internship in IS KOS. Every 10 credits correspond to 4 weeks		
	on. The maximum number of credits a student can earn for one internship is 30 credits. This amount can be divided into two subjects i		
a foreign instituti	on. The maximum number of credits a student can earn of one linemship is so credits. This amount can be divided into two subjects in academic year's dead-line.	the internship ex	xceeus ine
MI 7000			20
MI-ZS30	Master internship abroad for 30 credits	Z	30
	once within his / her master's degree have a foreign internship at a foreign university or other foreign scientific and/or research institut the vice-dean for study affairs assesses the professional content. The student must provide evidence of the professional content and ex		-
	MI-ZS20, MI-ZS30 are used used for the evidence and evaluation of the internship in IS KOS. Every 10 credits correspond to 4 weeks		
	on. The maximum number of credits a student can earn for one internship is 30 credits. This amount can be divided into two subjects i		-
	academic year's dead-line.		
NI-ADM	Data Mining Algorithms	Z.ZK	5
	s on algorithms used in the fields of machine learning and data mining. However, this is not an introductory course, and the students s	,	
basics. The empha	isis is put on advanced algorithms (e.g., gradient boosting) and non-basic kinds of machine learning tasks (e.g., recommendation system	ems) and models	(e.g., kerne
	methods).		
NI-ADP	Architecture and Design patterns	Z,ZK	5
The objective of th	is course is to provide students with both work knowledge about the underlying foundations of object-oriented design and analysis as	well as with unde	rstanding of
the challenges, iss	ues, and tradeoffs of advanced software design. In the first part of the course, the students will refresh and deepen their knowledge of	object-oriented p	rogramming
and get familiar wit	h the commonly used object-oriented design patterns that represent the best practices for solving common software design problems. In	the second part	the students
will be introduced t	o the principles of software architecture design and analysis. This includes the classical architectural styles, component based systems,	and some advance	ced software
	architectures used in large-scale distributed systems.		T
NI-AIB	Algorithms of Information Security	Z,ZK	5
•	equainted with the algorithms of secure key generation and cryptographic error (not only biometric) data processing. Furthermore, studential error (not only biometric) data processing.		
principles of cry	otographic protocols (identification, authentication, and signature schemes). Another part of the course is dedicated to malware detect		of machine
	learning in detection systems. The last topic includes practical steganographic methods and attacks on steganographic system		
NI-AM1	Middleware Architectures 1	Z,ZK	5
	dy new trends, concepts, and technologies in the area of service-oriented architectures. The will gain an overview of information syste		
architecture and ap	slication servers. The will also study principles and technologies for middleware focused on application integrations, asynchronous commi	inications and hig	gh availability
	of applications.		
NI-AM2	Middleware Architectures 2	Z,ZK	5
Students will learn	new trends and technologies on the Web including theoretical foundations. They will gain an overview of Web application architecture	s, concepts and t	echnologies
	for microservices, distrubuted cache and databases, smart contracts, realtime communication and web security.		
NI-AML	Advanced machine learning	Z,ZK	5
	ces students to selected advanced topics of machine learning and artificial intelligence. The topics present techniques in the field of recognitive and interespondent of the supplied in the field of machine learning. The size of the supplied in the feeling is to feeling in the field of machine learning.	-	_
	control and interconnection of physical laws with the field of machine learning. The aim of the exercise is to familiarize students with the		
NI-APR	Selected Methods for Program Analysis studies program behavior with the aim of code optimization and error detection. Students will learn static program analysis, which app	Z,ZK	5
	to actually run the program, as well as dynamic program analysis which analyse programs at runtime. Students will be introduced to t		
without the need	algorithms and use them on some classical problems.	ic common teem	iliques and
NI-BKO	Error Control Codes	Z,ZK	5
	al of the course is to present various ways to detect or correct individual errors and burst errors in data stored into memories or transm	•	_
NI-BML	Bayesian Methods for Machine Learning	KZ	5
	sed on practical use of basic Bayesian modeling methods in the dynamically evolving machine learning theory. In particular, it studies the		1
-	description of real phenomena, as well as their subsequent use, e.g., for forecasting of future evolution or learning about the hidden v		
	tions etc.). The emphasis is put on understanding of explained principles and methods and their practical adoption. For this purpose, a n		-
and applications	will be presented to students, for instance, 2D/3D object tracking, radiation source term estimation, or separation in medical imaging.	he students will	try to solve
	some of them.		
NI-BUI	Business Informatics	Z,ZK	5
The aim of the cou	rse is to focus on operational, tactical and strategic management of business informatics. Students will gain knowledge in the areas of bu	siness process m	anagement
ICT services and	architectures in enterprise informatics. They will also learn about the principles, models and standards (ITIL, COBIT) in IT management	ıt, and lifecycle m	nanagement
	ind resource management (sourcing). Students will learn the process of creating and implementing information strategy, IT Governance	•	
business and th	e context of information strategy with global business strategy. They will also gain knowledge in the areas of economic IT management	t, revenue and in	vestment
	management, IT investment evaluation and human resources management in IT (roles CIO, CEO, CFO).		1
NI-BVS	Embedded Security	Z,ZK	5
-	c knowledge in selected topics of cryptography and cryptanalysis. The course focuses particularly on efficient implementations of crypto		
and software (in en	nbedded systems). Students gain a good overview of functionality of (hardware) cryptographic accelerators, smart cards, and resources	for securing interi	nal functions
	of computer systems.		
NI-CCC	Creative Coding and Computational Art	KZ	4
	practical tasks, get acquainted with creative and yet proven methods of visualizing various types of data. The course freely follows the between students to suitable visualization methods for traditional as well as for appendix at the combines well known visualization technique.		
	duces students to suitable visualization methods for traditional as well as for open data. It combines well-known visualization technique ies. The aim is to create an interesting visualization project. It is planned to work closely with IPR CAMP (Center of Architecture and M		ū
modern technolog	(Institute of Intermedia FEL).	eliopolitari Fiariri	iiig) and iiivi
NI-DIP	Diploma Project	Z	30
NI-DPH	Game Design	Z,ZK	5
The course comple	ements the NI-APH (Architecture of Computer Games) and BI-VHS (Virtual gaming worlds) course, while focusing primarily on game d		
interested in de-			
	per knowledge of the principles used for games design, such as: level design, gameplay design, character design, game mechanics design the principle of game development from the designer's perspective, from theoretical concepts to practical implements.		
	per knowledge of the principles used for games design, such as: level design, gamepiay design, character design, game mechanics of a students will get an overview of game development from the designer's perspective, from theoretical concepts to practical implemance projects.		

NI-DSS **Decision Support Systems** Z,ZK 5 The aim of the course is to provide students with knowledge and skills in decision support systems, their classification (Powerova), selected principles of data-oriented, model-oriented and knowledge-oriented decision support systems. Students will also gain knowledge of multicriterial decision-making methods and game theory. They will also learn about the principles of conceptually and ontologically oriented decision support systems and the basics of distribution, optimization and evolution methods and algorithms. NI-EHW **Embedded Hardware** Z,ZK 5 The course brings basic laws that govern digital design and basic techniques to use them. It deals with both large and small scale systems. This is the base of advanced embedded systems, that profit from their specialized structure for effective computation and acceleration. Design of fast custom computing machines is discussed, including standardized means of internal communication, parallelism extraction and utilization in special structures and system architectures. NI-EPC Effective C++ programming Z,ZK Students learn how to use the modern features of contemporary versions of the C++ programming language for software development. The course focuses on programming effectivity and efficiency in the form of writing maintainable and portable source code and creating correct programs with low memory and processor time requirements NI-FSW Embedded Software Embedded software course acquainted students with the specifics of software development for embedded systems. The course covers the areas from the basic techniques of programming in C language and code optimizations, through typical areas as the reliable software development, embedded operating systems, signal processing, up to sophisticated techniques combined with artificial intelligence. NI-FMT Finite model theory 7.7K The aim of the course is to introduce students to the basics of finite model theory. The original motivation is the questions expressibility and verifiability of logical properties of database systems. Since its inception in the 1970s, the course has evolved rapidly and touched on many other areas of theoretical computer science, such as descriptive complexity theory, the Constraint Satisfaction Problem (CSP), the theory of algorithmic meta-theorems and combinatorics. Graph Neural Networks NI-GNN Z.ZK 4 The course introduces students to advanced artificial intelligence techniques for working with graphs. Lectures will focus on the latest graph neural networks for creating vector representations of nodes, edges and entire graphs. The techniques discussed cover various types of graphs, including time-varying graphs. The last part of the course also covers graph generation and interpretability of graph neural networks. In the exercises, students will try out selected techniques and problems. NI-GPU GPU Architectures and Programming Z,ZK 5 Students will gain knowledge of the internal architecture of modern massively parallel GPU processors. They will learn to program them mainly in the CUDA programming environment, which is already a widespread programming technology of GPU processors. As an integral part of the effective computational use of these hierarchical computational structures, students will also learn optimization programming techniques and methods of programming multiprocessor GPU systems. NI-GRI **Grid Computing** Z,ZK Grid computing and gain knowledge about the world-wide network and computing infrastructure. NI-HCM ZK Mind Hacking 5 Cognitive security is an emerging discipline that is closely related to cyber security. While the domain of cyber security is the protection of networks, information systems and assets, the domain of cognitive security is the protection of the human mind from intentional and unintentional digital manipulation. The topic of cognitive security is growing in importance in the context of information warfare, increasing digital dependence and the development of artificial intelligence, where these phenomena from the Internet environment have real societal impacts such as disruption of social cohesion, threats to democracy or war. NI-IAM 7.7K Internet and Multimedia The NI-IAM course is focused on principles and modern technologies for network transmissions of audiovisual (AV) signals. The syllabus includes acquisition of AV signals (input), presentation of AV signals (output), network communication protocols, device interfaces, codecs, data formats and stereoscopy. We will look at practical use case scenarios of real-time audiovisual transmissions. Within the labs, students will practically assemble AV transmission chains using HW and SW technologies and verify the effect of various components on the quality and latency of AV transmissions. Students will learn how to build Internet infrastructure for end-to-end AV transmissions from the recording the scene up to the presentation for audience. NI-LSM Statistical Modelling Lab ΚZ The subject is oriented on a single and multi-target tracking. The student both learns the existing methods and tries to implement them. The stress is put on the effective use of the available information and its modeling using numpy and scipy. The second half of the semester is focused on the design of methods and algorithms, and analyses of their properties. At this point, the subject is on the border of own research and may result in the topic of final work (diploma or bachelor thesis). ΚZ NI-LSM2 Statistical Modelling Lab 5 The topic of LSM2 is advanced multiple target tracking (MTT). This domain covers simultaneous tracking of multiple targets using radar under the presence of clutter, or video tracking. We aim at the state-of-the-art filters, in particular the PHD (Probability Hypothesis Density) and PMBM (Poisson Multi-Bernoulli) filters NI-MCC Multicore CPU Computing Students will get acquainted in detail with hardware support and programming technologies for the creation of parallel multithreaded computations on multicore processors with shared and virtually shared memories, which are today the most common computing nodes of powerful (super)computer systems. Students will gain knowledge of architecturally specific optimization techniques used to reduce the performance drop due to the widening gap between the computational requirements of multi-core CPUs and memory interface throughput. On specific non-trivial multithreaded programs, students will also learn the basics of the art of creating these applications. Machine Learning in Practice Applying machine learning methods to real projects in practice involves many other necessary tasks - from understanding the intentions of the client to, ideally, technical implementation The course guides students through all phases of a project according to the standard CRISP-DM methodology, not only theoretically but also practically. The aim is to experience real data processing and learn how to describe the whole process from exploration to evaluation of the model performance in the form of a clear and understandable report. Modern Object-Oriented Programming in Pharo Object-oriented programming is currently one of the most widespread paradigms of software creation, especially enterprise information systems, where its ability to natural abstraction is used to build complex modern applications. In this course, we build on the knowledge acquired in the course BI-OOP and aim to further deepen the skills of design and implementation of object systems in modern pure object system Pharo (https://pharo.org). The course focuses on individual approach to students, their development needs and areas of interest. In addition to deepening object programming skills, which are generally applicable in other OO languages, students will also gain the opportunity to work on interesting projects and OO technologies in terms of semestral work with the possibility of cooperation with practice and related bachelor, diploma, postgraduate our direct involvement in the Pharo Consortium. Modelling of Programming Languages The analysis, transformation, and code generation processes depend on the semantics of the language; in particular, they are correct if they preserve the semantics of the language. This course explores the semantics of programming languages. The students will learn the language models with emphasis on functional languages, students are expected to understand the basics of the lambda calculus and here get acquainted with the advanced lambda calculus. The students also get hands-on-experience with semantic modeling and execution tools. NI-MTI Modern Internet Technologies Z.ZK SYNOPSIS The subject "Modern Internet Technologies" is designed on four major pillars of networking: 1. Unified Communication and Collaboration - A single network, oriented on TCP/IP is able to carry whatever types of protocols for whatever purposes. This architecture is able to be protocol independent and carries voice, video and data to achieve seamless integrated services. 2. Design of Extremely Scalable Networks - This provides the insights of network architectures which can accommodate hundreds of millions of users and billions of devices. Thus, there is a paradigm switch from LANs (Local Area Networks) to SPs (Service Providers). 3. Traffic Segregation, Traffic Matching and Traffic Prioritisation - These

technologies allow service providers to create private channels of communication between customers, with guaranteed parameters (bandwidth, delay, jitter, type of protocol). 4. Acceleration Technologies - They allow traffic to be carried at the optimal speed and allow for graceful degradation of service parameters in case of failures. NI-MVI Computational Intelligence Methods Z.ZK 5 Students will understand methods and techniques of computational intelligence that are mostly nature-inspired, parallel by nature, and applicable to many problems. They will learn how these methods work and how to apply them to problems related to data mining, control, intelligen games, optimizations, etc. **NI-NUR** User Interface Design Students will understand the theorical background of human-computer interaction and user interface (UI) design, will learn formal description of UIs, formal user models, the fundamental notions and procesures. They get acquainted with graphical, speech, and multimodal Uls. Thanks to the gained knowledge, the students will be able to design advanced Uls. Operating Systems and Systems Programming Z.ZK NI-OSY The course covers system programming in UNIX environment. Emphasis is given on kernel development with focus on kernel architecture and kernel data structures. Key topics are: process management, memory management, file operations and architecture of modern file systems, device drivers and network programming. The course also addresses kernel development process, upgrades of existing kernels, kernel booting, debugging using dynamic instrumentation, and techniques to guarantee portability. Specifics of kernel architecture in embedded and real-time operating systems are also discussed. Theoretical and general principles are demonstrated on the LINUX kernel. Within labs, students will work on projects focused on development of LINUX kernel modules. NI-PAS Advanced Aspects of Business Z,ZK 4 The aim of the course is to provide students with advanced (compared to the bachelor's degree) knowledge and skills needed to establish and run their own business or business management, especially in law, administration (necessary steps and documents), business economics, foreign trade and related aspects NI-PDB Advanced Database Systems 5 Students orient themselves in problems of evaluation and optimization of SQL queries. The next part of the course deals with new concepts of database machines (so called NoSQL databases), with the related new data models (XML, graph databases, column databases) and languages for working with them (XQuery, XPath, CYPHER, Gremlin). The last part of the course deals with performance evaluation of database machines. NI-PDD **Data Preprocessing** Z,ZK 5 Students learn to prepare raw data for further processing and analysis. They learn what algorithms can be used to extract information from various data sources, such as images, texts, time series, etc., and learn the skills to apply these theoretical concepts to solve specific problems in individual projects - e.g., extraction of characteristics from images or from web pages. NI-PG1 Computer Grafics 1 7K The course builds on graphic courses (mainly BI-PGA and BI-PGR) and the knowledge from these courses is deepened by state-of-the-art knowledge. The course is designed for those interested in advanced computer graphics. Students will gain practical knowledge with realistic texturing and raytracing methods. An integral part of the course is the study of scientific articles and their subsequent implementation. The course will be followed by a course PG2 supplementing the knowledge of PG1 on other areas and topics of computer graphics. NI-PSD Public Services Design The course will introduce students to specifics of UX, Service design and development for public sector. We will look into the design and development process from the perspective of suppliers (devs and designesr) as well as clients. In small teams students will work on projects from partner organizations and will try out collaboration with client representatives. Course is aimed at students-designers as well as clients. NI-SBF System Security and Forensics Students will get familiar with aspects of system security (principles of end station security, principles of security policies, security models, authentication concepts). Furthermore, students will get familiar with forensic analysis as a tool for investigating security incidents (techniques used by malicious software/attackers and forensic analysis techniques and the importance of operating system/operating system artifacts or file system for attack analysis and detection). Parsing and Compilers 5 The module builds upon the knowledge of fundamentals of automata theory, formal language and formal translation theories. Students gain knowledge of various variants and applications of LR parsing and are introduced to special applications of parsers, such as incremental and parallel parsing. NI-TNN Theory of Neural Networks Z,ZK In this course, we study neural networks from the point of view of the theory of function approximation and from the point of view of probability theory. At first, we recall basic concepts pertaining to artificial neural Networks, such as neurons and connections between them, types of neurons from the point of view of signal transmission, network topology, somatic and synaptic mappings, network training, and the role of time in neural networks. In connection with network topology, we get acquainted with its transformation into a canonical topology, and in connection with somatic and synaptic mappings, with their composition into mappings computed by the Network, Finally in connection with training, we pay attention to the problem of overtraining and to the fact that training is actually a specific optimization task, recalling the most typical objective functions and the most important optimization methods employed for neural network training. We will see the meaninig of all these concepts in the context of common kinds of forward neural networks. Within the topic approximation approach to neural networks, we first notice the connection of neural networks to expressing functions of many variables using functions of fewer variables (Kolmogorov theorem, Vituškin theorem). Afterwards, we will see how the universal approximation capacity of neural networks can be mathematically formalized as the sets of mappings computed by neural networks being dense in important Banach spaces of functions, in particular in the spaces of continuous functions, spaces of functions integrable with respect to a finite measure, spaces of functions with continuous derivatives, and Sobolev spaces. Within the topic probabilistic approach, we first get acquainted with training based on expectation and training based on a random sample, and with probabilistic assumptions about training data with which those two kinds of neural networks can be employed. We will see how it is possible to get an estimate of the conditional expectancy of network outputs conditioned by its inputs using the expectancy based learning. We recall the strong and the weak law of large numbers and get acquainted with an analogy of the strong law of large numbers for neural networks and with the assumptions for its validity. Finally, we recall the central limit theorem, get acquinted with its analogy for neural networks, with the assumptions for its validity and with the hypothesis tests based on it. We will see how those tests can be employed to search for the topology of the network. NI-TSW Software Product Development ΚZ 4 The course is presented in Czech. NI-VCC Z.ZK Virtualization and Cloud Computing 5 Students will gain knowledge of architectures of large computer systems that are used in data centers and computer infrastructure of companies and organizations. They will get acquainted with virtualization principles, tools and technologies that serve to facilitate and automate configuration, testing and monitoring, and to efficiently operate and optimize the performance parameters of modern computer systems. Theoretically and practically, they will get acquainted with containerization as the most effective technology today for the management of complex computer systems and with specific technologies of cloud systems. Finally, they will learn the principles and gain practical skills in the use of modern integration and development tools (Continuous integration and development). NI-VMM Retrieval from Multimedia Z,ZK 5 The student obtains general knowledge regarding interfaces of portals providing multimedia content, the principles of similarity search, the methods of feature extraction from multimedia objects, indexing, and structure of distributed search engines. NI-VPR Ζ 5 Research Project Student obtains the credits for published scientific outputs. The details are at https://courses.fit.cvut.cz/NI-VPR/en.

NIE-PDL	Practical Deep Learning	KZ	5				
This course is designed to provide students with a comprehensive understanding of Deep Learning using PyTorch, a popular open-source machine learning framework. Throughout							
the course, student	the course, students will develop practical skills in building and training deep neural networks, using PyTorch to solve real-world problems in fields such as computer vision and natura						
	language processing.						
NIE-PML	Personalized Machine Learning	Z,ZK	5				
Personalized mad	hine learning (PML) is a sub-field of machine learning that aims to create models and predictions based on the unique characteristic	s and behaviors of	individual				
entities. While PML	is commonly used in applications such as recommender systems, which recommend items to users based on their personal interest	s, its principles car	n be applied				
to a wide range of o	ther fields, including education, medicine, and chemical engineering. In this course, we will explore the latest PML methods from theore	tical, algorithmic, a	and practical				
	perspectives. Specifically, we will focus on cutting-edge models that are of interest to both the research and commercial communities.						
PI-SCN	Seminars on Digital Design	ZK	4				
This subject deals	with problems of realization and implementation of digital circuits - both combinational and sequential. Basic means of description of	digital circuits and	basic logic				
synthesis and o	ptimization algorithms are described. Basics of EDA (Electronic Design Automation) systems are given, together with combinatorial p	problems emerging	in EDA.				

For updated information see http://bilakniha.cvut.cz/en/FF.html Generated: day 2024-07-27, time 08:26.