

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, 2 nd cycle		1. or 2.	1. or 3.

Vrsta predmeta / Course type

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:

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

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:

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).

Prerequisites:

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):

<p>Vsebina predmeta sestoji iz štirih delov:</p> <ul style="list-style-type: none"> • Pregled metod umetne inteligence s poudarkom na umetnih nevronskih mrežah, zgodovinski pregled razvoj umetnih nevronskih mrež, primerjava 	<p>The syllabus consists of four parts:</p> <ul style="list-style-type: none"> • The outline and motivation of artificial intelligence arise with the emphasis on Artificial Neural Networks, historical design of Artificial Neural Networks,
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<p>postopkov nadzorovanega in nenadzorovanega učenja.</p> <ul style="list-style-type: none"> • Pregled in spoznavanje temeljev umetnih nevronske mreže: model nevrona (perceptrona), aktivacijske funkcije nevronov, model umetne usmerjene nevronske mreže, arhitekture umetnih nevronske mreže, 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 nevronske mrežah za izdelavo projektne naloge s področja financ. 	<p>comparison of supervised and unsupervised learning.</p> <ul style="list-style-type: none"> • The outline of Artificial Neural Network necessities: 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 exercise on the Finance field.
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Temeljna literatura in viri / Readings:

<ul style="list-style-type: none"> • Martin T. Hagan, Howard B. Demuth, Mark H. Beale, Orlando De Jesus. <i>Neural Network Design</i> (2nd Edition). 2014. <p>(Knjiga je prosto dostopna na / Book freely accessible at: http://hagan.okstate.edu/nnd.html)</p> <ul style="list-style-type: none"> • Anderson, Patrick L. <i>Business economics and finance with MATLAB, GIS, and simulation models</i>. CRC Press, 2004.

Cilji in kompetence:

<p>Cilji:</p> <ul style="list-style-type: none"> • Ustrezno predstaviti motivacijo za uporabo umetnih nevronske mreže v praksi na področju financ. • Ustrezno predstaviti potek implementacije umetnih nevronske mreže v programskem okolju MATLAB. • Pripraviti študente za izdelavo projektne naloge na področju financ z neposredno aplikacijo pridobljenih znanj o umetnih nevronske mrežah.

Objectives and competences:

<p>Objectives:</p> <ul style="list-style-type: none"> • 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
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<p>Kompetence:</p> <ul style="list-style-type: none"> • Študentje bodo dosegli osnovno poznavanje različnih tipov in arhitektur umetnih nevronske mreže in razpoznali primernost posameznega tipa umetnih nevronske mreže za dan problem na področju financ. • Študentje bodo sposobni razumeti osnovne principe delovanja umetnih nevronske mreže in pripadajočih učnih algoritmov za področje financ. 	<p>application of obtained knowledge about Artificial Neural Networks.</p> <p>Competences:</p> <ul style="list-style-type: none"> • 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.
<p>Predvideni študijski rezultati:</p> <ul style="list-style-type: none"> • Študentje bodo sposobni samostojno s predpripravljenimi orodji implementirati umetno nevronske mreže 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 nevronske mreže ter uporabiti postopke za zmanjšanje teh težav, ali njihovo odpravo. 	<p>Intended learning outcomes:</p> <ul style="list-style-type: none"> • 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 techniques in order to eliminate or reduce the effect of these problems.
<p>Metode poučevanja in učenja:</p> <ul style="list-style-type: none"> • 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 nevronske mreže na področju financ (računalniške vaje bodo potekale z uporabo 	<p>Learning and teaching methods:</p> <ul style="list-style-type: none"> • 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 Artificial Neural Networks on the field of Finance are

<p>računalnikov; vsak študent bo imel na razpolago en računalnik).</p> <ul style="list-style-type: none"> • Samostojno delo študentov – izvajanje projektne naloge. 	<p>carried (computer exercises are carried using one computer per student).</p> <ul style="list-style-type: none"> • Individual work – students perform project exercise. 				
Delež (v %) / Weight (in %)	Assessment:				
<p>Načini ocenjevanja:</p> <ul style="list-style-type: none"> • Ustni izpit • Projektna naloga 	<table border="1" style="width: 100%;"> <tr> <td style="width: 50%; text-align: center;">50 %</td> <td style="width: 50%; vertical-align: top;"> <ul style="list-style-type: none"> • Oral exam </td> </tr> <tr> <td style="text-align: center;">50 %</td> <td style="vertical-align: top;"> <ul style="list-style-type: none"> • Project exercise </td> </tr> </table>	50 %	<ul style="list-style-type: none"> • Oral exam 	50 %	<ul style="list-style-type: none"> • Project exercise
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Reference nosilca

<ul style="list-style-type: none"> • JAGRIČ, Timotej, BOJNEC, Štefan, JAGRIČ, Vita. Optimized spiral spherical self-organizing map approach to sector analysis - the case of banking. <i>Expert systems with applications</i>. [Print ed.]. 2015, vol. 42, iss. 13, str. 5531-5540. ISSN 0957-4174. DOI: 10.1016/j.eswa.2015.03.002. [COBISS.SI-ID 11971868] • JAGRIČ, Timotej, ŽUNKO, Matjaž. Neural network world : optimized spiral spherical SOM (OSS-SOM). <i>Neural network world : international journal on non-standard computing and artificial intelligence</i>. 2013, vol. 23, no.5, str. 411-426. ISSN 1210-0552. http://search.proquest.com/docview/1462485139?accountid=28931. [COBISS.SI-ID 11637788] • JAGRIČ, Timotej, BOJNEC, Štefan, JAGRIČ, Vita. Micro and macro topologies of the EU banking sector - optimized spiral spherical SOM approach. V: BÓTA, Gábor (ur.). <i>Proceedings of the SSEM EuroConference 2014 : the International Conference on Emerging Markets Business, Economics, and Finance, July 6-8, 2014, Budapest, Hungary</i>. Budapest: Society for the Study of Emerging Markets: Budapest University of Technology and Economics, Department of finance, 2014. ISBN 978-963-313-114-5. [COBISS.SI-ID 11744028] • FISTER, Dušan, MUN, Johnathan, JAGRIČ, Vita, JAGRIČ, Timotej. Deep learning for stock market trading : a superior trading strategy?. <i>Neural network world : international journal on non-standard computing and artificial intelligence</i>. 2019, vol. 29, no.3, str. 151-171. ISSN 1210-0552. http://nnw.cz/doi/2019/NNW.2019.29.011.pdf, DOI: 10.14311/NNW.2019.29.011. [COBISS.SI-ID 13363996] • FISTER, Dušan, JAGRIČ, Timotej. Online long short-term memory network for stock trading. V: FISTER, Iztok (ur.), et al. <i>Proceedings of the 2019 6th Student Computer Science Research Conference - StuCoSReC</i>. Koper: University of Primorska Press, 2019. Str. 5-8. ISBN 978-961-7055-82-5, ISBN 978-961-7055-83-2. http://www.hippocampus.si/ISBN/978-961-7055-82-5.pdf. [COBISS.SI-ID 13436188]
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[http://www.ecocyb.ase.ro/nr2018_2/17%20-%20Timotej%20Jagric,%20Vita%20Jagric%20\(T\).pdf](http://www.ecocyb.ase.ro/nr2018_2/17%20-%20Timotej%20Jagric,%20Vita%20Jagric%20(T).pdf), DOI: [10.24818/18423264/52.2.18.17](https://doi.org/10.24818/18423264/52.2.18.17). [COBISS.SI-ID [13058076](#)]
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- JAGRIČ, Timotej. *Artificial intelligence and risk management : keynote researcher/ speaker at the European convention in quantitative methods and risk management hosted by the University of Nottingham (UK), July 15th to 19th 2019.* [COBISS.SI-ID [13375772](#)]
- JAGRIČ, Timotej. *Using AI in risk management - does it make a difference? : presented at the Fifth Annual Conference on Compliance and Ethics, Bled, 6-7 November 2019.* [COBISS.SI-ID [13443356](#)]
- JAGRIČ, Timotej. *Predstavitev modela neplačila s pomočjo strojnega učenja in drugih alternativnih metod : [predavanje na] "Posvet o upravljanju tveganj v bankah", Ljubljana, 24. 10. 2018.* [COBISS.SI-ID [13148956](#)]
- JAGRIČ, Timotej. *Umetna inteligenca v obvladovanju tveganj - naslednja velika stvar? : [predavanje na] "20. letna konferenca revizorjev", Portorož, 12. 9. 2019.* [COBISS.SI-ID [13399068](#)]
- JAGRIČ, Timotej. *Umetna inteligenca v ekonomiji : [predavanje] na II. gimnaziji Maribor, 15. 5. 2019.* [COBISS.SI-ID [13329948](#)]
- JAGRIČ, Timotej, ŠUŠTERŠIČ, Maja. *Umetna inteligenca : [predavanje] 13. seja skupščine Združenja SI.RISK in dogodek na temo "MRSP 9 in obvladovanje tveganj", Ljubljana, 9. 4. 2019.* [COBISS.SI-ID [13311516](#)]