Study program: Information Technology

Course title: INTELLIGENT MODELLING AND CONTROL

Teachers: Nedeljko G. Dučić, Snežana M. Dragićević

Course status: elective

Number of ECTS credits: 6

Prerequisite courses: /

Course objectives

Introducing students to techniques of artificial intelligence: neural networks, fuzzy logic, genetic algorithms, and training for application in solving various engineering problems related to modelling, optimization, and control.

Learning outcomes

The student familiarises themselves with various techniques of artificial intelligence and explains their types and potential applications in solving diverse engineering problems. The student utilizes the capabilities of artificial intelligence for modelling, optimization, and control of processes and systems. They analyse the efficiency of the used computational tools for solving such tasks and select tools based on efficiency criteria.

Content of the course

Theoretical teaching

- Computer intelligence.
- Artificial neural networks. (Neuron and model of neuron. The architecture and learning of artificial neural networks, including the backpropagation algorithm. Application of neural networks in approximating nonlinear functions.
- Fuzzy systems (Theory of fuzzy systems. Generating an initial population, objective function, genetic operators, and parameters of a genetic algorithm.)
- Genetic algorithms (Generating an initial population, objective function, genetic operators, parameters of the genetic algorithm.)
- Swarm intelligence (Generating an initial population, objective function, parameters of swarm intelligence optimization technique).
- Hybrid intelligent systems (neuro-fuzzy systems)

Practical teaching

- Designing neural networks using specialized software tools for solving engineering problems of different classes.
- Solving optimization problems using genetic algorithms and swarm intelligence with the use of specialized software tools.
- Designing fuzzy and neuro-fuzzy control structures.

Literature

[1] Дучић Н., Интелигентно моделирање и управљање - МАТЛАБ симулације, Универзитет у Крагујевцу, Факултет техничких наука, 2021.

[2] Ранковић В., Интелигентно управљање, Машински факултет Универзитета у Крагујевцу, 2008.

[3] Миљковић, З., Петровић, М., Интелигентни технолошки системи са изводима из роботике и вештачке интелигенције, Универзитет у Београд, Машински факултет, 2021.

[4] Jung, A., Machine Learning: Foundations, Methodologies, and Applications, Springer Nature Singapore Pte Ltd. 2022.

[5] Hagan T.M., Demuth B.H., Beale H.M., De Jesús O., Neural network design (2edition), Martin Hagan; 2 edition (September 1, 2014).

[6] Zilouchian, A., Jamshidi, M., Intelligent Control Systems Using Soft Computing Methodologies, CRC Press LLC, 2001.

Number of active teaching classes: 2	**Theoretical teaching: 2**	**Practical teaching: 2**

Teaching methods

Lecturing, computer exercises, consultations and mentored work.

Evaluation of knowledge (maximum number of points 100)

Pre-exam obligations	**Points**	**Final exam**	**Points**
Activities during teaching process	10	Final exam (written):	20
Practical teaching	/	Final exam (oral):	30
Project	40		