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| **UČNI NAČRT PREDMETA / COURSE SYLLABUS** | | | | | | | | | | | | | | | | | |
| **Predmet:** | | | Strojni vid | | | | | | | | | | | | | | |
| **Course title:** | | | Machine Vision | | | | | | | | | | | | | | |
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| **Študijski program in stopnja**  **Study programme and level** | | | | | **Študijska smer**  **Study field** | | | | | | | | **Letnik**  **Academic year** | | **Semester**  **Semester** | | |
| doktorski študijski program tretje stopnje Elektrotehnika | | | | | Ni smeri | | | | | | | | 1 | |  | | |
| 3rd cycle: doctoral study programme Electrical Engineering | | | | |  | | | | | | | |  | |  | | |
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| **Vrsta predmeta / Course type** | | | | | | | | | | | | Izbirni /elective | | | | | |
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| **Univerzitetna koda predmeta / University course code:** | | | | | | | | | | | | 64835 | | | | | |
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| **Predavanja**  **Lectures** | **Seminar**  **Seminar** | | | **Vaje**  **Tutorial** | | | **Klinične vaje**  **work** | | | | **Druge oblike študija** | | | **Samost. delo**  **Individ. work** | |  | **ECTS** |
| 25 | 12 | | | 0 | | | 0 | | | | 0 | | | 88 | |  | 5 |
|  | | | | | | | | | | | | | | | | | |
| **Nosilec predmeta / Lecturer:** | | | | | doc. dr. Janez Perš | | | | | | | | | | | | |
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| **Jeziki /**  **Languages:** | | **Predavanja / Lectures:** | | | | Slovenščina, English | | | | | | | | | | | |
| **Vaje / Tutorial:** | | | | **-** | | | | | | | | | | | |
| **Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:** | | | | | | | | |  | **Prerequisits:** | | | | | | | |
| Vpis na doktorski študij | | | | | | | | |  | Enrolment into the doctoral study programme | | | | | | | |
| **Vsebina:** | | | | | | | |  | | **Content (Syllabus outline):** | | | | | | | |
| Modeliranje vizualnih sistemov: fizikalne, matematične, biološke in računske osnove. Izbrana matematična orodja in algoritmi za analizo vizualnih informacij: izbrana poglavja iz linearne algebre, naključnih sistemov, teorije informacij.  Izbrani algoritmi za detekcijo in sledenje objektov, dogodkov, analizo gibanja, aktivnosti in obnašanja na osnovi vizualnih informacij. Večsenzorski vizualni sistemi. Biološko motivirane arhitekture za vidno zaznavanje. Omrežja vizualnih senzorjev in vgradni vizualni sistemi. Strojni vid v industriji, vizualno pregledovanje in merjenje.  Strojni vid v naprednih videonadzornih sistemih, v biometričnih sistemih in robotih. Uporaba strojnega vida v športu, analiza individualnih in skupinskih aktivnosti. Strojni vid v naprednih uporabniških vmesnikih. | | | | | | | |  | | Modelling of visual systems: physical, mathematical, biological and computational basics. Selected mathematical tools and algorithms for analysis of visual information: selected topics from linear algebra, stochastic systems and information theory.  Selected algorithms for detection and tracking of objects, events, for motion analysis and activity, based on visual information. Multi-sensor visual systems. Biologically motivated architectures for visual sensing. Visual sensor networks and embedded visual systems. Machine vision in industry, visual inspection and measurement.  Machine vision in advanced visual surveillance systems, biometric systems and robots. Use of machine vision in sport, analysis of individual and team activities. Machine vision in advanced user interfaces. | | | | | | | |

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| **Temeljni literatura in viri / Readings:** | | | | | |
| 1. David A. Forsyth, Jean Ponce. Computer Vision: A Modern Approach (2nd Edition), Prentice Hall, 2011  2. Milan Sonka, Vaclav Hlavac, Roger Boyle. Image Processing, Analysis, and Machine Vision (4th Edition), Cengage Learning, 2014  3. Richard Szeliski. Computer Vision: Algorithms and Applications, Springer, 2011, (http://szeliski.org/Book) | | | | | |
| **Cilji in kompetence:** | |  | | **Objectives and competences:** | |
| Spoznati inženirske, matematične, fizikalne, algoritmične ter biološke temelje vidnega zaznavanja. Priprava na znanstveno raziskovalno in razvojno delo na področju umetnih vizualnih zaznavnih sistemov. | |  | | Getting familiar with engineering, mathematical, physical, algorithmical and biological foundations of visual perception. Preparation for scientific research and development in the field of artificial visual perception systems. | |
| **Predvideni študijski rezultati:** | | |  | **Intended learning outcomes:** | |
| Po opravljenih študijskih obveznostih bodo študenti sposobni samostojno in kritično oceniti stanje znanosti na področju umetnih vizualnih zaznavnih sistemov. Posedovali bodo veščine, potrebne za izvajanje raziskav na nivoju doktorskega študija na tem področju, vključno z razvojem in analizo novih metod in algoritmov. Razumeli bodo pomembnost objektivne kvantitativne presoje razvitih metod in posedovali veščine, ki bodo omogočale izvedbo takšne presoje. | | |  | After completing the course, students will be able to independently and critically evaluate state of the art in the field of of artificial visual perception systems. They will have the skills to perform doctoral grade research in this field by developing and analyzing novel algorithms and methods. They will understand the importance of objective, quantitative evaluation of developed methods and have the skills to perform such an evaluation. | |
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| **Metode poučevanja in učenja:** | | |  | **Learning and teaching methods:** | |
| Predmet se bo izvajal v obliki predavanj in projektnih nalog.  Sklop predavanj bo vseboval predavanja nosilca in soizvajalca predmeta.  Projektne naloge bodo razdeljene v zaključene sklope, v katerih bodo študenti samostojno obravnavali izbrane metode in algoritme. Vsak sklop projektne naloge bo zahteval poročilo in predstavitev pred ostalimi študenti.  Pomemben del študija so diskusije v razredu. Vsak kandidat prav tako predstavi del teorije, ki se navezuje na projektno nalogo. | | |  | The course will be comprised of lectures and project assignments.  Lectures will be given by the lecturer and the co-lecturer.  Project assigment will be divided into self-contained parts, providing the framework for individual study of selected methods and algorithms. Each of the assignment parts will require written report and presentation/defense in front of other students.  Important part of the study are discussions in the class. Each candidate also presents a theoretical topic related to the project assignment. | |
| **Načini ocenjevanja:** | Delež (v %) /  Weight (in %) | | | | **Assessment:** |
| Projektna naloga (samostojno delo)  Sodelovanje na predavanjih, diskusija  Ustni izpit | 70%  20% 10% | | | | Assignment (individual work)  Participation in lectures and discussion  Oral exam |
| **Reference nosilca / Lecturer's references:** | | | | | |
| **Izbrani znanstveni članki/Scientific publications:**  1. Mandeljc R, Kovačič S, Kristan M, Perš J (2013) Tracking by identification using computer vision and radio. Sensors, 13(1):241-273  2. Sulić V, Perš J, Kristan M, Kovačič S (2011) Efficient feature distribution for object matching in visual-sensor networks.IEEE Trans*.* Circuits Syst Video Technol 21(7): 903-916  3. Kristan M, Kovačič S, Leonardis A, Perš J (2010) A two-stage dynamic model for visual tracking. IEEE TransSyst Man Cybern B 40(6):1505-1520    4. Kristan M, Perš J, Perše M, Kovačič S (2009) Closed-world tracking of multiple interacting targets for indoor-sports applications. Comput Vis Image Und 113(5):598-611  5.Perše M, Kristan M, Kovačič S, Vučković G, Perš J (2009) A trajectory-based analysis of coordinated team activity in a basketball game. Comput Vis Image Und 113(5):612-621 | | | | | |