UČNI NAČRT KREDITNO OVREDNOTENE OBŠTUDIJSKE DEJAVNOSTI / EXTRACURRICULAR COURSE SYLLABUS	
Predmet:	**Umetna inteligenca v financah I**
Course title:	**Artificial intelligence in finance I**

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Matematika, 2. stopnja		1. ali 2.	1. ali 3.
Mathematics, 2nd cycle		1. or 2.	1. or 3.

Vrsta predmeta / Course type   izbirni / elective

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Sem. vaje Tutorial	Lab. vaje Laboratory work	Teren. vaje Field work	Samost. delo Individ. work	ECTS
45			30		135	7

Nosilec predmeta / Lecturer: **Red. prof. ddr. Timotej Jagrič, CQRM**

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:

Osnovno poznavanje statističnih metod in programiranja, zaželeno je poznavanje programskega okolja MATLAB. V obštudijsko dejavnost se lahko vključijo študentje s področja študijske smeri Finance (EPF), študentje tehniških fakultet (FERI, FGPA, FKKT, FS, FL,…) ter študentje iz področja naravoslovja in matematike (FNM).	Fundamental knowledge of statistical methods and programming, knowledge of programming toolbox MATLAB desired. In the extracurricular activity can engage students from study field Finance (FEB), students from technical faculties (FERI, FGPA, FKKT, FS, FL,…) and students from natural sciences and mathematics (FNM).

Vsebina:

Content (Syllabus outline):

Vsebina predmeta sestoji iz štirih delov: • Pregled metod umetne inteligence s poudarkom na umetnih nevronskih mrežah, zgodovinski pregled razvoj umetnih nevronskih mrež, primerjava	The syllabus consists of four parts: • The outline and motivation of artificial intelligence arise with the emphasis on Artificial Neural Networks, historical design of Artificial Neural Networks,

postopkov nadzorovanega in nenadzorovanega učenja. • Pregled in spoznavanje temeljev umetnih nevronskih mrež: model nevrona (perceptrona), aktivacijske funkcije nevronov, model umetne usmerjene nevronske mreže, arhitekture umetnih nevronskih mrež, učni algoritmi in dokaz konvergence, nastavitve učnih parametrov, samo-organizirajoče se (kompetitivne) nevronske mreže–Hamming, SOM, LVQ. • Pregled in spoznavanje postopkov priprave podatkov in postopkov analize rezultatov za področje financ. • Praktično-aplikativna in neposredna uporaba pridobljenih znanj o umetnih nevronskih mrežah za izdelavo projektne naloge s področja financ.	comparison of supervised and unsupervised learning. • The outline of Artificial Neural Network neccesities: neuron (perceptron) model activation functions, model of feed-forward neural network, architectures of neural networks, learning algorithms and proofs of convergence, learning parameters tuning, self-organizing (competitive) neural networks–Hamming, SOM, LVQ. • The outline and recognition of methods for pre-processing data and post-processing results for financial applications. • Practical, applicative, and direct use of knowledge obtained about Artificial Neural Networks for synthesis of project excercise on the Finance field.

Temeljni literatura in viri / Readings:

- Martin T. Hagan, Howard B. Demuth, Mark H. Beale, Orlando De Jesus. Neural Network Design (2nd Edition). 2014.

(Knjiga je prosto dostopna na / Book freely accessible at: http://hagan.okstate.edu/nnd.html)

- Anderson, Patrick L. *Business economics and finance with MATLAB, GIS, and simulation models*. CRC Press, 2004.

Cilji in kompetence: / **Objectives and competences:**

Cilji: • Ustrezno predstaviti motivacijo za uporabo umetnih nevronskih mrež v praksi na področju financ. • Ustrezno predstaviti potek implementacije umetnih nevronskih mrež v programskem okolju MATLAB. • Pripraviti študente za izdelavo projektne naloge na področju finance z neposredno aplikacijo pridobljenih znanj o umetnih nevronskih mrežah.	Objectives: • Suitably present the motivation for exploiting the Artificial Neural Networks in practice for financial applications. • Suitably present the flow of implementation of Artificial Neural Networks in programming toolbox MATLAB. • Prepare students for independent work of project exercise on the Finance field, using a direct

Kompetence:
- Študentje bodo dosegli osnovno poznavanje različnih tipov in arhitektur umetnih nevronskih mrež in razpoznali primernost posameznega tipa umetnih nevronskih mrež za dan problem na področju financ.
- Študentje bodo sposobni razumeti osnovne principe delovanja umetnih nevronskih mrež in pripadajočih učnih algoritmov za področje financ.

application of obtained knowledge about Artificial Neural Networks.
Competences:
- Students will obtain fundamental knowledge of different types and architectures of Artificial Neural Networks and recognize the suitability of each type of Artificial Neural Network for given problem on the Finance field.
- Students will obtain understanding of fundamental principles of Artificial Neural Networks and viable learning algorithms for financial applications.

Predvideni študijski rezultati:

- Študentje bodo sposobni samostojno s predpripravljenimi orodji implementirati umetno nevronsko mrežo za reševanje problemov na področju financ, pripraviti finančne podatke za učenje umetne nevronske mreže, pognati učenje ter tolmačiti pridobljene rezultate. Študentje bodo sposobni razpoznati težave, ki lahko nastanejo pri postopku učenja nevronskih mrež ter uporabiti postopke za zmanjšanje teh težav, ali njihovo odpravo.

Intended learning outcomes:

- Students will, with the help of prepared tools, independently implement Artificial Neural Network on the Finance field, prepare the financial dataset for learning, execute learning, and interpret obtained results. Students will be capable of recognizing problems that may arise during the learning procedure and exploit the remediation tehniques in order to eliminate or reduce the effect of these problems.

Metode poučevanja in učenja:

- Predavanja – študentje aktivno sodelujejo pri izvedbi predavanj, vmesne miselne naloge, interaktivni prikazi obravnavane snovi, pogovarjanje o izvajanju projektne naloge.
- Računalniške vaje – utrjevanje snovi, diskusija, vprašanja-odgovori, izvajanje praktičnih nalog s področja umetnih nevronskih mrež na področju financ (računalniške vaje bodo potekale z uporabo

Learning and teaching methods:

- Lectures – students proactively participate during the lectures, teacher asks intermediate questions and discussion is stimulated, lessons are passed interactively, conversations about the project exercises are carried.
- Computer exercises – practicing the knowledge during lectures, students ask question, discussion is carried, computer exercises of Artical Neural Networks on the field of Finance are

Načini ocenjevanja:	Delež (v %) / Weight (in %)	Assessment:
• Ustni izpit • Projektna naloga	**50 %** **50 %**	• Oral exam • Project excercise

(previous table cells:)

| računalnikov; vsak študent bo imel na razpolago en računalnik).
• Samostojno delo študentov – izvajanje projektne naloge. | carried (computer exercises are carried using one computer per student).
• Individual work – students perform project exercise. |

Reference nosilca

1. AMON, Aleksandra, BOBEK, Samo, JAGRIČ, Timotej, STERNAD ZABUKOVŠEK, Simona. Analiza digitalne transformacije poslovnih modelov bank z modelom Canvas. *Bančni vestnik : revija za denarništvo in bančništvo*. [Tiskana izd.]. 2023, letn. 72, št. 1/2, str. 19-26, ilustr. ISSN 0005-4631. https://bv.zbs-giz.si/bancni-vestnik/e-arhiv/2023-1-2/analiza-digitalne-transformacije-poslovnih-modelov-bank-z-modelom-canvas. [COBISS.SI-ID 143655683]

2. ZDOLŠEK, Daniel, JAGRIČ, Timotej, KOLAR, Iztok. Auditor's going-concern opinion prediction : the case of Slovenia. *Ekonomska istraživanja*. 2022, vol. 35, no. 1, str. 106-121. ISSN 1331-677X. https://www.tandfonline.com/doi/full/10.1080/1331677X.2021.1888766, DOI: 10.1080/1331677X.2021.1888766. [COBISS.SI-ID 53383683]

3. JAGRIČ, Timotej, BROWN, Christine Elisabeth, FISTER, Dušan, DARLINGTON, Oliver, ASHTON, Kathryn, DYAKOVA, Mariana, BELLIS, Mark, JAGRIČ, Vita. Toward an economy of wellbeing : the economic impact of the Welsh healthcare sector. *Frontiers in public health*. 2022, vol. 10, article 953752, str. 1-14, ilustr. ISSN 2296-2565. https://www.frontiersin.org/articles/10.3389/fpubh.2022.953752/full, DOI: 10.3389/fpubh.2022.953752. [COBISS.SI-ID 128221443]

4. JAGRIČ, Timotej, FISTER, Dušan, JAGRIČ, Vita. Reshaping the healthcare sector with economic policy measures based on COVID-19 epidemic severity : a global study. *Healthcare*. 7. feb. 2022, vol. 10, spec. iss., art. 315, str. 1-10, ilustr. ISSN 2227-9032. https://www.mdpi.com/2227-9032/10/2/315, DOI: 10.3390/healthcare10020315. [COBISS.SI-ID 97619459]

5. JAGRIČ, Timotej, GRBENIC, Stefan O., JAGRIČ, Vita. What drives the healthcare sector's economic impact? : evidence from European countries. *International journal of health governance*. 2022, vol. 27, issue 1, str. 41-53, ilustr. ISSN 2059-464X. https://www.emerald.com/insight/content/doi/10.1108/IJHG-05-2021-0043/full/pdf?title=what-drives-the-healthcare-sectors-economic-impact-evidence-from-european-countries, DOI: 10.1108/IJHG-05-2021-0043. [COBISS.SI-ID 86893827]