

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet: Omrežni inteligentni sistemi in agenti
Course title: Network Intelligent Systems and Agents

Študijski program in stopnja Study programme and level	Modul Module	Letnik Academic year	Semester Semester
Informacijske in komunikacijske tehnologije, 2. stopnja	Inteligentni sistemi in robotika	1	1
Information and Communication Technologies, 2 nd cycle	Intelligent Systems and Robotics	1	1

Vrsta predmeta / Course type Izbirni / Elective

Univerzitetna koda predmeta / University course code: IKT2-882

Predavanja Lectures	Seminar Seminar	Sem. vaje Tutorial	Lab. vaje Laboratory work	Druge oblike študija	Samost. delo Individ. work	ECTS
60	30			60	450	20

**Navedena porazdelitev ur velja, če je vpisanih vsaj 15 študentov. Drugače se obseg izvedbe kontaktnih ur sorazmerno zmanjša in prenese v samostojno delo. / This distribution of hours is valid if at least 15 students are enrolled. Otherwise the contact hours are linearly reduced and transferred to individual work.*

Nosilec predmeta / Lecturer: Prof. dr. Matjaž Gams

Jeziki / Predavanja / Lectures: slovenščina, angleščina / Slovenian, English
Languages: Vaje / Tutorial:

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:

Zaključen študijski program prve stopnje s področja naravoslovja, tehnike ali računalništva.

Prerequisites:

Student must complete first-cycle study programmes in natural sciences, technical disciplines or computer science.

Vsebina:

Znanstvena metoda:
 strukture znanstvenega védenja, znanstvene aktivnosti in procesi
 Uvod:
 Definicije inteligentnih sistemov, umetne inteligence, agentov.
 Informacijska družba:
 Kratak pregled razvoja informacijske družbe, osnovnih zakonov informacijske družbe, značilnosti, trendi, umetna inteligenca, inteligentne storitve, novo poslovanje.
 Inteligentni sistemi:
 Lastnosti, področja, trendi, prednosti in slabosti, primeri; samostojni sistemi: ekspertni

Content (Syllabus outline):

Scientific Method:
 scientific knowledge structures, scientific activities/processes
 Introduction:
 Definitions of intelligent systems, artificial intelligence, agents.
 Information society:
 Overview, current state of the art, future directions, natural intelligent systems, intelligent services, computer intelligent systems, artificial intelligence, cognitive science.
 Intelligent systems:
 Properties, areas, advantages and disadvantages, trends, examples; single systems - expert

sistemi, nevronske mreže, evolucijski algoritmi, mehka logika in verjetnostni pristopi, strojno učenje, rudarjenje podatkov, sistemi na osnovi znanja; hibridni (mnogoteri) sistemi.

Umetna inteligenca:

Pregledno po knjigi Russel, Norvig:

- 1 uvod
- 2 inteligentni agenti
- 3 reševanje problemov s preiskovanjem
- 4 nadgradnja klasičnega iskanja
- 5 preiskovanja potez nasprotnikov
- 6 zadovoljevanje omejitev
- 7 logični agenti
- 8 logika prvega reda
- 9 sklepanje v logiki prvega reda
- 10 klasično planiranje
- 11 planiranje in delovanje v realnem svetu
- 12 predstavitev znanja
- 13 kvantificiranje verjetnosti
- 14 verjetnostno sklepanje
- 15 časovno verjetnostno sklepanje
- 16 preprosto odločanje
- 17 zapleteno odločanje
- 18 učenje s primeri
- 19 znanje in učenje
- 20 učenje verjetnostnih modelov
- 21 vzpodbujevalno učenje
- 22 procesiranje naravnega jezika
- 23 komunikacija v naravnem jeziku
- 24 zaznavanje
- 25 robotika
- 26 filozofske osnove
- 27 AI: sedanjost in bodočnost.

Inteligentni agenti:

Lastnosti, področja, prednosti in slabosti, trendi, primeri, taksonomija agentov, agentni jeziki in platforme, MAS, semantični Web in ontologije.

Globoke nevronske mreže: pregled.

Komunikacija človek-stroj:

Multimediji in komunikacija človek-stroj
Komuniciranje preko gibov, govora, izrazov, hipermediji, inteligentni vmesniki, govorna forenzika, uporabniški profili, inteligentni asistenti, avatarji.

Kognitivne znanosti:

Pregled področja, kognitivna informatika, osnovne teze kognitivne informatike (Turingov test, Church-Turingova teza) in paradoksi

systems, neural networks, evolutionary algorithms, fuzzy logic, machine learning, data mining, knowledge-based systems; hybrid (multiple) systems.

Artificial intelligence:

AI basic schoolbook (Russel and Norvig):

- 1 introduction
- 2 intelligent agents
- 3 solving problems by searching
- 4 beyond classical search
- 5 adversarial search
- 6 constraint satisfaction problems
- 7 logical agents
- 8 first-order logic
- 9 inference in first-order logic
- 10 classical planning
- 11 planning and acting in the real world
- 12 knowledge representation
- 13 quantifying uncertainty
- 14 probabilistic reasoning
- 15 probabilistic reasoning over time
- 16 making simple decisions
- 17 making complex decisions
- 18 learning from examples
- 19 knowledge in learning
- 20 learning probabilistic models
- 21 reinforcement learning
- 22 natural language processing
- 23 natural language for communication
- 24 perception
- 25 robotics
- 26 philosophical foundations
- 27 AI: the present and future.

Intelligent agents:

Properties, areas, overview, advantages and disadvantages, trends, examples, agent languages and platforms, MAS, semantic Web and ontologies.

Deep neural networks: a quick overview.

Communication human-computer:

Graphical user interfaces, speech synthesis and recognition, speech understanding, facial recognition, hypermedia, intelligent interfaces, forensic speech and audio analysis, user profiles.

Cognitive sciences:

Overview, cognitive informatics, basic theses of cognitive informatics (Turing test, Church-Turing thesis) and paradoxes (Searle room, Goedel

(Searlova soba, Goedlov stavek), pregled računskih strojev od univerzalnih Turingovih dalje, superinteligenca.

Izzivi pri razvoju inteligentnih programskih sistemov:

Predstavitev celotnega procesa razvoja programskih projektov s poudarkom na reševanju problemov, na katere naletimo le pri večjih projektih.

Orodja in rešitve:

Pregled najboljših orodij in rešitev na trgu.

statement), overview of computing mechanisms from the Universal Turing machine on, superintelligence.

Challenges at designing intelligent systems:

The whole SW process of designing systems using artificial intelligence, intelligent systems and agents with the emphasis on specific approaches and dilemmas.

Tools and solutions:

Overview of tools and solutions.

Temeljna literatura in viri / Readings:

Izbrana poglavja iz naslednjih knjig: / Selected chapters from the following books:

- S. Russel, and P. Norvig. *Artificial Intelligence: A Modern Approach*, 3rd Edition. Pearson Education Limited, 2016. ISBN-13: 978-1292153964
- A.A. Hopgood. *Intelligent Systems for Engineers and Scientists*, 3rd Edition. Taylor and Francis, 2011. ISBN 978-0300097603
- R. Sharda, D. Delen, and E. Turban. *Business Intelligence and Analytics: Systems for Decision Support*, 10th Edition. Prentice Hall, 2014. ISBN 978-0133050905
- D.L. Poole, and A.K. Mackworth. *Artificial Intelligence: Foundations of Computational Agents*. Cambridge University Press, 2010. ISBN 978-0521519007
- G. Weiss. *Multiagent Systems (Intelligent Robotics and Autonomous Agents series)*. MIT, 2013. ISBN 978-0262018890
- I. Goodfellow, and Y. Bengio. *Deep Learning*, MIT, 2016. ISBN-13: 978-0262035613

Cilji in kompetence:

Cilj predmeta je podati splošno znanje o umetni inteligenci, inteligentnih sistemih in inteligentnih agentih v povezavi s sorodnimi področji in informacijsko družbo. Uvodoma so predstavljeni osnovni koncepti omenjenih področij, cilji, motivacija, smisel, nameni in problemi pri uveljavljanju omenjenih metod.

Študenti, ki bodo uspešno končali ta predmet, bodo obvladali osnove inteligentnih sistemov in agentov in bodo usposobljeni za njihovo uporabo v reševanju zahtevnih problemov in vrednotenje njihovih rezultatov.

Objectives and competences:

The goal of the course is to provide general and advanced knowledge of artificial intelligence, intelligent systems and intelligent agents in relation to the related fields and information society. In the introduction, basic concepts, goals, motivations and objectives are presented.

The students who will successfully complete this course will master the basics of intelligent systems and agents and will be capable of applying these systems in solving demanding problems and evaluating their results.

Predvideni študijski rezultati:

Študenti bodo z uspešno opravljenimi obveznostmi tega predmeta pridobili:

- osnove znanstvenega pristopa in konceptov v umetni inteligenci, agentih in inteligentnih sistemih
- osnovna znanja umetne inteligence, agentov in inteligentnih sistemov

Intended learning outcomes:

Students successfully completing this course will acquire:

- Basic scientific approach and concepts in artificial intelligence, agents and intelligent systems
- Basic knowledge about AI and intelligent systems and agents

- pregled obstoječih nalog in metod
- obvladovanje tehničnih in praktičnih vidikov metod umetne inteligence in inteligentnih sistemov in agentov
- sposobnost uporabe obstoječih metod strojnega učenja in rudarjenja podatkov na novih problemih
- sposobnost ugotavljanja uspešnosti metod umetne inteligence, inteligentnih sistemov in agentov pri uporabi na konkretni nalogi

- Overview of existing tasks and methods
- Getting acquainted with technical and practical aspects of AI, intelligent systems and agents
- The ability to apply existing ML and DM methods to problems
- The ability to identify whether ML or DM methods are successful given domain

Metode poučevanja in učenja:

Predavanja, seminar, konzultacije, individualno delo

Learning and teaching methods:

Lectures, seminar, consultancy, individual work

Načini ocenjevanja:	Delež (v %) / Weight (in %)	Assessment:
Seminarska naloga	50 %	Seminar work
Ustni zagovor	50 %	Oral defense

Reference nosilca / Lecturer's references:

- H. Gjoreski, S. Kozina, **M. Gams**, M. Luštrek, J.A. Álvarez-García, J.H. Hong, J. Ramos, A.K. Dey, M. Bocca, and N. Patwari. "Competitive live evaluations of activity-recognition systems." *IEEE pervasive computing*, vol. 14, no. 1, pp. 70-77, 2015.
- M. Gjoreski, H. Gjoreski, M. Luštrek, and **M. Gams**. "How accurately can your wrist device recognize daily activities and detect falls?." *Sensors*, ISSN 1424-8220, vol. 16, no. 6, pp. 800-1-800-21, 2017.
- B. Kaluža, B. Cvetković, E. Dovgan, H. Gjoreski, V. Mirchevska, **M. Gams**, and M. Luštrek. "A Multiagent care system to support independent living." *International journal on artificial intelligence tools*, vol. 23, no. 1, pp. 1440001-30, 2014.
- A. Tavčar, D. Kužnar, and **M. Gams**. "Hybrid multi-agent strategy discovering algorithm for human behavior." *Expert systems with applications*, ISSN 0957-4174, vol. 71, pp. 370-382, 2017.
- V. Vidulin, M. Bohanec, and **M. Gams**. "Combining human analysis and machine data mining to obtain credible data relations." *Information sciences*, vol. 288, pp. 254-278, 2014.