COURSE TITLE:

ARTIFICIAL INTELLIGENCE

INSTRUCTOR:

Professor Ioannis Boutalis

ABSTRACT AND AIMS:

Artificial intelligence concerns mainly computational approaches aiming at the incorporation of a sort of "intelligence" in the computer. This lesson covers the basic notions of artificial intelligence and provides, in an introductory level, its main aspects, like solution searching techniques, the machine learning and the artificial neural networks, the evolutionary algorithms, elements from fuzzy knowledge representation and fuzzy aggregation and finally the expert systems. It also presents various applications of artificial intelligence in our every day activity.

The lesson aims to provide the students with the necessary theoretical substantiation of the topics that are presented and familiarize them with their use in various fields of application by using proper number of personal or team works.

SYLABUS:

Basic concepts and applications of artificial intelligence. Problem representation and solution. Solution searching techniques (Blind search algorithms, heuristics and informed solution searching, game algorithms, nature inspired algorithms). Evolutionary computations (Introduction to Genetic Algorithms, solution finding and optimization using GA, applications) Introduction to machine learning and Artificial Neural Networks (Basic concepts in neuronal computation, biological and artificial neurons, basic structures and ANN models, learning algorithms). Introduction to expert systems. Introduction to fuzzy systems (fuzzy logic, fuzzy sets, fuzzy relations, fuzzy linguistic description and reasoning)

CALENDAR:

Unit #	Course objective
1	Introductory concepts, history and applications of artificial Intelligence. Knowledge representation and problem solution. Graphs and searching trees.
2	Solution searching techniques. Blind searching algorithms (Width search, depth search and iterative deepening algorithm).
3	Heuristics and informed searching. The algorithms BestFs, A-star, Hill Climbing, Stochastic Hill Climbing, Simulated Annealing. Nature inspired algorithms.
4	Two players games. The MAX-MIN algorithm and the data pruning technique. Use of Matlab in solution searching problems.
5	Introduction to Genetic algorithms, basic elements of a GA. Solving optimization problems using GA. Use of optimization toolbox of Matlab to implement a GA.
6	Introduction to neural networks. Biological neurons and biological neural networks. Artificial neurons and artificial neural networks (ANN structures, classification of machine learning techniques).
7	The perceptron and its learning rule. The non linear separability problem of the input space. Hebian learning, associative memories.
8	Adaline, madaline networks and the Delta learning rule. Neural network structures that overcome the nonlinear separability problem. Multilayer feed forward neural networks and the error back propagation learning rule.

9	ANN simulation. Use of Matlab NN toolbox. Use of MLFFNN in pattern recognition, classification and function approximation applications.
10	Radial Basis Functions (RBF) neural networks and their learning approaches. High order NNs and their learning
11	Introduction to experts systems.
12	Introduction to fuzzy systems. Fuzzy sets, fuzzy relations, fuzzy reasoning.
13	Selective applications of artificial intelligence: Optical Character Recognition, natural language understanding, machine translation, image recognition and understanding.

BIBLIOGRAPHY:

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3. S. Haykin, "Neural Networks and Learning Machines - 3rd edition", Pearson Prentice Hall, New Jersey, 2009.
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