UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	Podatkovno rudarjenje
Course title:	Data mining

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Kibernetska varnost, magistrski študijski program druge stopnje	-	Prvi	Drugi
The second cycle masters study programme Cyber Security	-	First	Second

Vrsta predmeta / Course type	Izbirni/Elective

Univerzitetna koda predmeta / University course code:	5-KV-MAG-IP-PR-2021-12-14

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
30	-	30	-	-	90	5

Nosilec predmeta / Lecturer: izr. prof. dr. Biljana Mileva Boshkoska

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

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisits:
Ni posebnih pogojev za vključitev v delo. Študent/študentka mora pred pristopom k izpitu pripraviti in zagovarjati projekt.	There are no special prerequisites for the inclusion in work. Prior to the exam, the student has to prepare and present project.

Vsebina:	Content (Syllabus outline):
• Podatkovno rudarjenje in druge metode za analizo podatkov; • Standardi na področju podatkovnega rudarjenja; • Standardiziran proces podatkovnega rudarjenja: CRISP-DM; • Vrste problemov in nalog primernih za reševanje s podatkovnim rudarjenjem;	• Data mining and data analysis methods; • Standards in the field of data mining; • A standardized process - cross-industry process for data mining: CRISP-DM; • The types of problems and tasks addressed by the data mining; • Overview of the most important methods for data mining: decision

• Pregled najpomembnejših metod za podatkovno rudarjenje: odločitvena in regresijska drevesa, metoda podpornih vektorjev, Bayesovske mreže, nevronske mreže; • Pregled nekaterih najpomembnejših orodij za podatkovno rudarjenje; • Primeri podatkovnega rudarjenja; • Projekt: celovita rešitev praktičnega problema za podatkovno rudarjenje s pomočjo izbranega orodja na realnem problemu.	and regression trees, support vector machines, Bayesian networks, neural networks. • An overview of some of the important tools for data mining; • Examples of data mining • Project: a comprehensive solution on practical problems in data mining by application of the selected tool on a real problem

Temeljni literatura in viri / Readings:

- Hands-on machine Learning with Scikit-Learn, Keras & TensorFlow. Consepts, Aurelien Geron. (2019): Tools, and Techniques to Build Intelligent Systems. O'REILLY
- Zupan, Blaž in Demšar, Damjan (2018): Introduction to data mining. Working notes for the hands-on course with Orange Data mining. University of Ljubljana. Dostopno prek: https://file.biolab.si/notes/2018-05-intro-to-datamining-notes.pdf
- Tan Pang-Ning, Steinbach Michael, Karpatne Anuj, Kumar Vipin. (2018): Introduction to Data Mining (2nd Edition)
- Galit Shmueli, Galit, Bruce, Peter C., Patel, Nitin R. (2016): Data mininfg for business analytics. Wiley.
- Charu C. Aggarwal. (2015): Data Mining. The textbook. Springer.
- Tan, Pang-Ning, Steinbach, Michael, Kumar, Vipin, Karpante, Anuj (2018). *Introduction to data mining*, Pearson Addison Wesley. (2nd Edition) (izbrana poglavja).
- Aggarwal, Charu C. (2015): Data Mining, The Textbook. Springer.
- Han, Jiawei, Kamber, Micheline, Pei, Jian (2012): *Data Mining: Concepts and Techniques, third edition ed*. Morgan Kaufmann.
- Mileva Boshkoska, Biljana. Prosojnice iz predavanj in vaj pri predmetu Podatkovno rudarjenje, Moodle, FIŠ.

Cilji in kompetence:	**Objectives and competences:**
Cilj predmeta je študentom predstaviti osnovne ideje in principe na katerih temeljijo metode za podatkovno rudarjenje, ter jih seznaniti s paradigmami uporabe nekaterih najpomembnejših orodij.	*The aim of the course is to present students the basic ideas and principles which underlie methods for data mining and to acquaint them with the paradigms of some important tools.*
Učna enota prispeva k razvoju naslednjih splošnih in predmetno specifičnih kompetenc:	*The instructional unit contributes to the development of the following general and subject-specific competences:*
Splošne kompetence:	*General competences:*

• Poznavanje pomena kakovosti in prizadevanje za kakovost strokovnega dela skozi avtonomnost, samoiniciativnost, (samo)kritičnost, (samo)refleksivnost in (samo)evalviranje. *Predmetno-specifične kompetence:* • sposobnost sinteze izvirnih idej, konceptov in rešitev določenih problemov iz različnih disciplinarnih področij; • poznavanje programskih orodij in metodologij za analizo podatkov ter simulacije diskretnih oziroma zveznih modelov;	• Knowledge of the importance of quality and striving for the quality of professional work through autonomy, self-initiative, as well as (self-)criticism, (self-)reflection and (self-)evaluation. *Subject-specific competences:* • competence to form original ideas, concepts and solutions for specific problems from different disciplines; • knowledge of programming tools and methodologies for data analysis and simulation of discrete and continuous models;

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: *Sposobnost študenta/študentke bo:* • poznavanje pojmov, nalog in standardov podatkovnega rudarjenja • razumevanje osnovnih principov, na katerih temeljijo postopki za podatkovno rudarjenje • pravilna in samostojna uporaba nekaj aktualnih programskih orodij za podatkovno rudarjenje	Knowledge and understanding: Students will: • understand the concepts, tasks and standards of data mining • understand the basic principles underlying the procedures for data mining • independently use of some current software tools for data mining

Metode poučevanja in učenja:	**Learning and teaching methods:**
• *predavanja* z aktivno udeležbo študentov (razlaga, diskusija, vprašanja, primeri, reševanje primerov) • *laboratorijske vaje* pri teh vajah bodo študentje spoznali aktualna programska orodja za podatkovno rudarjenje in jih uporabili za reševanje konkretnih problemov; vaje bodo potekale v manjših skupinah v računalniški učilnici, tako da bo imel vsak študent na razpolago svoj računalnik	• lectures with active participation of students (explanation, discussion, questions, examples, case studies) • laboratory work on these exercises, students will learn about the current software tools for data mining and use them to solve concrete problems; Exercises will be held in small groups in the computer lab so that each student will have own computer • project that students will prepare in small groups; a concrete problem in

	the field of data mining by using selected data mining framework
• *projekt*, ki ga študentje pripravijo v manjših skupinah; vključeval bo konkreten problem s področja podatkovnega rudarjenja, katerega bodo morali študenti z izbiro pravilnega orodja samostojno obdelati	

Načini ocenjevanja:	Delež (v %) / Weight (in %)	Assessment:
Način (pisni izpit, ustno izpraševanje, naloge, projekt): • pisni izpit • projekt	 50 % 50 %	Type (examination, oral, coursework, project): • written exam • project

Reference nosilca / Lecturer's references:

•HAJNIĆ, Miljenko, MILEVA BOSHKOSKA, Biljana. A disruptive decision support platform for reengineering the strategic transfer of employees. *IEEE access*, ISSN 2169-3536, [in press] 2021, 9 str., doi: 10.1109/ACCESS.2021.3059895.

•BOŠKOSKI, Pavle, PERNE, Matija, RAMEŠA, Martina, MILEVA BOSHKOSKA, Biljana. Variational Bayes survival analysis for unemployment modelling. *Knowledge-based systems*, ISSN 0950-7051. [Print ed.], 11 Oct. 2021, vol. 229, [article no.] 107335, str. 1-11, doi: 10.1016/j.knosys.2021.107335.

• MILEVA BOSHKOSKA, Biljana, MILJKOVIĆ, Dragana, VALMARSKA, Anita, GATSIOS, Dimitros, RIGAS, George, KONITSIOTIS, Spyros, TSIOURIS, Kostas M., FOTIADIS, Dimitrios I., BOHANEC, Marko. Decision support for medication change of Parkinson's disease patients. *Computer methods and programs in biomedicine*, ISSN 0169-2607. [Print ed.], [in press] 2020, 35 str., doi: 10.1016/j.cmpb.2020.105552.

• HAJNIĆ, Miljenko, MILEVA BOSHKOSKA, Biljana. A decision support model for the operational management of employee redeployment in large governmental organisations. *Journal of decision systems*, ISSN 1246-0125, [in press] 2020, doi: 10.1080/12460125.2020.1768681.

• BOŠKOSKI, Pavle, DEBENJAK, Andrej, MILEVA-BOSHKOSKA, Biljana. Rayleigh copula for describing impedance data - with application to condition monitoring of proton exchange membrane fuel cells. European journal of operational research, ISSN 0377-2217. 2018, vol. 266, no. 1, str. 269-277.

• ZHAO, Guoqing, LIU, Shaofeng, LOPEZ, Carmen, LU, Haiyan, ELGUETA, Sebastian, CHEN, Huilan, MILEVA BOSHKOSKA, Biljana. Blockchain technology in agri-food value chain management : a synthesis of applications, challenges and future research directions. *Computers in industry*, ISSN 0166-3615. [Print ed.], 2019, vol. 109, str. 83-99

•MILEVA BOSHKOSKA, Biljana, LIU, Shaofeng, ZHAO, Guoqing, FERNANDEZ, Alejandro, GAMBOA, Susana, PINO, Mariana del, ZARATÉ, Pascale, HERNANDÉZ, Jorge, CHEN, Huilan. A decision support system for evaluation of the knowledge sharing crossing boundaries in agri-food value chains. *Computers in industry*, ISSN 0166-3615. [Print ed.], 2019, vol. 110, str. 64-80, doi: 10.1016/j.compind.2019.04.012.