

UČNI NAČRT PREDMETA / COURSE SYLLABUS (leto / year 2017/18)						
Predmet:		Inteligentni sistemi				
Course title:		Intelligent systems				
Študijski program in stopnja Study programme and level		Študijska smer Study field		Letnik Academic year	Semester Semester	
Interdisciplinarni univerzitetni študijski program Računalništvo in matematika		ni smeri		3	prvi	
Interdisciplinary first cycle academic study programme Computer Science and Mathematics		none		3	first	
Vrsta predmeta / Course type				izbirni / elective		
Univerzitetna koda predmeta / University course code:				63266		
Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
45	6	24			105	6
Nosilec predmeta / Lecturer:				prof. dr. Igor Kononenko, prof. dr. Marko Robnik Šikonja		
Jeziki / Languages:		Predavanja / Lectures:		slovenski / Slovene		
		Vaje / Tutorial:		slovenski / Slovene		
Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:				Prerequisites:		
Vpis v letnik študija.				Enrolment in the programme.		
Vsebina:				Content (Syllabus outline):		

Teme predavanj:

Inteligenca in umetna inteligenca ter interakcija človek-stroj: temeljna filozofska vprašanja glede intelligence in umetne intelligence, vloga umetne intelligence.

Strojno učen je in podatkovno rudarjenje, pregled osnovnih algoritmov.

Predprocesiranje podatkov, diskretizacija, vizualizacija.

Inteligentna analiza podatkov.

Osnovni principi strojnega učenja, ocenjevanje učenja, kombiniranje algoritmov strojnega učenja .

Paralelno distribuirano procesiranje in umetne nevrnske mreže.

Evolucijsko računanje in genetski algoritmi.

Osnovni principi modeliranja: učenje kot modeliranje, kakovost modelov, evaluacija modelov.

Statistično modeliranje: bayesovsko sklepanje, linearni in regresijski modeli, multivariatni modeli, neparametrični modeli, stohastični procesi.

Sistemi za podporo odločanju: klasična teorija odločanja, teorija uporabnosti in teorija iger, večkriterijsko odločanje, negotovost in upoštevanje tveganj, skupinsko odločanje, kakovost odločitvenih modelov.

Inteligentni agenti: pregled področja, agentne arhitekture in teorija agentov, večagentni sistemi.

Procesiranje naravnega jezika: vektorska

Lecture topics:

Intelligence, artificial intelligence (AI) and human-machine interaction: basic philosophical questions about intelligence and AI, the role of AI

Machine learning and data mining, overview of basic algorithms

Data preprocessing, discretization, visualization.

Intelligent data analysis

Basic principles of machine learning (ML), evaluation of learning, combining ML algorithms

Parallel distributed processing and artificial neural networks

Evolutionary computation and genetic algorithms

Basic principles of modelling: learning as modelling, model quality, model evaluation

Statistical modelling: Bayesian reasoning, linear models, regression models, multivariate models, non-parametric models, stochastic processes

Decision support systems: classical decision theory, utility functions, game theory, multi-parameter decision models, uncertainty and risk management, group decision making, quality of decision models

Intelligent agents: overview and state-of-the-art, agent architectures , multiagent systems.

Natural language processing: vector presentation of documents, corpus based methods, information extraction, automatic summarization, text mining.

Reinforcement learning: basic approaches and

<p>predstavitev besedil, korpusne metode, pridobivanje informacij, povzemanje., tekstovno rudarjenje.</p> <p>Spodbujevano učenje: osnovni pristopi in algoritmi, Q učenje, TD učenje</p> <p>Hevristično preiskovanje: princip minimaksa, alfa-beta rezanje, Monte Carlo drevesno preiskovanje.</p>	<p>algorithms, Q learning, TD learning</p> <p>Heuristic search: minimax principle, alpha-beta pruning, Monte Carlo tree search.</p>
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Temeljni literatura in viri / Readings:

Kononenko, M. Robnik-Šikonja: Inteligentni sistemi, Založba FE in FRI, Ljubljana, 2010.

I. Kononenko, M. Kukar: Machine Learning and Data Mining, Horwood publ., 2007.

S.J. Russell, P. Norvig: Artificial Intelligence: A Modern Approach, 3rd ed. Prentice Hall, 2009.

Cilji in kompetence:

Cilj predmeta je študente seznaniti s področjem inteligentnih sistemov, ki vsebuje nabor orodij in pristopov za reševanje problemov, ki jih je težko ali nepraktično reševati z drugimi metodami. Študenti morajo biti sposobni teoretično znanje praktično uporabiti na realnih problemih iz znanstvenega in poslovnega okolja. Študenti morajo biti za dani problem sposobni presoje, katero od predstavljenih tehnik uporabiti, ter sestaviti prototip rešitve.

Splošne kompetence:

sposobnost razumevanja in reševanja profesionalnih izzivov,

sposobnost profesionalne komunikacije v domačem in tujem jeziku,

sposobnost samostojne uporabe pridobljenega znanja za reševanje tehničnih in znanstvenih

Objectives and competences:

The goal of the course is the students to become acquainted with the field of intelligent systems, which includes a collection of tools and approaches for solving problems which are difficult or unpractical to tackle with other methods. Students will be able to apply the gained theoretical knowledge on real-world problems from scientific and business environment. The students shall be able to decide which of the presented techniques should be used for a given problem, and to develop a prototype solution.

General competences:

the ability to understand and solve professional challenges in computer and information science,

the ability of professional communication in the native language as well as a foreign language,

the ability to apply acquired knowledge in

problemov v računalništvu in informatiki,
seznanjenost z raziskovalnimi metodami na
področju računalništva in informatike.

Predmetno-specifične kompetence:

uporaba osnovnih algoritmov strojnega učenja

predpriprava podatkov za podatkovno
rudarjenje

izbira pomembnih atributov

vrednotenje odločitvenih modelov

uporaba sistemov za podatkovno rudarjenje

uporaba sistemov za optimizacijo z evolucijskim
računanjem

analiza besedil s tehnikami podatkovnega
rudarjenja

uporaba orodij za spodbujevano učenje.

independent work for solving technical and
scientific problems in computer and information
science,

familiarity with research methods in the field of
computer science.

Subject-specific competences:

using basic machine learning algorithms

preprocessing data for data mining

feature subset selection

evaluation of decision models

using data mining systems

using optimizations packages with evolutionary
techniques

text analysis and text mining

using reinforcement learning tools

Predvideni študijski rezultati:

Znanje in razumevanje:

Razumevanje konceptov elektronskega
poslovanja ter integracija z znanji, dobljenimi
pri drugih predmetih s tehničnega in
organizacijskega področja.

Uporaba:

Sposobnost za razvoj, administracijo ali vodenje
sistemov e-poslovanja v organizacijah.

Refleksija:

Razumevanje teoretičnih konceptov,

Intended learning outcomes:

Knowledge and understanding:

Expertise in several techniques and methods,
used for intelligent system modelling. The ability
for analysis, synthesis and anticipation of
solutions and their consequences for target
problems using the scientific methodology.

Application:

The use of the presented methods on target
problems from scientific and business
environment. The understanding and usage of
tools for statistical modelling and data mining.

pridobljenih na predavanjih skozi praktično realizacijo na vajah.

Prenosljive spretnosti - niso vezane le na en predmet:

Sposobnost integracije pridobljenih znanj z drugimi področji (obvladovanje in načrtovanje inf. sistemov, vodenje projektov, razvoj spletnih aplikacij, mobilne platforme), sposobnost samostojne pisne in ustne predstavitve strokovne problematike ter javnega nastopanja, podjetniško razmišljanje.

Reflection:

The recognition and understanding of the meaning of basic mathematical and statistical knowledge, the relation between theory and its application in concrete examples of intelligent modelling and learning. Autonomy, (self) criticalness, (self) reflexivity, aspiration for quality.

Transferable skills:

The transfer of the learned principles to planning of large systems where the principles of intelligent solutions help to improve the usability and the system performance. The ability to receive, select and evaluate new information and a proper interpretation in a context. A self-control and ability to manage limited time when preparing, planning and implementing plans and processes. Team work, writing of reports and articles, public presentations.

Coherent mastering of basic knowledge, gained through mandatory courses, and the ability to combine the knowledge from different fields and to apply it in practice.

Metode poučevanja in učenja:

Predavanja, vaje z ustnimi nastopi in predstavitevami, seminarski način dela pri domačih nalogah. Študenti bodo v manjših skupinah samostojno reševali realen problem. Skupine bodo svoje naloge in rešitve opisale v pisnem poročilu in predstavile ostalim v obliki kratke predstavitve, ki je ocenjena skupaj s poročilom.

Learning and teaching methods:

Lectures, assignments with written and oral demonstrations and presentations, seminar works and homework. Students from small project teams and autonomously solve assignments based on real-life problems. The teams describe their solutions in written reports and prepare short oral presentations. Written reports and oral presentations are graded.

Načini ocenjevanja:

Delež (v %) /

Weight (in %) **Assessment:**

Način: pisni in ustni izpit, naloge, projekt.	50%	50% of the final grade is obtained on the basis of on-going work in the laboratory (home-works, quizzes, practical project implementations and presentations). The other 50% is obtained on the basis of a written exam (this may be complemented by oral exam)
Sprotno preverjanje: domače naloge, kolokviji in projektno delo.	50%	
Končno preverjanje: pisni in ustni izpit.		
Ocene: 6-10 pozitivno, 1-5 negativno		

Reference nosilca / Lecturer's references:

Igor Kononenko:

KONONENKO, Igor, KUKAR, Matjaž. Machine learning and data mining : introduction to principles and algorithms. Chichester: Horwood Publishing, cop. 2007. XIX, 454 str., ilustr. ISBN 1-904275-21-4. ISBN 978-1-904275-21-3. [COBISS.SI-ID 5961556]

ŠTRUMBELJ, Erik, KONONENKO, Igor. An efficient explanation of individual classifications using game theory. Journal of machine learning research, ISSN 1532-4435. [Print ed.], Jan. 2010, vol. 11, no. [1], str. 1-18, ilustr. [COBISS.SI-ID 7543636]

ROBNIK ŠIKONJA, Marko, KONONENKO, Igor. Theoretical and empirical analysis of ReliefF and RReliefF. Machine learning, ISSN 0885-6125. [Print ed.], 2003, vol. 53, str. 23-69, graf. prikazi. [COBISS.SI-ID 3813460]

KONONENKO, Igor, BRATKO, Ivan. Information-based evaluation criterion for classifier's performance. Machine learning, ISSN 0885-6125. [Print ed.], 1991, vol. 6, no. 1, str. 67-80. [COBISS.SI-ID 7717972]

KONONENKO, Igor. Machine learning for medical diagnosis : history, state of the art and perspective. Artificial intelligence in medicine, ISSN 0933-3657. [Print ed.], 2001, vol. 23, no. 1, str. 89-109. [COBISS.SI-ID 2545236]

Marko Robnik Šikonja:

ROBNIK ŠIKONJA, Marko. Data generators for learning systems based on RBF networks. IEEE transactions on neural networks and learning systems, ISSN 2162-237X. [Print ed.], May 2016, vol. 27, no. 5, str. 926-938, ilustr. , doi: . [COBISS.SI-ID 1536875203]

PIČULIN, Matej, ROBNIK ŠIKONJA, Marko. Handling numeric attributes with ant colony based classifier for medical decision making. Expert systems with applications, ISSN 0957-4174. [Print ed.], Nov. 2014, vol. 41, no. 16, str. 7524-7535, graf. prikazi. [COBISS.SI-ID 10715732]

ROBNIK ŠIKONJA, Marko, VANHOOF, Koen. Evaluation of ordinal attributes at value level. Data mining and knowledge discovery, ISSN 1384-5810, 2007, vol. 14, no. 2, str. [225]-243, ilustr.

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ROBNIK ŠIKONJA, Marko, KONONENKO, Igor. Theoretical and empirical analysis of ReliefF and RReliefF. Machine learning, ISSN 0885-6125. [Print ed.], 2003, vol. 53, str. 23-69, graf. prikazi.

[COBISS.SI-ID 3813460]

ROBNIK ŠIKONJA, Marko, KONONENKO, Igor. Explaining classifications for individual instances. IEEE transactions on knowledge and data engineering, ISSN 1041-4347. [Print ed.], May 2008, vol. 20, no. 5, str. 589-600, ilustr. [COBISS.SI-ID 6528340]