Szkoła Doktorska
Politechniki Białostockiej

15-351 Białystok, ul. Wiejska 45a
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COURSE DESCRIPTION CARD

Course name	Artificial neural networks in regression problems and classification				
Course type	optional	**Course code**	SDPB0027	**ECTS credits**	**2**
Forms and number of hours	lecture: 10 h laboratory: 10 h	**Scientific discipline**	civil engineering and transportation, environmental engineering, mining and energy		

Course objectives	**Knowledge:** Getting to know the theory of artificial neural networks (ANN), types of networks, design and application of artificial neural networks in the analysis of the results of various types of research carried out in construction and environmental engineering. **Skills:** Application of the ANN method, assessment of the quality of the obtained networks, interpretation of the obtained results, operation of neural networks. **Social competences:** Ability to critically evaluate the achievements on the use of artificial neural networks to solve problems in various fields of science and practice.
Course content	**Lecture:** 1. Biological inspirations of ANN, biological neuron, 2. ANN properties, historical outline of ANN, 3. Artificial neuron and its operation, activation functions, data scaling, 4. Operation of the neural network, regression and classification neural models, 5. Network design, network architecture: unidirectional networks, recursive networks, Kohonen networks, networks with radial base functions, 6. Layered networks: number of network parameters, linear neural networks, unidirectional multilayer networks, 7. Supervised training algorithm, network learning algorithms, objective function, back error propagation algorithm, network "overfitting", network error measures, selection of the best neural network. **Laboratory:** 1. Organization and operation of the Statistica Neural Network simulator, 2. Automatic network designer, data input, 3. Network design, 4. Interpretation of the results of network operation, selection of the best model, 5. Using of neural networks.
Teaching methods	Problem lectures with discussion, multimedia presentations, exercises in a computer laboratory - simulations, individual project of students based on their own data
Assessment method	Lecture: oral exam, discussion; Laboratory: project, presentation of the project, defense, and discussion

Symbol of learning outcome	Learning outcomes	Reference to the learning outcomes for the field of study for the 8th level of Polish Qualification Framework (PRK)	Methods of assessing the learning outcomes
LO1	Phd student knows and understands the methodology of scientific research.	SD_W3	Project

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POLITECHNIKA BIAŁOSTOCKA

LO2	Can use knowledge from various fields of science or art for the creative identification, formulation and innovative solving of complex problems or performing research tasks, in particular: - define the purpose and subject of research, formulate a research hypothesis, - develop research methods, techniques and tools and use them creatively, - make conclusions on the basis of research results	SD_U1	Project, discussion
LO3	He can disseminate the results of scientific activity, also in popular forms.	SD_U5	Presentation
LO4	He is ready: to critically evaluate his achievements within a given scientific or artistic discipline; to critically evaluate one's own contribution to the development of a given scientific or artistic discipline; to recognize the importance of knowledge in solving cognitive problems and practical.	SD_K1	Defense of project, discussion

Student workload (in hours)	
Lecture / laboratory	10 / 10
Consultations	5
The unassisted student work	30
Implementation of project tasks and preparation for and participation in exams/tests	5
Total	**60**
ECTS credits	**2**

Basic references	1. Tadeusiewicz R., Gonciarz T., Borowik B., Leper B.: Odkrywanie właściwości sieci neuronowych przy użyciu programów w języku C#. Wyd. PAU, Kraków 2007. 2. Masters T.: Sieci neuronowe w praktyce. Programowanie w języku C++. WN-T, Warszawa 1996. 3. Osowski S.: Sieci neuronowe do przetwarzania informacji Ofic. Wyd. Polit. Warsz., Warszawa 2006. 4. Stanisz A.: Przystępny kurs statystyki z zastosowaniem STATISTICA PL na przykładach z medycyny. Tomy: 1, 2, 3, StatSoft, Kraków 2006, 2007, 2007.
Supplementary references	1. Duch W., Korbicz J., Rutkowski L., Tadeusiewicz R.: Sieci neuronowe. Tom 6: Biocybernetyka i inżynieria biomedyczna. Akad. Ofic. Wyd. Exit, Warszawa 2000. 2. Haykin S.: Neural Networks: A Comprehensive Foundation. Second Edition, Part I, Prentice Hall International, Inc. 1999. 3. Bishop Ch. M.: Neural Networks for Pattern Recognition. Clarendon Press, Oxford 1996.