UČNI NAČRT PREDMETA / COURSE SYLLABUS (leto / year 2016/17)			
Predmet:	Umetna inteligenca		
Course title:	Artificial intelligence		

Študijski program in stopnja **Study programme and level**	**Študijska smer** **Study field**	**Letnik** **Academic year**	**Semester** **Semester**
Interdisciplinarni magistrski študijski program Računalništvo in matematika	ni smeri	1 ali 2	drugi
Interdisciplinary Master's study programme Computer Science and Mathematics	none	1 or 2	second

Vrsta predmeta / Course type	izbirni / elective

Univerzitetna koda predmeta / University course code: 63510

Predavanja **Lectures**	**Seminar** **Seminar**	**Vaje** **Tutorial**	**Klinične vaje** **work**	**Druge oblike študija**	**Samost. delo** **Individ. work**		**ECTS**
45	10	20			105		6

Nosilec predmeta / Lecturer: prof. dr. Ivan Bratko

Jeziki / **Languages:**	**Predavanja /** **Lectures:**	slovenski / Slovene, angleški / English
	Vaje / Tutorial:	slovenski / Slovene, angleški / English

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisites:**
Vpis v letnik študija.	Enrolment in the programme.
Vsebina:	**Content (Syllabus outline):**

Pregled osnovnih metod reševanja problemov in zahtevnejše metode hevrističnega preiskovanja: prostorsko učinkovite metode, reševanje problemov v realnem času. Metode planiranja po principu sredstev in ciljev: robotsko planiranje, sestavljanje urnikov in planiranje opravil, princip sredstev in ciljev, delno urejeno planiranje, planirni grafi. Strojno učenje: pregled osnovnih metod (Bayesov klasifikator, učenje dreves in pravil), ocenjevanje verjetnosti, princip minimalne dolžina opisa (MDL), ocenjevanje uspešnosti učenja, principi poenostavljanja pravil in odločitvenih dreves, koncept naučljivosti in teoretične meje učenja. Nekatere druge paradigme strojnega učenja: induktivno logično programiranje, spodbujevano učenje, konstruktivno učenje in odkrivanje novih konceptov s funkcijsko dekompozicijo. Predstavitev in obravnavanje negotovega znanja:	Problem solving and search: review of problem solving techniques, advanced heuristic search techniques, space efficient techniques, real-time search. Means-ends planning: robot planning, task planning and scheduling, means-ends planning, partial order planning, planning graphs and GRAPHPLAN. Machine learning: review of basic methods (Bayes and naive Bayes classifier, learning of trees and rules, handling noise, pruning of trees and rules), MDL principle, Support Vector Machines, evaluating success of learning and comparing learning algorithms, learnability and theoretical limits for learning. Other paradigms of machine learning: inductive logic programming, reinforcement learning, constructive learning and discovering new concepts with functional decomposition. Reasoning with uncertainty: reasoning and learning in Bayesian networks, construction of networks and causality.

sklepanje in učenje v bayesovskih mrežah, konstrukcija mrež in predstavitev vzročnosti Kvalitativno sklepanje in modeliranje: kvantitavno in kvalitativno modeliranje, modeliranje brez števil, kvalitativna simulacija. Genetski algoritmi, genetsko programiranje, in druge alternativne paradigme reševanja problemov.	Qualitative reasoning and modelling: qualitative and quantitative modelling, modelling without numbers, qualitative simulation of dynamic systems. Genetic algorithms, genetic programming and other problem-solving paradigms.

Temeljni literatura in viri / Readings:

S. Russell, P. Norvig, Artificial Intelligence: A Modern Approach, 3rd edition, Prentice-Hall 2009, ISBN-013:978-0-13-604259-4.

I. Witten, A. Frank, Data Mining, 2nd edition, Morgan Kaufmann, 2005, ISBN: 1558605525.

T. Mitchell, Machine Learning, McGraw-Hill, 1997, ISBN: 007042807.

I. Bratko, Prolog Programming for Artificial Intelligence, Fourth edition, Pearson Education, Addison-Wesley 2011, ISBN: 0201403757.

Cilji in kompetence:	**Objectives and competences:**
Poglobljeno znanje o metodah in tehnikah umetne inteligence. Sposobnost reševanja zahtevnih konkretnih praktičnih problemov z metodami umetne inteligence. Zmožnost kompetentne uporabe metod in orodij umetne pri raziskovalnem delu, vključno s seminarskimi nalogami pri drugih predmetih	In-depth knowledge of methods and techniques of Artificial Intelligence (AI). Ability of solving complex practical problems with AI methods. Competence in using methods and tools of AI in research, including projects in other courses and in

in pri diplomskem delu. Usposobljenost za raziskovalno delo na področju umetne inteligence.	the final graduation project. Ability of conducting research in Artificial Intelligence.

Predvideni študijski rezultati:

Intended learning outcomes:

Znanje in razumevanje: Poglobljeno in razširjeno poznavanje metode umetne inteligence Uporaba: Študent je zmožen kompetentno uporabiti metode umetne inteligence pri načrtovanju in izvedbi zahtevnih računalniških aplikacij na širokem področju uporabe, med drugim pa tudi pri raziskovalnem delu na drugih področjih. Refleksija: Študent je zmožen znanstveno kritične presoje v zvezi z možnostmi in dosegom umetne inteligence, pa tudi v zvezi z relevantnimi filozofskimi vprašanji ter kognitivno znanostjo v luči tehničnih rezultatov umetne inteligence. Prenosljive spretnosti - niso vezane le na en predmet: Zmožnost uporabiti obravnavane metode v	Knowledge and understanding: Extrended and deepened knowledge of Artificial Intelligence. Application: The student is capable of competent application of AI methods in the planning and implementation of broad area of computer applications, including research in computer science and other sciences like medicine, biology, ecology etc. Reflection: The student wil be capable of critical scientific judgement regarding the possibilities and limitations of artificial intelligence. This includes deep questions in philosophy and cognitive science in the light of technical achievements of AI. Transferable skills: The skills of using the discussed methods in

sklopu načrtovanja zahtevnih računalniških aplikacij in inteligentnih sistemov.		design of advanced computer applications and intelligent systems.

Metode poučevanja in učenja:

Predavanja, seminarske naloge in avditorne ter laboratorijske vaje.

Learning and teaching methods:

Lectures, laboratory work and projects.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	Assessment:
Način (pisni izpit, ustno izpraševanje, naloge, projekt):		Type (examination, oral, coursework, project):
Sprotno preverjanje (domače naloge, kolokviji in projektno delo)		Continuing (homework, midterm exams, project work)
Končno preverjanje (pisni in ustni izpit)		Final (written and oral exam)
Ocene: 6-10 pozitivno, 1-5 negativno (v skladu s Statutom UL)	50% 50%	Grading: 6-10 pass, 1-5 fail (according to the rules of University of Ljubljana)

Reference nosilca / Lecturer's references:

BRATKO, Ivan. Prolog programming for artificial intelligence, (International computer science series). 3rd ed. Harlow (England) [etc.]: Addison-Wesley, 2001. XXI, 678 str., graf. prikazi. ISBN 0-201-40375-7. [COBISS.SI-ID 110104320]

MOŽINA, Martin, ŽABKAR, Jure, BRATKO, Ivan. Argument based machine learning. Artificial intelligence, ISSN 0004-3702. [Print ed.], 2007, vol. 171, no. 10/15, str. 922-937. [COBISS.SI-ID 6240084]

LUŠTREK, Mitja, GAMS, Matjaž, BRATKO, Ivan. Is real-valued minimax pathological?. Artificial intelligence, ISSN 0004-3702. [Print ed.], 2006, vol. 170, str. 620-642. [COBISS.SI-ID 19805735]

ŠUC, Dorian, VLADUŠIČ, Daniel, BRATKO, Ivan. Qualitatively faithful quantitative prediction. Artificial intelligence, ISSN 0004-3702. [Print ed.], 2004, vol. 158, no. 2, str. [189]-214, ilustr. [COBISS.SI-ID 4422740]

BRATKO, Ivan, MUGGLETON, Stephen. Applications od inductive logic programming.