UČNI NAČRT PREDMETA / COURSE SYLLABUS (leto / year 2017/18)			
Predmet:	Razvoj inteligentnih sistemov		
Course title:	Development of 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	drugi
Interdisciplinary first cycle academic study programme Computer Science and Mathematics	none	3	second

Vrsta predmeta / Course type	izbirni / elective
Univerzitetna koda predmeta / University course code:	63268

Predavanja **Lectures**	**Seminar** **Seminar**	**Vaje** **Tutorial**	**Klinične vaje** **work**	**Druge oblike študija**	**Samost. delo** **Individ. work**	**ECTS**
45		**30**			**105**	**6**

Nosilec predmeta / Lecturer:	prof. dr. Danijel Skočaj

Jeziki / Languages:	**Predavanja / Lectures:**	angleški / English
	Vaje / Tutorial:	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):**

Predmet bo v teoriji in na praktičnih primerih predstavil sledeče vsebine: Tehnologije in orodja za razvoj inteligentnih sistemov: uvod Značilne aplikacije inteligentnih tehnologij Tehnološke platforme in razvojne metodologije Orodja sistemov umetnega zaznavanja, strojnega učenja in sklepanja, s poudarkom na tehnikah njihove integracije Pristopi k integraciji tehnik umetnega zaznavanja, strojnega učenja in načrtovanja akcij v agentni sistem, ki deluje v realnem času Specifične lastnosti senzorsko-robotskih sistemov Osnove mobilne robotike Študijski primeri razvoja kompleksnih inteligentnih sistemov Na predavanjih bodo študenti spoznavali ključne tehnologije in orodja, s katerimi bodo tekom semestra na vajah in v okviru projektov oz. seminarskih nalog reševali praktične probleme. Pri tem bodo kombinirali znanja, ki so jih pridobili pri predmetih Inteligentni sistemi in Umetno zaznavanje istega modula. Poudarek bo na razvoju praktičnih, delujočih rešitev v simulacijskih okoljih in predvsem na razvoju praktičnih rešitev, ki bodo v realnem času delovale na primernih robotskih platformah. Pri tem bodo študenti spoznali odprtokodna in prostodostopna okolja in orodja za razvoj inteligentnih sistemov.	During the course the following topics will be presented: Technologies and tools for the development of intelligent systems: an introduction Typical applications of intelligent technologies Technological platforms and development methodologies Tools for machine perception, machine learning and reasoning, with the emphasis on the techniques for integration of these tools Approaches to the integration of machine perception, learning, and planning into an artificial real-time agent system Specific properties of robotic systems Basics of mobile robotics Case studies of the development of complex intelligent systems The lectures will familiarize the students with key technologies and tools. The students will use these on practical problems within the scope of laboratory classes and projects. They will combine the knowledge and skills obtained in Artificial Intelligence and Machine Perception classes from the same course module. The emphasis of this course will be on the development of practical and functional implementations in both in simulation environments and especially in real-time systems operating on robot platforms. The implementations will be developed in open-source frameworks and tools for development of intelligent systems.

Temeljni literatura in viri / Readings:

Dokumentacija prostodostopnega Robotskega operacijskega sistema ROSDocumentation of the open source Robot Operating System ROSwww.ros.org.

Dokumentacija prostodostopne knjižnice za delo s slikovnimi in 3D podatki PCLDocumentation of the open source Point Cloud Library PCLhttp://pointclouds.org.

S. Thrun, W. Burgard, D. Fox, Probabilistic Robotics (Intelligent Robotics and Autonomous Agents series), The MIT Press, 2005.

Dokumentacija sistema za strojno učenje Orange, prosto dostopna na spletnih straneh/Documentation of the system for machine learning Orange, freely available on the web pages www.ailab.si/orange/doc.

Cilji in kompetence:

Cilj predmeta je študente naučiti povezati ter v praksi uporabiti znanja s področij umetne inteligence in umetnega zaznavanja v namene samostojnega razvoja inteligentnega sistema. Pri predmetu se bodo naučili pravilno zasnovati inteligentni sistem, izbrati ustrezne metode in orodja, implementirati nove komponente ter te z že obstoječimi integrirati v delujoč robotski sistem.

Študentje bodo razvijali sposobnosti kritičnega in analitičnega razmišljanja. Osvojili bodo tudi veščine iskanja po ustreznih podatkovnih virih, najdeno informacijo pa bodo znali tudi kritično ovrednotiti. Osvojili bodo tudi sposobnost apliciranja osvojenega znanja za reševanje tehničnih problemov in sposobnost samostojnega opravljanja inženirskih nalog na področju inteligentne robotike, kjer bodo sposobni samostojnega reševanja specifičnih dobro opredeljenih nalog. Ker bo večino dela potekala v skupinah, bodo študentje osvojili tudi veščine skupinskega dela.

Objectives and competences:

The course aims at teaching the students to develop an intelligent system by integrating techniques from artificial intelligence and machine perception. Students will learn how to design an intelligent system, how to select which tools and methods to use, and how to implement new components and integrate them into a functional robot system.

The students will develop skills in critical and analytical thinking. They will also acquire the ability to search knowledge sources and to search for resources and critically evaluate information. They will acquire the ability to apply the acquired knowledge in independent work for solving technical problems and to independently perform engineering tasks in the field of intelligent robotics. They will be able to solve specific well-defined tasks from this area. Since most of the work will be performed in teams, the students will also acquire the ability of team work.

Predvideni študijski rezultati:

Intended learning outcomes:

Znanje in razumevanje: Pristopi k razvoju IS, strukturne tehnike, objektne tehnike, sodobne, sociološko naravnane tehnike razvoja, ključni problemi in dejavniki uspeha pri razvoju IS. Uporaba: Izbira in uporaba različnih tehnik pri skupinskem razvoju informacijskih rešitev, obvladovanje razvoja. Refleksija: Poglobljeno razumevanje problematike skupinskega razvoja in zmožnost razvoja novih, posameznim skupinam prilagojenih pristopov. Prenosljive spretnosti - niso vezane le na en predmet: Spretnosti uporabe domače in tuje literature in drugih virov, uporaba IKT, uporaba sistematičnih pristopov, analiza potreb, identifikacija in reševanje problemov, delo v timih.	Knowledge and understanding: Knowledge on methods and tools from machine perception and artificial intelligence and their integration within real-world functional systems. Application: The application of techniques from machine perception and artificial intelligence, design and implementation of integrated intelligent systems for solving practical problems. Reflection: Understanding the suitability of theoretical methods for solving practical problems, as well as understanding their requirements and limitations. The ability of analyzing and solving problems by developing intelligent systems. Transferable skills: Combining the knowledge and skills the students learned during the courses on Artificial Intelligence and Machine perception, multidisciplinary approach, skills for searching and using the literature, application of suitable (primarily open source) software and hardware, identification and solving of complex problems.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja s podporo avdio-vizualne opreme, laboratorijske vaje v računalniški učilnici z ustrezno strojno in programsko opremo, vključno s primernimi senzorsko-robotskimi platformami. Delo posamezno in v skupinah. Velik poudarek na praktičnem razvojnem delu in reševanju problemov ter implementaciji na robotskih sistemih.	Lectures with the appropriate audio-visual equipment in a classroom with suitable hardware and software, including appropriate robot platforms. Individual and group work. Emphasis on hands-on approaches and problem solving including implementation of the developed solutions on robotic systems.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**

Način (pisni izpit, ustno izpraševanje, naloge, projekt): Sprotno preverjanje (domače naloge in projektno delo) Končno preverjanje (izpitna naloga in ustni izpit) Ocene: 6-10 pozitivno, 1-5 negativno (v skladu s Statutom UL)	 50% 50%	Type (examination, oral, coursework, project): Continuing (homework, midterm exams, project work) Final (written and oral exam) Grading: 6-10 pass, 1-5 fail.

Reference nosilca / Lecturer's references:

WYATT, Jeremy L., AYDEMIR, Alper, BRENNER, Michael, HANHEIDE, Marc, HAWES, Nick, JENSFELT, Patric, KRISTAN, Matej, KRUIJFF, Geert-Jan M., LISON, Pierre, PRONOBIS, Andrzej, SJÖÖ, Kristoffer, VREČKO, Alen, ZENDER, Hendrik, ZILLICH, Michael, SKOČAJ, Danijel. Self-understanding and self-extension : a systems and representational approach. IEEE transactions on autonomous mental development, ISSN 1943-0604. [Print ed.], Dec. 2010, vol. 2, no. 4, str. 282-303, ilustr. [COBISS.SI-ID 8305492]

SKOČAJ, Danijel, LEONARDIS, Aleš, BISCHOF, Horst. Weighted and robust learning of subspace representations. Pattern recognition, ISSN 0031-3203. [Print ed.], May 2007, vol. 40, no. 5, str. [1556]-1569, ilustr. [COBISS.SI-ID 5898836]