

Faculty: FACULTY OF TELECOMMUNICATIONS AND MANAGEMENT
Department: INFORMATION TECHNOLOGIES
Professional Field: 5.3.Communication and Computer Engineering
Specialty: Cybersecurity of communication technologies
Educational-qualification degree: BACHELOR

LEARNING COURSE DESCRIPTION

1. **Course title:** ARTIFICIAL INTELLIGENCE

2. **Course code:** B.43.044.1

3. **Type of the course:** compulsory

4. **Level:** Bachelor

5. **Year of study:** third

6. **Semester:** sixth

7. **Number of credits:** 6

8. **Name of the lecturer (s):** Assoc. Prof. PhD Irina Topalova-Georgieva,

9. **Course learning outcomes:** The aim of the course is to acquaint the students with the theoretical and practical aspects of the principles, structure and application of artificial intelligence. The course addresses issues related to the ideology, functioning and design of artificial intelligence in its implementation in innovative information technologies. Students who have completed their training in the discipline must acquire::

Basic knowledge of the functional features of artificial intelligence, the types of neural networks, their optimization, selection and application for hypothesis creation, recognition, classification, adaptation and prediction in artificial intelligence systems.

Practical skills for working with various software applications and APIs for designing neural networks and fuzzy logic for their implementation in artificial intelligence systems.

Competencies: After the successful completion of the course students should be able to:

- know and design the functions of artificial intelligence;
- explain concepts related to different types of modern neural networks, to design the structure and functional parameters of the types of neural networks;
- select the type of neural network according to the type of application task;
- train neural networks and to apply fuzzy logic, to optimize their parameters to achieve optimal accuracy of results;
- work with software products NeuroSystem, SimBrain, VisionBulder, ArcGisPro, Keras, NEST;
- work with the Keras open source software library, with an interface to Tensorflow libraries for the design and implementation of neural networks.

10.Teaching methods: The lectures are conducted in the classical way as the students get acquainted with the material. The statements are illustrated with examples that make it easier for students to work in the exercises. The lectures are illustrated with graphic and video material, which is presented through presentations using a multimedia projector and supplemented with examples in a concrete real implementation.

Practical exercises are held in the computer labs of the department, equipped with the necessary applications and devices, as well as software packages for simulation.

11. Prerequisites: The inputs are acquired knowledge of *Signals and Systems*, *Programming Basics*, *Databases*, etc. taught in previous semesters technical subjects.

12. Course contents: The course focuses on acquisition of knowledge about the functionalities of artificial intelligence, the methods of recognition and classification, the types of neural networks and fuzzy logic, to optimize their parameters and their proper integration into autonomous intelligent systems. Applications of techniques in the field of deep machine learning of neural networks and pattern recognition, as their main functional subsystems of artificial intelligence, are considered. Students are introduced to the Keras open source software library, a Python interface for artificial

neural networks, as well as methods for processing and recognizing images in adaptive intelligent systems.

13. Bibliography

Basic literature:

1. Ник Бострьом, СВРЪХИНТЕЛЕКТ: ПОСОКИ, ОПАСНОСТИ, СТРАТЕГИИ , SBN:978-619-01-0262-5, 2018.
2. Topalova, I., Intelligent Manufacturing Systems - Industrial applications of machine vision and neural networks - concepts and experiments, Учебник - English Language, ISBN 978-954-723-076-7, Tip-Top Press Publishing House, 2012. COBISS.BG – ID 1238576868
3. Topalova, I., “Recognition of Similar Wooden Surfaces with a Hierarchical Neural Network Structure, SAI/ IJARAI – International Journal of Advanced Research in Artificial Intelligence, October, pp. 35-39, Volume 4 Issue10, U.S ISSN: 2165-4069, 2015.
4. <http://aima.cs.berkeley.edu/> - Изкуствен интелект: съвременен подход, 2019.
5. Graupe, ‘Deep Learning Neural Networks: Design and Case Studies’, World Scientific Publishing Co Inc. pp. 57–110, ISBN 978-981-314-647-1, July, 2016.

Additional literature:

1. Y. Sahu and S. K. Sar, ‘Congestion analysis in wireless network using predictive techniques’, Research Journal of Computer and Information Technology Sciences, ISSN 2320 – 6527 vol. 5(7), pp. 1-4, September, 2017.
2. S. Floyd and V. Jacobson, ‘Random Early Detection Gateways for Congestion Avoidance’, IEEE/ACM Transactions on Networking, Networking, vol. 1 No. 4, pp. 397-413, August, 1993, Available: <http://www.icir.org/floyd/papers/early.twocolumn.pdf>: accessed august, 2018.
3. A. F. Luque Calderón, E. J. Vela Porras and O. J. Salcedo Parra, ‘Predicting Traffic through Artificial Neural Networks’, Contemporary Engineering Sciences, vol. 10, no. 24, pp. 1195 - 1209 HIKARI Ltd, www.m-hikari.com <https://doi.org/10.12988/ces.2017.710146>, 2017.
4. E. Stergiou, D. Liarokapis, C. Angelis and F. Vartziotis, “Vigorous Distance Learning Applications Using the Stream Control Transmission Protocol”, Science Journal of Education. Vol. 5, No. 6, pp. 262-267, 2017.
5. Neuro Solutions, Copyright © 2014 by NeuroDimension, pp. 67-79, 2015.
6. B. Widrow and S. Stearns, “Adaptive Signal Processing,” Prentice-Hall, Inc. Englewood Cliffs, N.J. 07632, pp.36-40, 2004.

14. Assessment methods and criteria: The final assessment is based on the points obtained during the semester, the correspondence between the number of points and the assessment of the sixth-point system is presented in Table 1. On the announced examination date, for completion of the final grade, the students develop in writing one or two questions from the discipline syllabus, solve a case study and a practical task.

Table 1.

Number of points	Assessment According to the 6-point Scale System
0 – 10	Fail 2 (F)
11 – 20	Fail 2 (FX)
21 – 26	Satisfactory 3.00 (E)
27 – 31	Satisfactory 3.00 (D)
32 – 40	Good 4.00 (C)
41 – 48	Very good 5.00 (B)
over 49 points	Excellent 6.00 (A)

15. Language of instruction: *Bulgarian/English*