

INTELIGENTNI SISTEMI

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet: Inteligentni sistemi

Course title: Intelligent Systems

**Članica nosilka/UL
Member:**

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Digitalno jezikoslovje, druga stopnja / Digital Linguistics, 2nd cycle		2. letnik	1. semester	izbirni

Univerzitetna koda predmeta/University course code: 0039643

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
45	6	24			105	6

Nosilec predmeta/Lecturer: Marko Robnik Šikonja

Vrsta predmeta/Course type: izbirni predmet/elective course

Jeziki/Languages:	Predavanja/Lectures:	Angleščina
	Vaje/Tutorial:	Angleščina

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

Za uspešno delo je potrebno poznavanje osnov statistike in programiranja.

Prerequisites:

Knowledge of basic statistics and programming.

Vsebina:

Teme predavanj:

1. Uvod v inteligentne sisteme in podatkovne vede
2. Računanje po vzorih iz narave (genetski algoritmi, genetsko programiranje)
3. Uvod v strojno učenje
4. Pristranskost, varianca in pretirano prilagajanje
5. Učenje predstavitev in izbira atributov
6. Ansambelske metode

Content (Syllabus outline):

Lecture topics:

1. Introduction to intelligent systems and data science
2. Nature inspired computing (genetic algorithms, genetic programming)
3. Introduction to predictive modelling
4. Bias, variance and overfitting
5. Representation learning and feature selection

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|---|---|
| <ol style="list-style-type: none"> 7. Jedrne metode 8. Nevronske mreže: arhitekture, vzvratno razširjenje napak, globoke nevronske mreže 9. Razlaga modelov 10. Obdelava naravnega jezika: predstavitev besedil, pridobivanje informacij, klasifikacija besedil, semantična podobnost 11. Spodbujevano učenje: osnovni pristopi in algoritmi, učenje Q, učenje TD, globoko spodbujevano učenje | <ol style="list-style-type: none"> 6. Ensemble methods 7. Kernel methods 8. Neural networks: architectures, backpropagation, deep neural networks 9. Model inference and explanation 10. Natural language processing: text representation, information extraction, text classification, semantic similarity 11. Reinforcement learning: basic approaches and algorithms, Q learning, TD learning, deep RL |
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Temeljna literatura in viri/Readings:

G. James, D. Witten, T. Hastie, and R. Tibshirani, 2021. *An introduction to statistical learning with applications in R, 2nd edition*. New York: Springer.

D. Jurafsky, J. H. Martin. *Speech and language processing: An introduction to natural language processing, computational linguistics, and speech recognition. 3rd edition draft*, 2022

Richard S. Sutton and Andrew G. Barto: Reinforcement Learning, An Introduction, 2nd edition, MIT press, 2018

Cilji in kompetence:

Cilj predmeta je študente seznaniti s področjem inteligentnih sistemov, ki vsebuje nabor orodij in pristopov za reševanje problemov, ki jih je težko ali nepraktično reševati z drugimi metodami. Študenti morajo biti sposobni teoretično znanje praktično uporabiti na realnih problemih iz znanstvenega in poslovnega okolja. Študenti morajo biti za dani problem sposobni presoje, katero od predstavljenih tehnik uporabiti, ter sestaviti prototip rešitve.

Splošne kompetence:

sposobnost razumevanja in reševanja profesionalnih izzivov,

sposobnost profesionalne komunikacije v domačem in tujem jeziku,

sposobnost samostojne uporabe pridobljenega znanja za reševanje tehničnih in znanstvenih problemov v računalništvu in informatiki,

seznanjenost z raziskovalnimi metodami na področju računalništva in informatike.

Predmetno-specifične kompetence:

uporaba osnovnih algoritmov strojnega učenja
 predpriprava podatkov za podatkovno rudarjenje
 izbira pomembnih atributov
 vrednotenje odločitvenih modelov
 uporaba sistemov za podatkovno analizo

Objectives and competences:

The goal of the course is the students to become acquainted with the field of intelligent systems, which includes a collection of tools and approaches for solving problems which are difficult or impractical to tackle with other methods. Students will be able to apply the gained theoretical knowledge on real-world problems from scientific and business environment. The students shall be able to decide which of the presented techniques should be used for a given problem, and to develop a prototype solution.

General competences:

the ability to understand and solve professional challenges in computer and information science,

the ability of professional communication in the native language as well as a foreign language,

the ability to apply acquired knowledge in independent work for solving technical and scientific problems in computer and information science,

familiarity with research methods in the field of computer science.

Subject-specific competences:

using basic machine learning algorithms
 preprocessing data for data mining
 feature subset selection
 evaluation of decision models

uporaba sistemov za optimizacijo z evolucijskim računanjem
analiza besedil s tehnikami podatkovnega rudarjenja
uporaba orodij za spodbujevano učenje.

using data mining systems
using optimizations packages with evolutionary techniques
text analysis and text mining
using reinforcement learning tools

Predvideni študijski rezultati:

Ob koncu predmeta bodo študenti;
poznali in uporabljali različne tehnike in metode, ki se uporabljajo pri modeliranju inteligentnih sistemov
poznali in uporabljali orodja za strojno učenje
poznali in uporabljali pristope za analizo besedil
reševali in analizirali konkretne primere inteligentnih sistemov z uporabo znanstvenih metod
uporabljali in vrednotili orodja za statistično modeliranje in podatkovno rudarjenje
sposobni analize problemov s področja inteligentnih sistemov in izbora primernih tehnik za njihovo reševanje
uporabljali in medsebojni primerjali metode evolucijskega računanja

Intended learning outcomes:

Upon course completion the student will:

- know and use various techniques and methods for modelling of intelligent systems
- know and use machine learning tools
- know and use text analysis approaches
- solve and analyse examples of intelligent systems using scientific methods
- use and evaluate tools for statistical modelling and data mining
- be capable to analyse problems from the area of intelligent systems and choose adequate approaches for their solutions
- use and compare different approaches for evolutionary computing

Metode poučevanja in učenja:

Predavanja, vaje z ustnimi nastopi in predstavitvami, seminarski način dela pri domačih nalogah. Študenti bodo v manjših skupinah samostojno reševali realen problem. Skupine bodo svoje naloge in rešitve opisale v pisnem poročilu in predstavile ostalim v obliki kratke predstavitve, ki je ocenjena skupaj s poročilom.

Learning and teaching methods:

Lectures, assignments with written and oral demonstrations and presentations, seminar works and homework. Students from small project teams and autonomously solve assignments based on real-life problems. The teams describe their solutions in written reports and prepare short oral presentations. Written reports and oral presentations are graded.

Načini ocenjevanja:

Način: pisni in ustni izpit, naloge, projekt.

Delež/Weight

Assessment:

		Type: written and oral exam, coursework, project.
Sprotno preverjanje: domače naloge, kolokviji in projektno delo.	50,00 %	Continuing: homework, project work.
Končno preverjanje: pisni in ustni izpit.	50,00 %	Final: written and oral exam.
Ocene: 6-10 pozitivno, 5 negativno (v skladu s Statuom UL).		Grading: 6-10 pass, 5 fail (according to the rules of University of Ljubljana).

Ocenjevalna lestvica:

Grading system:

Reference nosilca/Lecturer's references:

1. VREŠ, Domen, ROBNIK ŠIKONJA, Marko. Preventing deception with explanation methods using focused sampling. *Data mining and knowledge discovery*. 2023, vol. , no. , str. 1-46
2. MIOK, Kristian, ŠKRLJ, Blaž, ZAHARIE, Daniela, ROBNIK ŠIKONJA, Marko. To BAN or not to BAN: Bayesian attention networks for reliable hate speech detection. *Cognitive computation*. Jan. 2022, vol. 14, iss. 1, str. 353-371
3. ŠKVORC, Tadej, GANTAR, Polona, ROBNIK ŠIKONJA, Marko. MICE: mining idioms with contextual embeddings. *Knowledge-based systems*. Jan. 2022, vol. 235, str. 1-11
4. MARTINC, Matej, POLLAK, Senja, ROBNIK ŠIKONJA, Marko. Supervised and unsupervised neural approaches to text readability. *Computational linguistics*. 2021, vol. 47, no. 1, str. 141-179
5. LAVRAČ, Nada, ŠKRLJ, Blaž, ROBNIK ŠIKONJA, Marko. Propositionalization and embeddings: two sides of the same coin. *Machine learning*. 2020, vol. 109, no. 7, str. 1465-1507.

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