SYLLABUS OF A MODULE

Polish name of a module	**Algorytmy ewolucyjne i strategie przeszukiwań**
English name of a module	Evolutionary algorithms & search strategies
ISCED classification - Code	0619
ISCED classification - Field of study	*Information and Communication Technologies (ICTs), not elsewhere classified*
Languages of instruction	*English*
Level of qualification:	*2*
Number of ECTS credit points	*5*
Examination:	*A*
Available in semester:	*S*

Number of hours per semester:

Lecture	Tutorial	Laboratory	Seminar	Project	Others
30	0	30	0	15	0

MODULE DESCRIPTION

Module objectives

O1. Introducing the students to the evolutionary algorithms and search strategies.

O2. Obtaining by the students the practical skills in the field of evolutionary algorithms and search strategies.

PRELIMINARY REQUIREMENTS FOR KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Knowledge of mathematics and basics of computer science.
2. Basic knowledge of probability theory and mathematical statistics.
3. Basic knowledge in the field of optimization theory.
4. Basic knowledge and skills in the field of computer programming.
5. Ability to use different sources of information and technical documentation.

6. Ability to work independently and in a group.
7. Ability to correctly interpret and present their own activities.

LEARNING OUTCOMES

LO 1 –Students will possess basic theoretical knowledge in the field of evolutionary algorithms and search strategies.

LO 2 – Students will possess knowledge about different types of evolutionary algorithms.

LO 3 – Students will know how to apply evolutionary algorithms to different problems.

LO 4 – Students will be familiar with applications of evolutionary algorithms in hybrid intelligent systems.

LO 5 – Students will be able to solve various optimization problems, working independently and in a group.

LO 6 – Students will be able to present results of their work, with correct interpretation, using proper sources of information and documentation.

MODULE CONTENT

Type of classes – Lectures	**Number of hours**
Lect. 1 - Introduction to the basic genetic algorithm	**2**
Lect. 2 - Optimization problems and search strategies	**2**
Lect. 3 - Different types of evolutionary algorithms	**2**
Lect. 4 - Applications of evolutionary algorithms	**2**
Lect. 5 - Encoding and genetic operators	**2**
Lect. 6 - Fitness functions	**2**
Lect. 7 - Selection methods	**2**
Lect. 8 - Mutation and crossover	**2**
Lect. 9 - Convergence of the genetic algorithm	**2**
Lect. 10 - Parameters of the evolutionary algorithms	**2**
Lect. 11 - Evolution strategies	**2**
Lect. 12 - Evolutionary programming	**2**
Lect. 13 - Genetic programming	**2**

Lect. 14 - Swarm intelligence and other optimization techniques	**2**
Lect. 15 - Evolutionary algorithms in hybrid intelligent systems	**2**
Type of classes– Laboratories	**Number of hours**
Lab. 1 - Software overview	**2**
Lab. 2 - Basic genetic algorithm in MATLAB	**2**
Lab. 3 - Optimization problems in MATLAB	**2**
Lab. 4 - Modifications of the basic genetic algorithm	**2**
Lab. 5 - Genetic algorithm in EXCEL	**2**
Lab. 6 - Evolutionary algorithms in VBA	**2**
Lab. 7 - Various applications of evolutionary algorithms	**2**
Lab. 8 - Traveling salesman problem	**2**
Lab. 9 - Example of multi-objective optimization	**2**
Lab. 10 - Example of optimization with constraints	**2**
Lab. 11 - Example of scheduling problem	**2**
Lab. 12 - Application to neural network learning	**2**
Lab. 13 - Genetic programming in LISP	**2**
Lab. 14 - Evolution strategies in MATLAB	**2**
Lab. 15 - Evolutionary programming	**2**
Type of classes– Project	**Number of hours**
Proj. 1 - Sorting by use of an evolutionary algorithm	**1**
Proj. 2 - Resource allocation problem solved by an evolutionary algorithm	**2**
Proj. 3 - Knapsack problem solved by an evolutionary algorithm	**2**
Proj. 4 - Class schedule created by use of an evolutionary algorithm	**3**
Proj. 5 - Job shop scheduling problem solved by an evolutionary algorithm	**2**
Proj. 6 - Bin packing problem solved by an evolutionary algorithm	**2**
Proj. 7 - Routing with constraints problem solved by an evolutionary algorithm	**3**

TEACHING TOOLS

1. – lectures using multimedia presentations
2. – blackboard and chalk or whiteboards and pens
3. – laboratory guides and tutorials
4. – reports from laboratory activities (paper and electronic versions)
5. – computer stations with software

WAYS OF ASSESSMENT (F – FORMATIVE, S – SUMMATIVE

F1. – assessment of preparation for laboratory exercises
F2. – assessment of the ability to apply acquired knowledge during laboratory exercises and projects
F3. – assessment of reports
F4. – assessment of activity during classes
S1. – assessment of the ability to solve the posed problems and the method of presentation of the obtained results - credit for the grade
S2. – assessment of mastery of the lecture material - passing the lecture (or exam)

*) warunkiem uzyskania zaliczenia jest otrzymanie pozytywnych ocen ze wszystkich ćwiczeń laboratoryjnych oraz realizacji zadania sprawdzającego

STUDENT'S WORKLOAD

L.p.	**Forms of activity**	**Average number of hours required for realization of activity**
1.	**Contact hours with teacher**	
1.1	Lectures	30
1.2	Tutorials	0
1.3	Laboratory	30
1.4	Seminar	0
1.5	Project	15
1.6	Consulting teacher during their duty hours	1
1.7	Examination	0

Total number of contact hours with teacher:		76
2. Student's individual work		
2.1	Preparation for tutorials and tests	6
2.2	Prreparation for laboratory exercises, writing reports on laboratories	10
2.3	Preparation of project	15
2.4	Preparation for final lecture assessment	10
2.5	Preparation for examination	0
2.6	Individual study of literature	8
Total numer of hours of student's individual work:		49
Overall student's workload:		100
Overall number of ECTS credits for the module		5
Number of ECTS points that student receives in classes requiring teacher's supervision:		3,04
Number of **ECTS** credits acquired during practical classes including laboratory exercises and projects :		1,8

BASIC AND SUPPLEMENTARY RESOURCE MATERIALS

1. Michalewicz Z., Genetic Algorithms + Data Structures = Evolution Programs, Springer, 1992.
2. Goldberg D.E., Genetic Algorithms in Search, Optimization, and Machine Learning, Addison-Wesley, 1989.
3. Davis L. (Ed.), Handbook of Genetic Algorithms, Van Nostrand Reinhold, New York, 1991.
4. Mitchell M., An Introduction to Genetic Algorithms, The MIT Press, 1996.
5. De Jong K., Evolutionary Computation: A Unified Approach, The MIT Press, 2006.
6. Fogel D.B., Evolutionary Computation: Towards a New Philosophy of Machine Intelligence, IEEE Press, New York, 1995.
7. Koza J.R., Genetic Programming: On the Programming of Computers by means of Natural Evolution, MIT Press, Massachusetts, 1992.
8. Beyer H.-G., Theory of Evolution Strategies, Springer-Verlag, 2001.
9. Simon D., Evolutionary Optimization Algorithms, Wiley, 2013.

MODULE COORDINATOR (NAME, SURNAME, INSTITUTE, E-MAIL ADDRESS)

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