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| **UČNI NAČRT PREDMETA / COURSE SYLLABUS** | | | | | | | | | | | | | | | | | | | | |
| **Predmet:** | | | | Seminar iz biometričnih sistemov | | | | | | | | | | | | | | | | |
| **Course title:** | | | | Seminar on Biometric Systems | | | | | | | | | | | | | | | | |
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| **Študijski program in stopnja**  **Study programme and level** | | | | | | | **Študijska smer**  **Study field** | | | | | | | | | **Letnik**  **Academic year** | | **Semester**  **Semester** | | |
| Podiplomski magistrski študijski program druge stopnje Elektrotehnika | | | | | | | Avtomatika in informatika | | | | | | | | | 2 | | 1 | | |
| 2nd cycle masters study programme in Electrical Engineering | | | | | | | Control systems and computer engineering | | | | | | | | | 2 | | 1 | | |
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| **Vrsta predmeta / Course type** | | | | | | | | | | | | | | | Izbirni-strokovni / Elective professional | | | | | |
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| **Univerzitetna koda predmeta / University course code:** | | | | | | | | | | | | | | | 64278 | | | | | |
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| **Predavanja**  **Lectures** | | **Seminar**  **Seminar** | | | **Vaje**  **Tutorial** | | | | **Klinične vaje**  **work** | | | | | **Druge oblike študija** | | | **Samost. delo**  **Individ. Work** | |  | **ECTS** |
| 15 | |  | | | 60 | | | | 0 | | | | | 0 | | | 75 | |  | 6 |
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| **Nosilec predmeta / Lecturer:** | | | | | | Simon Dobrišek | | | | | | | | | | | | | | |
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| **Jeziki /**  **Languages:** | | | **Predavanja / Lectures:** | | | | | slovenski in po potrebi angleščki / Slovenian and English, if necessary | | | | | | | | | | | | |
| **Vaje / Tutorial:** | | | | | slovenski in po potrebi angleščki / Slovenian and English, if necessary | | | | | | | | | | | | |
| **Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:** | | | | | | | | | |  | | **Prerequisits:** | | | | | | | | |
| Vpis v letnik predmeta | | | | | | | | | |  | | Enrolment in the year of the course | | | | | | | | |
| **Vsebina:** | | | | | | | | | |  | | **Content (Syllabus outline):** | | | | | | | | |
| * Uvod v biometrične sisteme: biometrične značilnosti (biološke, vedenjske), gradniki in faze delovanja sistema (registracija, verifikacija, identifikacija). * Zajemanje bioloških (obraz, prstni odtis, šarenica, roka) in vedenjskih (glas, mimika, rokopis, hoja) značilnosti: merjenje z dotikom in brez dotika, najbolj pogosto uporabljani senzorji. Preverjanje kakovosti in pristnosti zajetih podatkov. * Gradnja eno-modalnih in več-modalnih biometričnih sistemov: viri biometrične informacije, nivoji in metode združevanja biometrične informacije. Primerjava eno- in več-modalnih sistemov. * Vrednotenje biometričnih sistemov: povprečni časi registracije in razpoznavanja, sistemske napake (napake prileganja in odločanja), napaka pri registraciji, napaka pri zajemu. * Preizkušanje biometričnih sistemov: načrt preizkusa, preizkusna populacija ljudi, preizkus registracije, verifikacije in identifikacije, preizkus, ki vključuje ponaredke. Baze biometričnih podatkov za avtomatizirane in ponovljive preizkuse. * Standardizacija in varovanje biometričnih podatkov. Etična in kulturološka vprašanja, povezana z uporabo biometričnih sistemov. * Seminarji: razvoj eno- in več-modalnih biometričnih sistemov, uporaba biometričnih sistemov v varnostnih (identifikacijski in potovalni dokumenti, elektronsko poslovanje, elektronski varnostni sistemi) in drugih (pametne sobe in okolja, uporabniku prilagojeno iskanje vsebin) aplikacijah. | | | | | | | | | |  | | * Introduction to Biometric Systems: identifiable biometric characteristics (physiological, behavioural), system components and phases of system operation (enrolment, verification, identification). * Acquisition of Physiological (face, fingerprint, iris, hand palms and geometry) and Behavioural (voice, mimic, handwriting, and gait) Characteristics: contact and noncontact measurement, frequently used sensors. Testing the quality and genuineness of acquired data. * Design of Uni-modal and Multi-modal Biometric Systems: sources of biometric information, levels and methods of biometric information fusion. Comparison of uni- and multi-modal systems. * Evaluation of Biometric Systems: average enrolment and recognition time, biometric system errors (matching and decision errors), enrolment error, data acquisition error. * Testing of Biometric Systems: test plan, person group, testing enrolment, verification and identification processes. Forgery tests. Databases for automated and repeatable tests. * Biometric Standards and Privacy Issues. Ethical and Cultural Issues associated with biometric system applications. * Seminars: development of uni- and multi-modal biometric systems: biometric systems in security (identification and travel documents, e-commerce, e-security systems) and others (smart rooms and environments, user-adapted content search) applications. | | | | | | | | |

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| **Temeljni literatura in viri / Readings:** | | | | | |
| 1. N. Pavešić: Razpoznavanje vzorcev (3. izdaja), Založba FE in FRI, 2012. 2. K. Jain, A. A. Ross, K. Nandakumar, Introduction to Biometrics, Springer, 2011. 3. R. M. Bolle et al.: Guide to Biometrics, Springer, 2004. | | | | | |
| **Cilji in kompetence:** | |  | | **Objectives and competences:** | |
| * Seznaniti študenta z osnovnimi načeli in gradniki biometričnih sistemov. * Predstaviti in obdelati primere biometričnih sistemov za samodejno razpoznavanje ljudi. * Razširiti znanje s področja samodejnega razpoznavanja vzorcev. | |  | | * To acquaint students with the principles and basic components of biometric systems. * To present and elaborate examples of biometric systems for the automated recognition of people. * To expand knowledge from the field of pattern recognition. | |
| **Predvideni študijski rezultati:** | | |  | **Intended learning outcomes:** | |
| Znanje in razumevanje:  Po zaključku predmeta bo študent zmožen izkazati znanje in razumevanje:   * osnovnih načel in gradnje biometričnih sistemov za samodejno razpoznavanje ljudi, * problemov zagotavljanja kakovosti biometričnih sistemov in varovanja biometričnih podatkov, * etičnih in kulturoloških vprašanj, povezanih z uporabo biometričnih sistemov.   Uporaba znanja:  Uporaba pridobljenih znanj pri razvoju in gradnji biometričnih sistemov za samodejno razpoznavanje ljudi (identifikacijski in potovalni dokumenti, elektronsko poslovanje, elektronski varnostni sistemi, pametne sobe in okolja, uporabniku prilagojeno iskanje multimedijskih vsebin, razpoznavanje piscev zgodovinskih dokumentov, pomoč pri kriminalističnih preiskavah).  Prenosljive spretnosti:   * uporaba domače in tuje literature ter drugih virov s področja biometričnih sistemov; * uporaba razvojnih orodij, računalniških podatkovni zbirk in okolij za programiranje: študenti izvedejo projekte v enem od programskih jezikov C/C++, python, C#, Java ali z uporabo orodja MatLab, uporabijo eno od biometričnih podatkovnih zbirk (NIST SRE, XM2VTS, FRGC, Banca, LFW, PolyU ipd) in uporabijo orodja, kot je OpenCV, ORANGE in WEKA; * komuniciranja: ustni zagovor seminarskih nalog, pisno izražanje pri pisanju seminarskih nalog; * reševanja problemov: skupinska analiza problema, načrtovanje algoritmov, izvedba in testiranje programov; in * dela v skupini: organizacija in vodenje skupine, aktivno sodelovanje v skupini. | | |  | Knowledge and understanding:  After completing this course, the student will be able to demonstrate a knowledge and understanding of the:   * principles of the construction of biometric systems for the automated recognition of people, * problems of quality assurance in biometric systems and the protection of biometric data, * ethical and cultural issues associated with the use of biometric systems.   The use of knowledge:  The student will be able to use the acquired knowledge to develop and construct biometric systems for the automated recognition of people (identification and travel documents, e-commerce, e-security systems, smart rooms and environments, user-adapted multi-media content search, identification of the writers of historical documents, criminal investigations support).  Transferable skills:   * the use of literature and other resources in the field of biometric systems; * the use of open source development tools, data sets and programming environments: the students carry out the projects in one of the programming languages ​​C/C++, Python, C#, Java, or using MATLAB, use one of the biometric databases (NIST SRE, XM2VTS, FRGC, Banca, LFW, PolyU, etc.), and use tools like OpenCV, ORANGE and WEKA; * communication skills: oral presentation of seminar projects, preparing seminar project reports; * problem solving: problem analysis, algorithm design, implementation and testing of a program; * group work: the organization and management of groups, active participation in groups. | |
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| **Metode poučevanja in učenja:** | | |  | **Learning and teaching methods:** | |
| * predavanja, * seminarji, * seminarski projekti. | | |  | * lectures, * seminars, * seminar projects. | |
| **Načini ocenjevanja:** | Delež (v %) /  Weight (in %) | | | | **Assessment:** |
| Način: seminarsko delo, seminarski projekt, ustni izpit.  Ocene od 1 do vključno 5 so negativne, ocene od vključno 6 do 10 so pozitivne.  Pozitivna ocena seminarskega projekta je pogoj za pristop k izpitu.  Prispevki k oceni:   * udeležba na seminarjih, * seminarski projekt, * ustni izpit. | 10%  70%  20% | | | | Type: seminar work, seminar project, oral exam.  Negative grades: from 1 to 5, positive grades: from 6 to 10.  Positive evaluation of the seminar project is a prerequisite for the exam.  Contributions to the final grade:   * participation in seminars, * seminar project, * oral examination. |
| **Reference nosilca / Lecturer's references:** | | | | | |
| 1. DOBRIŠEK, Simon, ŠTRUC, Vitomir, KRIŽAJ, Janez, MIHELIČ, France. Face recognition in the wild with the probabilistic Gabor-Fisher classifier. V: 11th IEEE International Conference on Automatic Face and Gesture Recognition (FG 2015), Ljubljana, Slovenia, May 4-8, 2015. FG 2015. Danvers: IEEE, cop. 2015, b-Wild, str. 1-6. 2. DOBRIŠEK, Simon. Pametni nadzorni sistemi : je to grožnja umetne inteligence. V: 1. dnevi prava zasebnosti in svobode izražanja, [Kranjska Gora, 9. in 10. april 2015]. Zbornik 2015. 1. natis. Ljubljana: IUS Software, GV založba, 2015, str. 134-138. 3. DOBRIŠEK, Simon, GAJŠEK, Rok, MIHELIČ, France, PAVEŠIĆ, Nikola, ŠTRUC, Vitomir. Towards efficient multi-modal emotion recognition. International journal of advanced robotic systems, ISSN 1729-8814, 2013, vol. 10, no. 53, str. 1-10. 4. GAJŠEK, Rok, MIHELIČ, France, DOBRIŠEK, Simon. Speaker state recognition using an HMM-based feature extraction method. Computer speech & language, ISSN 0885-2308, Jan. 2013, vol. 27, no. 1, str. 135-150. 5. KRIŽAJ, Janez, ŠTRUC, Vitomir, DOBRIŠEK, Simon. Towards robust 3D face verification using Gaussian mixture models. International journal of advanced robotic systems, ISSN 1729-8814, 2012, vol. 9, no. 162, str. 1-11. | | | | | |