

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	Modeliranje z agenti
Course title:	Agent Based Modelling

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Informatika v sodobni družbi, magistrski študijski program druge stopnje	-	Prvi ali drugi	Drugi ali četrsti
Informatics in Contemporary Society, second cycle Masters Study Programme	-	First or second	Second or fourth

Vrsta predmeta / Course type

Izbirni / Elective

Univerzitetna koda predmeta / University course code:

1-ISD-MAG-IP-MZA-2026-09-29

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
30	-	30	-	-	90	5

Nosilec predmeta / Lecturer:

izr. prof. dr. Blaž Rodič

Jeziki / Languages:

Predavanja / Lectures:

slovenski, angleški / Slovene, English

Vaje / Tutorial:

slovenski, angleški / Slovene, English

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

Študent/študentka mora pred pristopom k izpitu pripraviti empirično seminarsko nalogo.

Prerequisites:

The student is obliged to submit an empirical seminar paper before their admission to the exam.

Vsebina:

- Uvod v modeliranje z agenti (MA), kdaj in zakaj uporabljati MA;
- Uvod v projekt, izbira teme MA projekta;
- Pregled in primerjava metodologij modeliranja, primerjava MA in drugih možnih metodologij za izbrani MA projekt;
- Simulacijski primeri: Kreativno Jedro: Simulacije in drugi projekti;
- Razvoj agentnega modela, Razvoj zasnove modela za izbrani MA projekt
- Pregled MA orodij, Izbira najbolj

Content (Syllabus outline):

- Introduction to agent based modelling (ABM), when and why to use ABM;
- Introduction to the project, choice of theme for the ABM project;
- Review of modeling methodologies, comparison of ABM and alternative methodologies for selected ABM project;
- Simulation examples: Creative Core: Simulations and other projects;
- Development of agent-based model, design of the model for selected ABM project;

primerne MA orodja za izbrani MA projekt; • Delavnica z izbranimi MA orodji, implementacija enostavnega modela; • Arhitekture agentnih modelov, izbira arhitekture za izbrani MA projekt; • Verifikacija in validacija, načrtovanje verifikacije in validacije za izbrani MA projekt; • Zbiranje in priprava podatkov, izbira vsaj enega vira podatkov za izbrani MA projekt; • Analiza in predstavitev rezultatov, izvajanje simulacije in analiza modela in rezultatov simulacije; • Upravljanje MA projekta; • Priprava predstavitve projekta.	• Overview of ABM tools, choosing the most appropriate tools for selected ABM project; • Workshop with selected tools, implementation of a simple model; • Architectures of agent-based models, selection of architecture for the selected ABM project; • Verification and validation, design verification and validation of the selected ABM project; • Collection and preparation of data, selection of at least one data source for the selected ABM project; • Analysis and presentation of results, implementation of simulation and analysis of the model and simulation results; • ABM project Management; • Preparation of project presentations.
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Temeljni literatura in viri / Readings:

- Gilbert, N. (2019), Agent-Based Models 2nd Ed., Quantitative Applications in the Social Sciences Vol. 153, SAGE Publications
- Gilbert N. (Ed.), Doran J. (Ed.) (2020), Simulating Societies: The Computer Simulation of Social Phenomena 1st Ed., Routledge
- Borshchev, A. (2022). The Big Book of Simulation Modeling, AnyLogic North America
- Grigoryev, I. (2023) AnyLogic 8 in Three Days: A Quick Course in Simulation Modeling 6th Ed., AnyLogic North America
- Railsback, S. F., & Grimm, V. (2019). Agent-Based and Individual-Based modeling: A Practical Introduction, Second Edition. Princeton University Press.

Cilji in kompetence:

Cilji:

- definirati procesa modeliranja z agenti
- primerjati modeliranja z agenti z alternativnimi in komplementarnimi metodologijami in artikulacija relativnih prednosti in slabosti. Druge metodologije:
 - sistemska dinamika, simulacija diskretnih dogodkov, teorija iger, statistično modeliranje, analiza tveganja
- utemeljiti, kdaj in zakaj uporabiti modeliranje in simulacijo z agenti
- razložiti, kako zasnovati in razviti simulacije z agenti
- predstaviti način menedžmenta projektov agentnega modeliranja

Objectives and competences:

Objectives:

- define the ABM process
- compare ABM with alternative and complementary methodologies and articulation of the relative strengths and weaknesses. Other methodologies: system dynamics, discrete event simulation, game theory, statistical modeling, risk analysis
- justify when and why to use ABM
- explain how to design and develop simulations ABM
- present methods of ABM project management
- demonstrate the development of ABM with one or two tools
- explain how to perform verification and

- demonstrirati razvoj agentnih modelov z enim ali dvema orodjema
- razložiti, kako izvesti verifikacijo in validacijo modelov
- natančno opredeliti poglobitve izzive in tehnike zbiranja in priprave/čiščenja podatkov za gradnjo modelov in izvajanje simulacijskih scenarijev
- razložiti postopek analize rezultatov simulacij
- opisati postopek in tehniko predstavitve rezultatov simulacije odločevalcem

Učna enota prispeva k razvoju naslednjih splošnih in predmetno-specifičnih kompetenc:

- poznavanje pomena kakovosti in prizadevanje za kakovost strokovnega dela skozi avtonomnost, samoiniciativnost, (samo)kritičnost, (samo)refleksivnost in (samo)evalviranje v strokovnem delu
- uporaba metodoloških orodij, tj. izvajanje, koordiniranje in organiziranje raziskav, uporaba raznih raziskovalnih metod in tehnik ter ocenitev njihove uporabnosti
- usposobljenost za samostojno in avtonomno uporabo, nadzor in vzdrževanje informacijsko komunikacijske tehnologije v organizaciji
- sposobnost fleksibilne uporabe znanja v praksi
- poznavanje programskih orodij in metodologij za analizo podatkov ter simulacije diskretnih oziroma zveznih modelov

validation of models

- identify key challenges and techniques for the collection and preparation / cleaning of data for modelling and implementation of simulation scenarios
- explain the process of analyzing the results of simulations
- describe the process and technique of presentation of simulation results to decision makers

The instructional unit contributes to the development of the following general and subject-specific competences:

- familiarity with the importance of quality, striving to maintain the quality of professional work through practicing autonomous behaviour, showing initiative, as well as through (self-) criticism, (self-)reflection and (self-)evaluation
- use of methodological tools, i.e. implementation, coordination and organisation of research, use of various research methods and techniques and to evaluate their usefulness
- competence for independent and autonomous use, monitoring and maintenance of information communication technology in an institution
- ability to flexibly apply knowledge in practice
- knowledge of programming tools and methodologies for data analysis and simulation of discrete and continuous models

Predvideni študijski rezultati:

Znanje in razumevanje:

Študent/študentka pridobi znanja za:

- agentno modeliranje organizacijskih in socialnih problemov
- analizo vhodnih podatkov, priprava in statistična obdelava
- definicijo kriterijev in dinamično testiranje hipoteze pri izboru rešitve
- analizo zakonitosti delovanja kompleksnih adaptivnih sistemov

Intended learning outcomes:

Knowledge and understanding:

The student has the knowledge of:

- agent based modeling of organizational and social problems
- input data analysis, preparation and statistical processing
- definition of criteria and dynamical hypothesis testing at the solution selection
- analysis of behaviour of complex

	adaptive systems
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Metode poučevanja in učenja:

- predavanja z aktivno udeležbo študentov (razlaga, diskusija, vprašanja, primeri, reševanje problemov)
- laboratorijske vaje (uporaba simulacijskih orodij)
- individualne in skupinske konzultacije (diskusija, dodatna razlaga, obravnava specifičnih vprašanj)

Learning and teaching methods:

- lectures with active students' involvement (explanation, discussion, questions, examples, problem solving)
- laboratory work (usage of simulation tools)
- individual and group consultations (discussions, supplementary explanations, treatment of specific questions)

Načini ocenjevanja:

Delež (v %) /
Weight (in %)

Assessment:

Način (pisni izpit, ustno izpraševanje, naloge, projekt):		Type (examination, oral, coursework, project):
• pisni/ustni izpit • empirična seminarska naloga	50 50	• written/oral examination • empirical seminar paper

Reference nosilca / Lecturer's references:

- RODIČ, Blaž. Mobile agents for distributed decision support systems. Int. Sci. J. Manag. Inf. Syst., 2011, vol. 6, no. 1, str. 20-27.
- RODIČ, Blaž, BAGGIA, Alenka. Dynamic airport ground crew scheduling using a heuristic scheduling algorithm. International journal of applied mathematics and informatics, ISSN 2074-1278, 2013, vol. 7, iss. 4, str. 153-163.
- KANDUČ, Tadej, RODIČ, Blaž. Optimisation of factory floor layout in a complex manufacturing process. V: MASTORAKIS, Nikos E. (ur.). Recent advances in applied mathematics, modelling and simulation : proceedings of the 8th International Conference on Applied Mathematics, Simulation, Modelling (ASM '14), Florence, Italy, November 22-24, 2014, (Mathematics and computers in science and engineering series, 34). WSEAS, cop. 2014, str. 261-269.
- VUKOVIČ, Goran, ZAVRŠNIK, Bruno, RODIČ, Blaž, MIGLIČ, Gozdana. The training of civil servants in the Slovene state administration: issues introducing training evaluation. Int. rev. adm. sci., dec. 2008, vol. 74, no. 4, pg. 653-676.
- KLJAJIĆ, Miroljub, BRESKVAR, Uroš, RODIČ, Blaž. Computer aided scheduling with use of genetic algorithms and a visual discrete event simulation model. WSEAS Trans. Syst., 2004, vol. 3, no. 3, pg. 1021-1026.
- RODIČ, Blaž, KLJAJIĆ, Miroljub. Mobile agents and XML for distributed simulation support. V: KLJAJIĆ, Miroljub (ed.), ŠKRABA, Andrej (ed.). Simulation based decision support, (Organizacija, Letn. 38, 2005, No. 9). Kranj: Moderna organizacija, 2005, pg. 490-498.