UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	Uporaba strojnega učenja v družboslovju
Course title:	Machine learning in social sciences

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Informacijska družba, doktorski študijski program tretje stopnje	-	Prvi	Prvi
Information Society, third cycle Doctoral Study Programme	-	First	First

Vrsta predmeta / Course type	Izbirni/ Optional
Univerzitetna koda predmeta / University course code:	1-ID-DR-IP-USUD-2024-02-05

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
20	/	20	/	/	410	15

Nosilec predmeta / Lecturer:	doc. dr. Bernard Ženko

Jeziki / Languages:	**Predavanja / Lectures:**	Slovenski / Slovenian, Angleški / English
	Vaje / Tutorial:	Slovenski / Slovenian, Angleški / English

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Vpis v prvi letnik študija.	Enrolment in the first year of studies.

Vsebina:	**Content (Syllabus outline):**
V okviru predmeta bo delo usmerjeno k spoznavanjeu osnovnih metod strojnega učenja ter njihove uporabe v družboslovju. Poleg predstavitve teoretskega metodološkega okvira se bo izvajalo tudi samostojno raziskovalno delo študentov z uporabo različnih metod podatkovnega rudarjenja (v okviru vaj in seminarske naloge). Predvideni so naslednji tematski sklopi: • postopek analize podatkov; • priprava in transformacija podatkov; • gradnja in izbira značilk;	The course is focused on learning of basic methods of machine learning and their application to problems in social sciences. In addition to the presentation of theoretical principles, individual student research work with practical application of different data mining techniques will be reqiured (laboratory and individual seminar work). The course contains the following themes: • data analysis procedure; • data preparation and transformation; • feature construction and selection;

• osnovne metode nenadzorovanega strojnega učenja (razvrščanje v podskupine, asociacijska pravila) • osnovne metode nadzorovanega strojnega učenja (odločitvena drevesa in pravila, k-najbližjih sosedov, naivni Bayes, ansambelske metode); • vrednotenje modelov.	• basic unsupervised machine learning methods (clustering, association rules) • basic supervised machine learning methods (decision rules and trees, k-nearest neigbors, naive Bayes, ensemble methods); • model evaluation.

Temeljni literatura in viri / Readings:

- H. Witten, F. Eibe, M. A. Hall. Data mining: Practical machine learning tools and techniques, Morgan Kaufman, Fourth edition, 2016
- M. Bramer. Principles of data mining. Springer, London, 2016.
- Hastie T., Tibshirani R., Friedman J.: The elements of statistical learning: Data Mining, Inference, and Prediction, Second edition, 2009, Springer.
- Kononenko I.: Strojno učenje, Založba FE in FRI, Ljubljana, 2005.

Cilji in kompetence:	**Objectives and competences:**
Učna enota prispeva k razvoju naslednjih splošnih in predmetno-specifičnih kompetenc: • sposobnost identificiranja danega raziskovalnega problema, njegove analize ter možnih rešitev • ustvarjanje novega znanja, ki pomeni relevanten prispevek k razvoju znanosti • sposobnost obvladanja standardnih metod, postopkov in procesov raziskovalnega dela na različnih znanstvenih področjih • sposobnost za reševanje konkretnih raziskovalnih problemov na posameznih področjih družbenih in ostalih ved • razvoj veščin in spretnosti v uporabi znanja na raziskovalnem področju doktorske disertacije • sposobnost pridobivanja, selekcije, ocenjevanja in umeščanja novih znanj in zmožnost interpretacije v kontekstu družboslovja in ostalih ved • sposobnost oblikovanja in implementacije izvirnih znanstvenih rešitev danih družbenih problemov	*Learning unit contributes to the development of the following general and subject-specific competences:* • the ability to identify, analyze and construct solution for a given research problem • the creation of new knowledge and contribution to the development of science • mastery of standard methods, approaches and processes of scientific research in various scientific fields • skills and abilities for solving concrete research problems in various fields of social and other sciences • development of skills and abilities in usage of knowledge in doctoral research • the ability to extract, select, evaluate and insert new knowledges and the competence of interpretation in the context of social and other sciences • ability of designing and implementing novel scientific solutions for given social problems

Predvideni študijski rezultati:	**Intended learning outcomes:**

Znanje in razumevanje: *Študent/študentka:* • demonstrira poznavanje ključnih pojmov strojnega učenja, • demonstrira praktično obvladovanje osnovnih metod strojnega učenja, • demonstrira sposobnost samostojnega raziskovalnega dela z uporabo metod strojnega učenja, • demonstirra sposobnost prezentacije svojih raziskovalnih rezultatov na znanstvenih srečanjih in v znanstvenih publikacijah.	Knowledge and understanding: *The student:* • demonstrates knowledge of basic machine learning concepts, • demonstrates the ability of practical application of basic machine learning methods, • demonstrates the ability of individual and independent research work with help of machine learning tools, • demonstrates the ability of presenting the acquired research results in scientific meetings and publications.

Metode poučevanja in učenja:	**Learning and teaching methods:**
• *Predavanja* z aktivno udeležbo študentov; razlaga, diskusija, vprašanja, primeri, reševanje problemov. • *Vaje* s praktičnim izvajanjem predstavljenih metod na konkretnih podatkih. • *Individualno delo* študentov; samostojni študij znanstvene in strokovne literature, izdelava seminarske naloge in njena ustna predstavitev.	• *Lectures* with active participation of students; explanation, discussion, questions, examples, problem solving. • *Lab work* with practical applications of the presented methods on specific data. • *Individual work* of students; independent study of scientific and professional literature, writing of the seminar work and its presentation.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Način (pisni izpit, ustno izpraševanje, naloge, projekt): • Projektna naloga	100	Type (examination, oral, coursework, project): • Project assignment

Reference nosilca / Lecturer's references:

- GRAU LEGUIA, Marc, LEVNAJIĆ, Zoran, TODOROVSKI, Ljupčo, ŽENKO, Bernard. Reconstructing dynamical networks via feature ranking. Chaos, ISSN 1054-1500, 2019, vol. 29, no. 9, str. 09310-1-093107-15, doi: 10.1063/1.5092170.
- PETKOVIĆ, Matej, BOUMGHAR, Redouane, BRESKVAR, Martin, DŽEROSKI, Sašo, KOCEV, Dragi, BOUMGHAR, Redouane, LEVATIĆ, Jurica, LUCAS, Luke, OSOJNIK, Aljaž, ŽENKO, Bernard, SIMIDJIEVSKI, Nikola. Machine learning for predicting thermal power consumption of the Mars Express spacecraft. IEEE aerospace and electronic systems magazine, ISSN 0885-8985, 2019, vol. 34, no. 7, str. 46-60, doi: 10.1109/MAES.2019.2915456.
- STROJNIK, Lidija, STOPAR, Matej, ZLATIĆ, Emil, KOKALJ, Doris, NAGLIČ GRIL, Mateja, ŽENKO, Bernard, ŽNIDARŠIČ, Martin, BOHANEC, Marko, MILEVA BOSHKOSKA, Biljana, LUŠTREK, Mitja, GRADIŠEK, Anton, POTOČNIK, Doris, OGRINC, Nives. Authentication of key aroma compounds in apple using stable isotope approach. Food chemistry, 2019, vol. 277, str. 766-773, doi: 10.1016/j.foodchem.2018.10.140.

- SIMIDJIEVSKI, Nikola, TANEVSKI, Jovan, ŽENKO, Bernard, LEVNAJIĆ, Zoran, TODOROVSKI, Ljupčo, DŽEROSKI, Sašo. Decoupling approximation robustly reconstructs directed dynamical networks. New journal of physics, 2018, 29 str., doi: 10.1088/1367-2630/aae94.
- TUŠAR, Tea, GANTAR, Klemen, KOBLAR, Valentin, ŽENKO, Bernard, FILIPIČ, Bogdan. A study of overfitting in optimization of a manufacturing quality control procedure. Applied soft computing, 2017, vol. 59, str. 77-87, doi: 10.1016/j.asoc.2017.05.027.
- GAMBERGER, Dragan, ŽENKO, Bernard, MITELPUNKT, Alexis, SHACHAR, Netta, LAVRAČ, Nada. Clusters of male and female Alzheimer's disease patients in the Alzheimer's Disease Neuroimaging Initiative (ADNI) database. Brain informatics, 2016, vol. 3, no. 3, str. 169-179, doi: 10.1007/s40708-016-0035-5.
- NOVAK BABIČ, Monika, ZALAR, Polona, ŽENKO, Bernard, DŽEROSKI, Sašo, GUNDE-CIMERMAN, Nina. Yeasts and yeast-like fungi in tap water and groundwater, and their transmission to household appliances. Fungal ecology, 2016, vol. 20, str. 30-39, doi: 10.1016/j.funeco.2015.10.00.
- DEBELJAK, Marko, POLJANEC, Aleš, ŽENKO, Bernard. Modelling forest growing stock from inventory data : a data mining approach. Ecological indicators, 2014, vol. 41, str. 30-39.
- AHO, Timo, ŽENKO, Bernard, DŽEROSKI, Sašo, ELOMAA, Tapio. Multi-target regression with rule ensembles. Journal of machine learning research, 2012, vol. 13, str. 2367-2407.
- DŽEROSKI, Sašo, ŽENKO, Bernard. Is combining classifiers with stacking better than selecting the best one?. Machine learning, 2004, vol. 54, str. 255-273.