Course name: **Inteligent systems of signal processing**		
Field of study: **Computer science**	Type of study: **Full-time**	Sourse code: **CIDM2_04**
Course characteristics: **Mandatory within the additional content**	Level: **Second (M.Sc.)**	Year: **I** Semester: **II**
Type of classes: **lectures, laboratories**	Hours per week: **2 lect^{E}, 2 lab**	ECTS points amount: **5 ECTS**

COURSE GUIDE

AIMS

A1. Acquainting the student with selected methods of intelligent data processing, especially artificial neural networks, genetic alorithms and multi-criterion optimization.

A2. Obtaining by the students the practical skils in recognizing the fields when presented methods could be applied.

A3. Obtaining by the students the practical skils in developing solutions to intelligent data processing.

PREREQUISITES

1. The basic knowledge in the field of the arithmetics.
2. The basic knowledge in the field of programming.
3. The skills of working alone and in the group.
4. The skills of correct interpretation and presentation of own activity.

LEARNING OUTCOMES

EK 1 – Students will possess adepth theoretical knowledge in the field of the feed forward neural networks and their learning

EK 2 – Students will possess abasic knowledge in the field of the recurrent neural networks, especially Hopfield's like networks.

EK 3 – Students will possess a basic knowledge in the field of the optimization process with using of Hopfield networks.

EK 4 – Students will possess a basic knowledge in the field of the construction of autoassociative memories with using of discrete Hopfield networks.

EK 5 – Students will possess a basic knowledge in the field of the optimization process with using of evolutionary algorithms.

EK 6 – Students will possess practical skils in developing neural networks and evolutionary programming to processing a data.

EK 7 – Students will develop the ability to use literature, databases and other sources in their work.

EK 8 – Students will develop the ability to work alone and in the team and prepare the report from the work.

CONTENT

Lectures	**Hours**

Lect. 1	Introduction to intelligent computational system	**2**
Lect. 2	Artificial neuron and its application. Single layer neural networks.	**2**
Lect. 3	Multilayer feed-forward neural networks and their lerning	**2**
Lect. 4	Multi-criterion optimization problems	**2**
Lect. 5	Physical bases of the Hopfield's structure - a spin glass theory.	**2**
Lect. 6	Continuous Hopfield Neural Networks	**2**
Lect. 7	Discrete Hopfield Neural networks	**2**
Lect. 8	Autoassociative memories	**2**
Lect. 9	Countinuous Hopfield's structures in optimization tasks	**2**
Lect. 10	Hybrid Hopfield's like networks	**2**
Lect. 11	Unsuppervised learning	**2**
Lect. 12	Hamming neural networks	**2**
Lect. 13	Self-organizing maps	**2**
Lect. 14	Genetic algorithms	**2**
Lect. 15	Evolutionary strategies	**2**
Laboratories		**Hours**
Lab. 1	Perceptron in logical processing (OR, AND)	**2**
Lab. 2	Multilayer neural network for XOR processing	**2**
Lab. 3	Multilayer neural network for XOR processing	**2**
Lab. 4	Autoassociative memory for storing letters patterns	**2**
Lab. 5	Autoassociative memory for storing letters patterns	**2**
Lab. 6	Countinuous Hopfield Network for solving of travelling salesman problem	**2**
Lab. 7	Countinuous Hopfield Network for solving of travelling salesman problem	**2**
Lab. 8	Self-Correcting Neural Network for solving of N-Quinn problem	**2**
Lab. 9	Self-Correcting Neural Network for solving of N-Quinn problem	**2**
Lab. 10	Unsupervised learning of Neural Networks - vectors classification	**2**
Lab. 11	Unsupervised learning of Neural Networks - vectors classification	**2**
Lab. 12	Self-organizing maps for objects systematization	**2**
Lab. 13	Self-organizing maps for objects systematization	**2**
Lab. 14	Evolutionary strategy for functions fitting	**2**
Lab. 15	Evolutionary strategy for functions fitting	**2**

TEACHING TOOLS

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

LITERATURE

1. Andries P. Engelbrecht: Computational Intelligence: An Introduction, Wiley 2007
2. James P. Coughlih, Robert H. Baran: Neural Computation in Hopfield Networks and Boltzmann Machines, Univ of Delaware Pr 1995
3. Dan Simon: Evolutionary Optimization Algorithms, Wiley 2013
4. Rangarajan K. Sundaram: A First Course in Optimization Theory, Cambridge University Press 2014
5. Teuvo Kohonen: Self-Organization and Associative Memory, Springer-Verlag, 1988

TEACHERS

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ADDITIONAL NOTES

Links to course unit teaching materials can be found on the http://iisi.pcz.pl/CIaDM/ website for current students.