COURSE DESCRIPTION CARD - SYLLABUS

Course name
Expert systems and artificial intelligence [N2IBez1>SEiSI]

Course

Field of study
Safety Engineering

Year/Semester
1/2

Area of study (specialization)
Ergonomics and Work Safety

Profile of study
general academic

Level of study
second-cycle

Course offered in
polish

Form of study
part-time

Requirements
compulsory

Number of hours

Lecture
16

Laboratory classes
0

Other (e.g. online)
0

Tutorials
10

Projects/seminars
0

Number of credit points

5,00

Coordinators

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Lecturers

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Prerequisites

Student has knowledge of the basics of management and information technology carried out at first cycle studies. In addition, he should also be able to use the acquired knowledge in practice and is ready to work within team structures.

Course objective

To interest the students of Safety Engineering course of the future problems of using Expert Systems as well as Artificial Intelligence methods and techniques in solving both technological and decision-making problems in this knowledge discipline.

Course-related learning outcomes

Knowledge:
student knows the basic methods, techniques, tools and materials used to solve simple engineering tasks in the field of ergonomics and work safety using intelligent digital technologies and business security in the conditions of cyberattacks [p7s_wk_03]
student knows the concept of man and the world of his values and basic ethical categories as well as the role of man in ensuring security of human-technical object systems [p7s_wk_03]

student distinguishes between conceptual categories: data, information, knowledge and wisdom, and knows the principles of the construction and functioning of expert systems, artificial neural networks and evolutionary algorithms [p7s_wk_04]

Skills:
student is able to notice and formulate system and non-technical aspects as well as socio-technical, organizational and economic aspects in engineering tasks [p7s_uw_01, p7s_uw_02]
student is able to use research, analytical, simulation and experimental methods to formulate and solve engineering tasks, also using intelligent methods and tools [p7s_uw_03, p7s_uw_04]
student is able to perform a critical analysis of the functioning and evaluate - in conjunction with security engineering - existing technical solutions, in particular machines, devices, objects, systems, processes and services in the field of intelligent digital technologies [p7s_uw_06]

Social competences:
student is aware of the recognition of the cause-and-effect relationship in achieving the set goals and ranking the importance of alternative or competitive tasks in the field of intelligent digital technologies [p7s_kk_01]
student is aware of the recognition of the importance of knowledge in solving cybersecurity engineering problems and continuous improvement in the use of intelligent digital technologies [p7s_kk_02]

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Learning outcomes presented above are verified as follows:
Knowledge acquired as part of the lecture is verified by conducting an oral exam, during which the student randomly selects 3 questions for which the student receives points. Assessment threshold: 50% of the points (satisfactory).
Knowledge acquired as part of the exercises is verified on the basis of solving individual tasks covered by the curriculum. The student receives points for each task. Assessment threshold: 50% of the points (satisfactory).

Programme content

Lecture: Against the background of definitions of concepts such as broadly understood intelligence and data, information, knowledge and wisdom, the definitions of the Expert System and Artificial Intelligence are derived (for example, Security Engineering). In a similar context, issues of knowledge acquisition, methods of its representation in intelligent systems, creation and reconstruction of professional knowledge bases as well as expert strategy and intelligent problem solving are further developed. This part of the lecture is of a methodological nature and deals with, among others, heuristics and strategies of graph searching as well as classical and fuzzy inference methods. Expert Systems are presented in variants of solutions based on fuzzy logic systems. Among the solutions of Artificial Intelligence classified as based on Computational Intelligence, Artificial Neural Networks (in variants: Self Organizing Maps and Learning Vector Quantization) and Evolutionary Algorithms (in variants: Genetic Algorithms, Evolutionary Strategies, Evolutionary Programming) are presented. The so-called hybrid systems and elements of chaos theory. The applications of artificial intelligence to support management information systems (including solutions such as the Business Intelligence System in security management) and the economy based on intelligent digital technologies (with issues of business security as the object of cyber attacks) constitute together with the issue of the so-called "intelligent dilemma of the sixth cycle conjunctural "the final part of the lecture.
Exercises: This type of classes is implemented in a joint form with the tutor of student analysis exercises, team practical studies for the issues: a), b), c) and d) and jointly with the tutor of the analysis of an example problem prepared by him e).
The list of exercises include:
a) selected methods of symbolic knowledge representation in the field of security engineering for the purposes of creating and rebuilding professional knowledge bases,
b) methods of building and searching knowledge graphs in the field of security engineering,
c) operation on triangular and trapezoidal forms of membership functions for the purpose of inference in a fuzzy expert system of a selected issue of security engineering,
d) preparation of training programs in the field of business security engineering in cyber threat conditions,

e) generating in MATLAB an Artificial Neural Network with multilayer feedback and one hidden layer with 15 input nodes and one node in output layer (as a network learning algorithm - Levenberg-Marquardt gradient back propagation, as a transfer function in both the input and output layers - hyperbolic tangent; the number of neurons in a hidden wa layer determined by trial and error, changing the number of neurons from the set: {7, 10, 13, 16, 19, 22, 25, 27, 29, 31}).

Teaching methods

Information lecture in the form of a multimedia presentation, with elements of a conversational lecture. Exercises: auditorium exercises, task solving and case study.

Bibliography

Basic
1. Pacholski L. (2011), Systemy ekspertowe i sztuczna inteligencja, Wydawnictwo Politechniki Poznańskiej, Poznań.
2. Zieliński J.S. (red.) (2000), Inteligentne systemy w zarządzaniu, PWN, Warszawa.
3. Mulawka J.J. (1996), Systemy ekspertowe, WNT, Warszawa.
4. Rutkowska D., Piliński M., Rutkowski L. (1997), Sieci neuronowe, algorytmy genetyczne i systemy rozmyte, PWN, Warszawa.
5. Cytowski J. (1996), Algorytmy genetyczne. Podstawy i zastosowania, Akademicka Oficyna Wydawnicza, Warszawa.
Additional
1. Medsker L.M. (1994), Hybryd Neural Networks and Expert Systems, Kluwer Academic Publisher, Boston.
2. Żurada J.M., Barski M., Jędruch W. (1996), Sztuczne sieci neuronowe, PWN, Warszawa.
3. Budrewicz J. (1993), Fraktale i chaos, WNT, Warszawa.

Breakdown of average student's workload

	Hours	ECTS
Total workload	125	5,00
Classes requiring direct contact with the teacher	30	1,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	95	3,50