UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	Odkrivanje znanja iz okoljskih podatkov
Course title:	Knowledge Discovery from Environmental Data

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Ekotehnologije, 3. stopnja	/	1	1
Ecotechnologies, 3rd cycle	/	1	1

Vrsta predmeta / Course type izbirni/elective

Univerzitetna koda predmeta / University course code: EKO3-760

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
15	15			15	105	5

**Navedena porazdelitev ur velja, če je vpisanih vsaj 15 študentov. Drugače se obseg izvedbe kontaktnih ur sorazmerno zmanjša in prenese v samostojno delo. / This distribution of hours is valid if at least 15 students are enrolled. Otherwise the contact hours are linearly reduced and transfered to individual work.*

Nosilec predmeta / Lecturer: Prof. dr. Sašo Džeroski

Jeziki / Languages:	**Predavanja / Lectures:**	slovenščina, angleščina Slovenian, English
	Vaje / Tutorial:	

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisites:**
Znanje, ki je ekvivalentno izobrazbi druge stopnje ali univerzitetni izobrazbi s področja naravoslovja ali tehnologije.	Knowledge, which is equivalent to a second level or university degree from natural sciences or technology.

Vsebina:

Uvod v odkrivanje znanja in metode strojnega učenja:

- odločitvena in regresijska drevesa, učenje pravil
- verjetnostna klasifikacija, metoda najbližjih sosedov, odkrivanje enačb

Primeri uporabe strojnega učenja za analizo podatkov o okolju:

- biološka klasifikacija voda v Sloveniji in Angliji, napovedovanje biorazgradljivosti
- modeliranje populacijske dinamike in habitata medvedov, jelenov, ...

Praktično delo z izbranimi metodami strojnega učenja na okoljskih podatkih.

Content (Syllabus outline):

Introduction to knowledge discovery and machine learning methods:

- decision and regression trees, learning the rules
- probability classification, nearest neighbour method, equation discovery

Examples of machine learning application in environmental data analysis:

- biological classification of Slovenian waters, biodegradability prediction
- modelling of population dynamics and the habitats of bear, deer, etc.

Practical work on environmental data using selected machine learning methods.

Temeljni literatura in viri / Readings:

- Recknagel, G., and Michener, W., Eds. Ecological Informatics, 3d edition. Springer, 2018. ISBN 978-3-319-59926-7.
- Zuur, A., and Ieno, E.N. Analyzing Ecological Data. Springer, 2011. ISBN 978-1-441-92357-8.
- Haupt, S.E., Pasini, A., and Marzban, C., Eds. Artificial Intelligence Methods in the Environmental Sciences. Springer, 2009. ISBN 978-1-4020-9119-3.
- Džeroski S., and Todorovski L., editors. Computational Discovery of Scientific Knowledge: Introduction, Techniques, and Applications in Environmental and Life Sciences. Springer, 2007. ISBN 978-3-540-73919-7.

Cilji in kompetence:

Vpeljati študente v raziskovalno delo na področju odkrivanja znanja iz okoljskih podatkov. Podiplomci si bodo pridobili temeljna znanja o analizi podatkov z metodami strojnega učenja. Seznanili se bodo s primeri uporabe teh metod za analizo okoljskih podatkov. V okviru praktičnega dela se bodo usposobili za samostojno uporabo nekaterih metod za strojno učenje za odkrivanje znanja iz okoljskih podatkov.

Splošne kompetence:

- obvladanje izbranih raziskovalnih metod, postopkov in procesov
- razvoj kritične in samokritične presoje
- sposobnost uporabe znanja v praksi
- kooperativnost, delo v skupini
- industrijska relevantnost

Predmetno-specifične kompetence:
Predmet pripravlja študente za delo na predmetnem področju.

Objectives and competences:

To introduce students to research work in knowledge discovery from environmental data. Postgraduate students will acquire basic knowledge and skills about data analysis using machine learning methods. They will become acquainted with examples of the use of these methods for environmental data analysis. In the scope of practical work, they will be trained to independently use some machine learning methods for knowledge discovery from environmental data.

General Competences:

- The student will master selected research methods, procedures and processes
- The student will develop critical thinking and self-assessment
- The student will develop communication skills to present research results in an international environment
- The student will be able to cooperate in a team

Course Specific Competences:
This course prepares students to work in this field of research.

Predvideni študijski rezultati:

Študenti bodo z uspešno opravljenimi obveznostmi tega predmeta pridobili:

- Razumevanje predmetnega področja.
- Pridobiti sposobnost uporabe obstoječih metod odkrivanja znanja iz novih okoljskih podatkov.
- Pridobiti sposobnost ugotavljanja primernosti različnih metod odkrivanja znanja za različne okoljske podatke.

Intended learning outcomes:

Students successfully completing this course will acquire:

- The student will understand this field of research.
- Obtaining the ability to apply existing knowledge methods to new data.
- Obtaining the ability to identify the best methods for knowledge discovery in different kinds of environmental data.

Metode poučevanja in učenja:

- predavanja
- seminarji
- laboratorijsko delo

Learning and teaching methods:

- lectures
- seminar work
- laboratory work

Načini ocenjevanja:	Delež (v %) / Weight (in %)	Assessment:
• ustni izpit	50 %	• oral exam
• seminarska naloga	25 %	• seminar work
• ustni zagovor	25 %	• oral defense

Reference nosilca / Lecturer's references:

Aleksovski, D., Kocijan, J., and **Džeroski, S**. (2015). Model-tree ensembles for noise-tolerant system identification. Adv. Eng. Informatics, 29(1): 1-15. DOI: 10.1016/j.aei.2014.07.008

Simidjievski, N., Todorovski, L., and **Džeroski, S.** (2015). Learning ensembles of population dynamics models and their application to modelling aquatic ecosystems. Ecological Modelling, 306: 305-317. DOI: 10.1016/j.ecolmodel.2014.08.019

Simidjievski, N., Todorovski, L., and **Džeroski, S.** (2015). Predicting long-term population dynamics with bagging and boosting of process-based models. Expert Systems with Applications, 42(22): 8484-8496. DOI: 10.1016/j.eswa.2015.07.004

Škerjanec, M., Atanasova, N., Čerepnalkoski, D., **Džeroski, S.**, and Kompare, B. (2014). Development of a knowledge library for automated watershed modeling. Environmental Modelling and Software, 54: 60-72. DOI: 10.1016/j.envsoft.2013.12.017

Taškova, K., Šilc, J., Atanasova, N., and **Džeroski, S.** (2012). Parameter estimation in a nonlinear dynamic model of an aquatic ecosystem with meta-heuristic optimization. Ecological Modelling, 226(1): 36-61. DOI: 10.1016/j.ecolmodel.2011.11.029