SYLLABUS

SUBJECT: ARTIFICIAL INTELLIGENCE

TEACHER : Prof. WIESŁAW WAJS, PhD, DSc, Eng., JOLANTA WOJTOWICZ, PhD

COURSE DESCRIPTION:
The aim of the course is to provide the most fundamental as well as the most useful concepts and methods of the artificial intelligence.

LECTURE:
Introduction and artificial intelligence subject: The field of artificial intelligence has a history of some six decades but it has found a solid application only in the past years, and the field is still developing rapidly. Throughout the toolbox emphasis is placed on neural network paradigms that build up to or are themselves used in the engineering applications today.

Neuron Model and Network Architectures: Neuron model, single input neuron, transfer function, multiple input neuron, a layer of neuron, multiple layers of neurons, multiple input vectors, learning rule, training.

Linear Network: Linear network functions, designing a linear neuron, training a linear neuron, training a linear layer, a learning rate, and an adaptive linear layer.

Backpropagation: Important backpropagation functions, network architecture, initialization, learning rule, training, training a nonlinear neuron, local and global error minima, function approximation, improving backpropagation.

Neural Networks: Radial basis network, self-organizing networks, recurrent network.

Applications: Linear prediction, adaptive prediction, linear system identification, adaptive system identification, adaptive noise cancellation.

CLASSES:
Modeling and programming by practical exercises on elements such as classification with a two-input perceptron, classification with 3-input perceptron, classification with 2-neuron perceptron, classification with a two-layer perceptron, training a nonlinear neuron, local and global error minima, learning rates, function approximation, faster backpropagation, Levenberg – Marquardt method, radial basis approximation, character recognition.

LEARNING OUTCOMES:
Students should acquire a basic knowledge about the most fundamental and useful notions, concepts and methods of the artificial intelligence.

GRADING POLICY:
LECTURE: Written test.
CLASSES: Two written tests.

TIMETABLE:
Number of hours:
LECTURE: 2h x 15 weeks = 30 hours (1 semester)
CLASSES: 2h x 15 weeks = 30 hours (1 semester)

TEXTBOOK AND REQUIRED MATERIALS:

[1] http://pl.wikipedia.org/wiki/Algorihm_Levenberga-Marquardta
[2] K. Levenberg. A Method for the Solution of Certain Non-linear Problems in Least Squares. Quarterly of Applied Mathematics, 2(2):164–168, Jul. 1944.
[3] D. Marquardt. An Algorithm for the Least-Squares Estimation of Nonlinear Parameters. SIAM Journal of Applied Mathematics, 11(2):431–441, Jun. 1963.
[4] K. Madsen, H.B. Nielsen, O. Tingleff: METHODS FOR NON-LINEAR LEAST SQUARES PROBLEMS, 2nd Edition, April 2004.
[5] P.E. Frandsen, K. Jonasson, H.B. Nielsen and O. Tingleff (2004): Unconstrained Optimization, 3rd Edition, IMM, DTU.
[6] Damping parameter in Marquardt's Method, Hans Bruun Nielsen, Technical Report IMM-REP-1999-05.
[7] Global Optimization Test Problems http://www-optima.amp.i.kyoto-u.ac.jp/member/student/hedar/Hedar_files/TestGO.htm
[8] S.J. Russell, P. Norvig: Artificial Intelligence: A Modern Approach. Prentice Hall, Englewood Cliffs, NY 1995.

PREREQUISITES:

High school course in mathematics.