UNIVERSITY OF DEBRECEN
Doctoral School of Informatics

Doctoral Program Data science and visualization

Director of Doctoral Program Dr. Hajdu, András

Objectives of Doctoral Program

The aim of the program is to make interested PhD students to get familiar with the basic analytical, geometrical, algebraic, combinatorial concepts of image- and data processing, geometrical modeling, computer graphics and information visualization, and to acquire the corresponding general methods and algorithms, the programming environments for effective data processing.

Academic and Research Fields

Computer-aided geometrical modeling and visualization.

Spline curves and surfaces, subdivision methods. Modeling unordered data, application of artificial neural networks.

Constructive, projective and descriptive geometrical methods and mappings, their application in computer graphics. Models and related analytical methods for scientific and information visualization. 3D modeling and finite element analysis.

Image processing and pattern recognition.

Medical and biological imaging. Pattern matching, object simplification, hierarchical template databases, temporal analysis.

Multimodal human-machine interaction. Biometrical identification (face detection and recognition, fingerprint recognition), character recognition.

Image databases, indexing and retrieval, semantic image and video content description. Surface and volume reconstruction from projections. Machine learning, representation learning.

Big data processing.

Data mining methods for large-scale data. Distributed storage and programming environments, grid technologies, structured and non-structured data storage and processing. Discrete stochastic methods for optimization of geometrical modeling and data processing systems.

Powerful computing solutions, graphics accelerators. Sensor-based data acquisition technologies. Processing of genetic data, automated clinical screening systems based on heterogeneous data. Data fusion methods for geometric problems.

Digital geometry.

Adaptation of image processing methods for heterogeneous grids. Compressing binary shapes. Theory and applications of neighborhood sequences, their analytical, algebraic and topological properties on the square and other grids. Approximation of the Euclidean metric by distance transformations. Grid approximations in image classification.

Theory of the discrete tomography.

Unambiguous reconstruction in the classical and absorptional discrete tomography. Investigation of the structure of tomographically equivalent sets. Convex and HV-convex sets. Algorithmic and complexity problems.

Machine learning.

Supervised and unsupervised learning. Models of regression. Classification. Clustering. Associative learning. Introduction into deep learning. Neural network. Feedforward network. Backpropagation algorithm. Regularization. Cost functions. Convolutional neural networks. Pooling and dropout layers, normalization. Representation learning. Deep convolutional neural networks. Recurrent neural networks. Ensemble methods.

Participant Supervisors

Dr. Antal, Bálint
Dr. Emri, Miklós
Dr. Fazekas, Attila
Dr. Hajdu, András
Dr. Hajdu, Lajos
Dr. Hajdu, Sándor
Dr. Harangi, Balázs
Dr. Hoffmann, Miklós
Dr. Kunkli, Roland Imre
Dr. Mankovits, Tamás
Dr. Papp, Ildikó
Dr. Tornai, Róbert
Dr. Zichar, Marianna

Participant Tutors

Dr. Antal, Bálint
Dr. Baran, Ágnes
Dr. Bácsó, Sándor
Dr. Emri Miklós
Dr. Fazekas, Attila
Dr. Figula, Ágota
Dr. Hajdu, András
Dr. Hajdu, Lajos
Dr. Hajdu, Sándor
Dr. Harangi, Balázs
Dr. Hoffmann, Miklós
Dr. Kunkli, Roland Imre
Dr. Mankovits, Tamás
Dr. Papp, Ildikó
Dr. Szeghalmy, Szilvia
Dr. Tomán, Henrietta
Dr. Tornai, Róbert
Dr. Zichar, Marianna

UNIVERSITY OF DEBRECEN
Doctoral School of Informatics

Courses

Codes	Courses	Credits	Type of Exam.	Lecture	Practice	Lab	Tutor	Scient. Grad.
	Compulsory courses							
	Compulsorily eligible courses							
	Mathematics of data science	2	K	2			Dr. Baran, Ágnes	PhD
	Machine learning	2	K	2			Dr. Harangi, Balázs	PhD
	Big Data processing	2	K	2			Dr. Antal, Bálint	PhD
	Topics in geometry	2	K	2			Dr. Bácsó, Sándor	CSc habil
	Low-level image processing	2	K	2			Dr. Fazekas, Attila	PhD habil
	Discrete stochastic optimization	2	K	2			Dr. Hajdu, András	DSc
	Image processing algorithms	2	K	2			Dr. Hajdu, András	DSc
	Discrete mathematics	2	K	2			Dr. Hajdu, Lajos	DSc
	Information and scientific visualization	2	K	2			Dr. Zichar, Marianna	PhD habil
	Computer aided design and simulation	2	K	2			Dr. Papp, Ildikó	PhD
	Optional courses							
	Deep Learning	2	K	2			Dr. Harangi, Balázs	PhD
	Pattern analysis	2	K	2			Dr. Antal, Bálint	PhD
	Image processing in medicine and biology	2	K	2			Dr. Szeghalmy, Szilvia	PhD
	Applied descriptive and projective geometry	2	K	2			Dr. Bácsó, Sándor	CSc habil
	Digital geometry and mathematical morphology	2	K	2			Dr. Fazekas, Attila	PhD habil
	Loops and nets	2	K	2			Dr. Figula, Ágota	PhD
	Bioinformatics	2	K	2			Dr. Hajdu, András	DSc
	Discrete tomography	2	K	2			Dr. Hajdu, Lajos	DSc
	Lattices	2	K	2			Dr. Hajdu, Lajos	DSc
	Computer aided modelling of curves and surfaces	2	K	2			Dr. Hoffmann, Miklós	DSc
	Finite geometries	2	K	2			Dr. Kunkli, Roland Imre	PhD
	Topics in computer graphics	2	K	2			Dr. Papp, Ildikó	PhD
	Finite Element Analysis	2	K	2			Dr. Mankovits, Tamás	PhD
	Data fusion models	2	K	2			Dr. Tomán, Henrietta	PhD
	Sensor-based data collection and processing	2	K	2			Dr. Tomán, Henrietta	PhD
	Graphics accelerators	2	K	2			Dr. Tornai, Róbert	PhD
	Geoinformatics	2	K	2			Dr. Zichar, Marianna	PhD habil
	Visual analytics methods	2	K	2			Dr. Kunkli, Roland Imre	PhD

Students of the doctoral program Data science and visualization have to get 8 credits by taking compulsory eligible courses. The last 8 credits can be got by taking further courses of the doctoral school or other doctoral

schools. Before taking subjects, students have to consult with their supervisor about the order and time of taking them.

UNIVERSITY OF DEBRECEN
Doctoral School of Informatics

Doctoral Program	Applied Information Technology and its Theoretical Background
Director of Doctoral Program	Dr. Terdik György
Objectives of Doctoral Program	The goal of this program is to acquaint PhD students with high-level applications in information technology, get to know the theoretical backgrounds, and involve students in researches that lay the foundation of further applications. The fundamental objective of the program is to give scientific answers to problems that are raised by practical needs.
Academic and Research Fields	Data science. Statistical data mining. Modelling high speed networks and HPC, multiprocessor technologies. Large scale databases and data warehouses, quality management, data cleaning. Identification and statistical analysis of linear and non-linear dynamic systems. Modelling of information systems and the WEB. Fine tuning of information systems and databases. Statistical models in psychology, pedagogy and computer science. Modelling and technological implementation of an intelligent city and similar, social-based applications. Intelligent objects' machine-to-machine (M2M) communication, traffic modelling and quality measures. IT didactics. Models of quality assurance of electronic teaching environments.

UNIVERSITY OF DEBRECEN
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Participant Supervisors

Adamkó Attila
Bujdosó Gyöngyi
Csernoch Mária
Gál Zoltán
Gilányi Attila
Godó Zoltán Attila
Ispány Márton
Szathmáry László
Terdik György
Vágner Anikó

Participant Tutors

Abari Kálmán
Adamkó Attila
Baranyi Péter
ifj. Benczúr András
Biró Piroska
Bujdosó Gyöngyi
Csernoch Mária
Gál Zoltán
Gilányi Attila
Godó Zoltán Attila
Ispány Márton
Kósa Márk
Kovásznai Gergely
Máth János
Pánovics János
Szathmáry László
Terdik György
Vágner Anikó

UNIVERSITY OF DEBRECEN
Doctoral School of Informatics

Courses

Codes	Courses	Credits	Type of Exam.	Lecture	Practice	Lab	Tutor	Scient. Grad.
	Compulsory courses							
	Stochastic data mining	2	V	E			Ispány Márton	PhD habil
	Statistics with application to Infromation Technology	2	V	E			TerdikGy	DSc
	Statistical Analysis of the Distributed Systems	2	V	E			Gál Zoltán	PhD habil
	Developing computational thinking	2	V	E			Csernoch Mária	PhD habil
	Compulsorily eligible courses							
	Novel approaches for Internet-based applications	2	V	E			Adamkó Attila	PhD habil
	Virtual reality systems	2	V	E			Gilányi Attila	PhD habil
	Advanced data mining methods and applications	2	V	E			Ispány Márton	PhD habil
	Symbolic Data Mining	2	V	E			Szathmáry László	PhD habil
	Statistics for high speed network data	2	V	E			Terdik György	DSc
	Sprego Programming	2	V	E			Csernoch Mária	PhD habil
	Verifying Systems by Modern Formal Methods	2	V	E			Dr. Kovásznai Gergely	PhD habil
	Optional courses							
	Knowledge space theory in practice	2	V	E			Abari Kálmán	PhD
	Development and usage of Content Management Systems	2	V	E			Bíró Piroska	PhD
	Informatics education in ICT rich environment	2	V	E			Bíró Piroska	PhD
	Online and virtual environments in knowledge transfer	2	V	E			Bujdosó Gyöngyi	PhD
	Knowledge-Transfer Items in Teaching Informatics	2	V	E			Csernoch Mária	PhD habil
	Applications of virtual and augmented reality systems	2	V	E			Gilányi Attila	PhD habil
	Informatics in life sciences	2	V	E			Godó Zoltán	PhD
	Functional Programming Languages and its Applications	2	V	E			Kósa Márk	PhD
	Examining qualitative variables	2	V		Gy		Máth János	PhD habil
	Multiparadigm Programming in F#	2	V	E			Pánovics János	PhD
	Statistics and time series with applications	2	V	E			Terdik György	DSc
	Data warehouses	2	V	E			Vágner Anikó	PhD

UNIVERSITY OF DEBRECEN
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Criteria to complete the program:

With the approval of the program's leader:

1. One course must be selected from the list of compulsory courses; 2 courses must be selected from the list of compulsorily eligible courses; 2 courses must be selected from the list of optional courses.
2. Two courses must be selected from the other programs of the Doctoral School of Informatics (i.e. one course from a program and another course from a different program of the Doctoral School of Informatics).

UNIVERSITY OF DEBRECEN
Doctoral School of Informatics

Doctoral Program	**Theoretical computer science, data security and cryptography**
Director of Doctoral Program	**Dr. Attila Pethő, DSc, professor**
Objectives of Doctoral Program	PhD students get in touch and start research with methods used in informatics, with the basics of protecting data and the application of these. Students will learn to collect and order data and the method of publishing. They have to learn important algorithms and the analysis of their correctness and their complexity. We pay attention that students learn to work with important software products and applications as well.
Academic and Research Fields	Developing of cryptographic algorithms, analysis of these ones, especially hash functions and random number generators, which are secure in cryptographic applications. Developing cryptographic protocols and analyzing these, e.g. identifications, secret sharing, voting protocols, digital watermark. Analyzing cryptographic systems, which are stronger than quantum algorithms. Computing models with new principles, classical and non classical logical systems, Theory of computing and complexity, formal languales, computer algebra, Theory of automata, automatic networks, artificial intelligence, descriptive logic, automated proofs, logical programming, standard and non standard logical languages.
Participant Supervisors	Dr. László Aszalós, Dr. Pál Dömösi, Dr. Tamás Herendi, Dr. Géeza Horváth, Dr. Tamás Mihálydeák, Dr. Attila Pethő, Dr. Andrea Pintér-Huszti, Dr. György Vaszil
Participant Tutors	Dr. László Aszalós, Dr. Péter Battyányi, Dr. László Csirmaz, Dr. Pál Dömösi, Dr. Carolin Hannusch, Dr. Tamás Herendi, Dr. Géza Horváth, Dr. Tamás Kádek, Dr. József Ködmön, Dr. András Tibor Kruppa, Dr. Tamás Mihálydeák, Dr. Attila Pethő, Dr. Andrea Pintér-Huszti, Dr. György Vaszil, Dr. Magda Várterész

UNIVERSITY OF DEBRECEN
Doctoral School of Informatics

Courses

Codes	Courses	Credits	Type of Exam.	Lecture	Practice	Lab	Tutor	Scient. Grad.
	Compulsorily eligible courses							
	Dynamic logic	2	E	L			László Aszalós	PhD habil
	Cryptographic protocols	2	E	L			László Csirmaz	CSc habil
	Automata Networks	2	E	L			Pál Dömösi	DSc
	Automata and Languages	2	E	L			Pál Dömösi	DSc
	Finite fields and their applications	2	E	L			Tamás Herendi	PhD
	Network Security	2	E	L			Tamás Kádek	PhD
	Theory of computability and its applications in logic	2	E	L			Tamás Mihálydeák	CSc habil
	Rough Set Theory	2	E	L			Tamás Mihálydeák	CSc habil
	Information and Coding Theory	2	E	L			Attila Pethő	DSc
	Cryptographic algorithms	2	E	L			Attila Pethő	DSc
	Design and analysis of cryptographic protocols	2	E	L			Andrea Pintér-Huszti	PhD habil
	DNA computing	2	E	L			György Vaszil	DSc
	Introduction to Membrance Computing	2	E	L			György Vaszil	DSc
	Optional courses							
	Artificial Intelligence	2	E	L			László Aszalós	PhD habil
	Proof theory in modal logic	2	E	L			László Aszalós	PhD habil
	Models of parallel computing	2	E	L			Péter Battyányi	PhD
	Combinatorial Properties of Formal Languages	2	E	L			Pál Dömösi	DSc
	Computational number theoretical and algebraic program packages	2	E	L			Carolin Hannusch	PhD
	Context-free Languages	2	E	L			Géza Horváth	PhD habil
	Context-sensitive Languages	2	E	L			Géza Horváth	PhD habil
	Pushdown Automata	2	E	L			Géza Horváth	PhD habil
	Problems of Data Security	2	E	L			József Ködmön	PhD
	Quantum computers	2	E	L			András Tibor Kruppa	DSc
	Classical First-order Logic	2	E	L			Tamás Mihálydeák	CSc
	E-business	2	E	L			Attila Pethő	DSc
	Automated theorem proving	2	E	L			Magda Várterész	PhD habil
	Boolean functions in Computer Science	2	E	L			Magda Várterész	PhD habil

Criteria to complete the program: Students taking part in this doctoral program need to fulfill 8 creditpoints from compulsorily eligible courses. Further 8 credit points need to be fulfilled due to the criteria of the doctoral regulation, primarily these should be fulfilled from optional courses listed in the table above.

UNIVERSITY OF DEBRECEN
Doctoral School of Informatics

Doctoral Program	Theoretical foundation and applications of information technology and stochastic systems
Director of Doctoral Program	István Fazekas
Objectives of Doctoral Program	The students get acquainted with the theoretical foundation of information technology and stochastic systems, get insight to the applications of the theory, and they achieve competency to develop the theory. Those topics are preferred which improve the quality of info-communication technology, therefore meet the requirements of the information society.
Academic and Research Fields	Modelling complex systems: stochastic and computer models. Modelling evolution of networks by random graphs and computer experiments. Scientific calculations: applying supercomputer and parallel programming to solve problems in statistics, numeric analysis and operational research, their applications in natural and social sciences (physics, meteorology, economics,…). Study of methods of operational research and their applications in science and industry. Description of temporal and spatial processes by stochastic models. Studying statistical models by mathematical methods and computer simulations. Stochastic financial, insurance and other econometric models and their statistical aspects. Machine learning. Statistical, mathematical and software tools of business intelligence. Library informatics, applications of multimedia and Web, virtual reality. History of information, cognitive science. Libraries and digital archives. Didactics of informatics and electronic (e-learning) teaching frameworks.
Participant Supervisors	Sándor Baran, Ágnes Baran, Anett Rácz, Miklós Bényei, István Boda, Gyöngyi Bujdosó, Erzsébet Dani Bujdosóné, Mária Borbély Eszenyiné, István Fazekas, József Gáll, Erzsébet Tóth, Tamás Vertse, MártaVirágos
Participant Tutors	Bernadett Aradi, Ágnes Baran, Sándor Baran, Mátyás Barczy, Anett Rácz, Miklós Bényei, István Boda, Gyöngyi Bujdosó, Erzsébet Dani Bujdosóné, Pál Burai, Mária Borbély Eszenyiné, István Fazekas, József Gáll, Margit Némethi.Takács, Gyula Pap, Kinga Sikolya-Kertész, Patricia Szokol, Erzsébet Tóth, Tamás Vertse, Márta Virágos

UNIVERSITY OF DEBRECEN
Doctoral School of Informatics

Courses

Codes	Courses	Credits	Type of Exam.	Lecture	Practice	Lab	Tutor	Scient. Grad.
	Compulsory courses							
	Foundation of machine Learning	2	O	+	-	+	István Fazekas	DsC, habil
	Library Management	2	O	+	-	-	Márta Virágos	PhD
	Compulsorily eligible courses							
	Scientific computing	2	W	+	-	+	Ágnes Baran	PhD
	Topics in the theory of stochastic processes	2	O	+	-	-	Sándor Baran	DSc, habil
	Selected topics in probability	2	O	+	-	-	Mátyás Barczy	PhD, habil
	Random graphs and networks	2	O	+	-	-	István Fazekas	DsC, habil
	History of information	2	O	+	-	-	Miklós Bényei	DsC, habil
	The narratives of digital reading, electronic literature	2	O	+	-	-	Erzsébet Dani Bujdosóné	PhD, habil
	Optional courses							
	Finite element methods	2	W	+	-	+	Ágnes Baran	PhD
	Stochastic algorithms	2	O	+	+	-	Sándor Baran	DSc, habil
	Multivariable statistical methods	2	O	+	+	-	Sándor Baran	DSc, habil
	Applications of virtual reality	2	W	+	-	+	Anett Rácz	PhD
	Implementation techniques of simplex method	2	W	+	-	+	Anett Rácz	PhD
	Integer programming	2	W	+	-	+	Anett Rácz	PhD
	Nonlinear Optimization	2	W	+	+	-	Pál Burai	PhD, habil
	Convex analysis and optimization	2	W	+	+	-	Pál Burai	PhD, habil
	Convergence of Probability Measures	2	O	+	-	-	István Fazekas	DsC, habil
	Statistical analysis with SAS	2	W	+	-	+	Patrícia Szokol	PhD
	Financial mathematics	2	O	+	-	-	József Gáll	PhD
	Insurance mathematics	2	O	+	-	-	József Gáll	PhD
	Computer statistics	2	W	+	-	+	Kinga Sikolya-Kertész	PhD
	Numerical analysis for engineers	2	W	+	-	+	Vertse Tamás	DsC, habil
	Cognitive Science	2	O	+	-	-	István Boda	PhD, habil
	Software quality	2	O	+	-	-	Mária Borbély,Eszenyiné	PhD

	Metadata of digital collections	2	O	+	+	-	Margit Némethi-Takács	PhD
	Web information retrieval	2	O	+	-	+	Erzsébet Tóth	PhD
	Basic Questions of the Copyright in the Digital Age	2	O	+	-	-	Márta Virágos	PhD
	Questions of knowledge transfer	2	O	+	-	-	Márta Virágos	PhD

Students of the doctoral program have to get 2 credits by taking compulsory courses. After this they have to collect 10 credits by taking 2 compulsorily eligible and 3 optional courses. The last 4 credits can be get by taking further courses of the doctoral school or other doctoral schools. Before taking subjects students have to consult with their supervisor about the order and time of taking them.

UNIVERSITY OF DEBRECEN
Doctoral School of Informatics

Doctoral Program	Information Technology Systems and Networks with Industrial applications
Director of Doctoral Program	Dr. Sztrik, János

Objectives of Doctoral Program

Information Technology Systems and Networks subprogram: One of the main purposes of the program is to give firm and practical knowledge of advanced techniques of modeling, analysis, performance evaluating, maintaining, designing and creating complex information technology systems and networks to students intending to conduct research in this field. The modeling tools are based on the elements of the queueing theory. After completion of the courses students will be capable of applying the most important theoretical or experimental techniques in their chosen specific field and can start the research and practical part of their training. We study connection possibilities of information technology systems and their applications in architectural planning and maintenance. We examine transmission between information technology system with special attention on sound and video, including security questions as well. We also investigate reconfigurable embedded systems and sensor networks with emphasis on data acquisition and signal processing applications. We follow global trends of research and participate in international cooperations with the aim on applying theoretical result in practice.

Industrial and scientific applications of informatics subprogram: Studying the possibilities of interconnection between the elements of design, control and measuring systems, applications in engineering design, manufacturing, and maintenance, furthermore in the organisation of supply chains. Application of asymmetric parallel computers (GPU+CPU, FPGA+CPU) for data processing in manufacturing, supply and service processes. Modelling and simulation of industrial systems and processes. Optimization of products and technologies with IT support.

Academic and Research Fields

Queueing systems and their applications for performance evaluation of complex infocommunication systems: infocommunication networks, tool supported analysis of stochastic systems, modeling and analysis of information technology systems. Next generation networks, future Internet: application-centric design of wireless sensor platforms, QoS analysis of sensor networks, experimental measurement and analysis of network traffic, future Internet. Development of FPGA–based calculations: artificial neural networks hardware implementation using programmable logic devices, networked systems for calculations and measurements. Logic design with FPGA circuits, computer hardware modelling. Programming and testing properties of microcontrollers and embedded systems. Data transmission and communication between the elements of measuring systems. Developing effective solutions for industrial communication systems and digital manufacturing. Developing tools for condition monitoring and process monitoring. Integration of condition monitoring techniques into digital production systems. Process optimisation based on the integration of engineering design software and machine learning. Structure optimisation, analysis and modelling of mechanical properties of cellular structures. Measurement and analysis of noise propagation processes. Computer aided designing of gear pairs. Description of the connecting surface of the gear pairs using a mathematical model and special purpose software. Design and simulation of special gear manufacturing tools and clamping

devices. Analysis of the gear cutting technologies with IT support. Drive-train modelling and optimisation. Optimisation and control renewable energy systems. Complex design methods for mechatronics applications.

Participant Supervisors	Dr. Sztrik János, Dr. Oniga István, Dr. Gál Zoltán, Dr. Varga Imre, Dr. Kocsis Gergely, Dr. Szilágyi Szabolcs, Dr. Bérczes Tamás, Dr. Haller Piroska, Dr. Bodzás Sándor, Dr. Budai István, Dr. Husi Géza, Dr. Kocsis Dénes, Dr. Kocsis Imre, Dr. Mankovits Tamás, Dr. Pálinkás Sándor, Dr. Szemes Péter, Dr. Szíki Gusztáv Áron, Dr. Tóth János, Dr. Ailer Piroska, Dr. Tornai Róbert
Participant Tutors	Dr. Gál Zoltán, Dr. Oniga István, Dr. Sztrik János, Dr. Varga Imre, Dr. Bérczes Tamás, Dr. Buchman Attila, Dr. Kocsis Gergely, Dr. Kuki Attila, Dr. Szilágyi Szabolcs, Dr. Sütő József, Dr. Bodzás Sándor, Dr. Budai István, Dr. Husi Géza, Dr. Kocsis Dénes, Dr. Kocsis Imre, Dr. Krauszné Dr. Princz Mária, Dr. Mankovits Tamás, Nagyné Dr. Kondor Rita, Dr. Pálinkás Sándor, Dr. Szemes Péter, Dr. Szíki Gusztáv Áron, Dr. Tóth János

UNIVERSITY OF DEBRECEN
Doctoral School of Informatics

Courses of the Information Technology Systems and Networks subprogram

Codes	Courses	Credits	Type of Exam.	Lecture	Practice	Lab	Tutor	Scient. Grad.
	Compulsory courses							
	Routing and Switching	2	K	2	0	0	Dr. Gál Zoltán	
	Reconfigurable Embedded Systems based Cyber-Physical systems	2	K	2	0	0	Dr. Oniga István	
	Queueing Theory	2	K	2	0	0	Dr. Sztrik János	
	Network science	2	K	2	0	0	Dr. Varga Imre	
	Compulsorily eligible courses							
	Stochastic Modeling of Informatics Systems	2	K	2	0	0	Dr. Sztrik János	
	Analytic methods in stochastic modeling	2	K	2	0	0	Dr. Bérczes Tamás	
	Communication in the Internet of Things	2	K	2	0	0	Dr. Buchman Attila	
	Agent-based models and simulation methods	2	K	2	0	0	Dr. Kocsis Gergely	
	Tools for Network Modeling	2	K	2	0	0	Dr. Kuki Attila	
	Performance analysis of multipath infocommunication technologies	2	K	2	0	0	Dr. Szilágyi Szabolcs	
	Communication Mechanisms of the Wireless Sensor Networks	2	K	2	0	0	Dr. Gál Zoltán	
	Classification and Regression with Machine Learning	2	K	2	0	0	Dr. Sütő József	
	Optional courses							

Criteria to complete the program:

Students of the doctoral subprogram have to get 8 credits by taking compulsory courses. After this they have to collect 4 credits by taking 2 compulsorily eligible courses. The last 4 credits can be get by taking further courses of the doctoral school or other doctoral schools. Before taking subjects students have to consult with their supervisor about the order and time of taking them.

UNIVERSITY OF DEBRECEN
Doctoral School of Informatics

Courses of the Industrial and scientific applications of informatics subprogram

Codes	Courses	Credits	Type of Exam.	Lecture	Practice	Lab	Tutor	Scient. Grad.
	Compulsory courses							
	IT applications in the development of business processes	2	V	2	0	0	Budai István	PhD
	Model Investigation of Technical Systems	2	V	2	0	0	Husi Géza / Szemes Péter	PhD/PhD
	Advanced signal processing methods in technical diagnostics	2	V	2	0	0	Kocsis Imre	PhD
	Automated technical systems	2	V	2	0	0	Korondi Péter	PhD
	Compulsorily eligible courses							
	Computer aided modelling, finite element analysis and simulation of gear pairs	2	V	2	0	0	Bodzás Sándor	PhD
	Computer aided manufacturing and analysis of manufacturing processes	2	V	2	0	0	Bodzás Sándor	PhD
	Decision Models and Applications	2	V	2	0	0	Budai István	PhD
	Computer Process Control	2	V	2	0	0	Husi Géza	PhD
	Modeling of Sound Propagation	2	V	2	0	0	Kocsis Dénes	PhD
	Modeling IT systems to support enterprise processes	2	V	2	0	0	Krauszné Princz Mária	PhD
	Engineering modelling, simulation of dynamic systems	2	V	2	0	0	Nagyné Kondor Rita / Szíki Gusztáv Áron	PhD/PhD
	Finite element modelling of metal forming processes	2	V	2	0	0	Pálinkás Sándor	PhD
	Embedded systems and wireless sensors networks	2	V	2	0	0	Buchman Attila	PhD
	Optional courses							

Criteria to complete the subprogram:
Students of the doctoral subprogram have to take the four compulsory courses of the program (8 credits) and – in accordance with the suggestions of the supervisor – further two compulsorily eligible courses (4 credits). Additional 4 credits should be obtained based on the guideline of the Doctoral School.