Biologically inspired computation

Academic Year: (2020 / 2021) **Review date: 30-07-2020**

Department assigned to the subject:

Coordinating teacher: ISASI VIÑUELA, PEDRO

Type: Electives ECTS Credits : 3.0

Year : 1 Semester : 1

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

None

OBJECTIVES

Nature inspired techniques have recently become very important within the field of Artificial Intelligence. The course aims to introduce students to these techniques, in its most advanced aspects. The key objectives are to help students understand the theoretical foundations of these techniques, how they can be used to solve problems, and in which areas are most useful and effective.
The biologically-inspired techniques are based, mainly, on two separate paradigms, Genetic Algorithms and Neural Networks. Both paradigms are covered in the course, as well as the relationship between them and their combined use to expand the effectiveness of problem solving separately.

DESCRIPTION OF CONTENTS: PROGRAMME

1. Introduction to bio-inspired computing techniques
   1.1. Biological inspiration in engineering
   1.2. General concepts of evolutionary algorithms

2. Emerging systems
   2.1. Complex adaptive systems
   2.2. Self-organized systems
   2.3. Cellular Automata
   2.4. Evolution of strategies of cooperation / competition

3. Swarm systems
   3.1. Glowworm Optimization
   3.2. Particle Swarm Optimization
   3.3. Ant Colony Optimization
   3.4. Bee Colony Optimization
   3.5. Swarm Robotics

4. Applications of bio-inspired systems
   4.1. Generation of rules by means of Evolutionary Strategies
   4.2. Colonies of ants for the generation of paths in graphs
   4.3. Evolutionary paradigm for the generation of classifiers systems

LEARNING ACTIVITIES AND METHODOLOGY

1. Theoretical classes. magisterial teaching of the theoretical concepts of the course contents and their practical and applied aspect classes will be held.

2. Practical Case. Students must choose a case of problem resolution proposed by teachers and perform one of:

2.1 A critical analysis.
2.2 An implementation of the problem and experimentation environment in which they must be able to develop an analysis and conclusions on the case study.

3. Oral presentation. Students must perform in the classroom in front of their peers, an oral presentation and defense of case study developed.

4. tutorials will be conducted, both onsite and remotely.

ASSESSMENT SYSTEM

Evaluation will be done from two works, one theoretical work and and one practical work. They will be related with the subjects teached in class.

The works will be focused on current research topics and the students must complete a class presentation thereof.

% end-of-term-examination:	0
% of continuous assessment (assigments, laboratory, practicals…):	100

BASIC BIBLIOGRAPHY

- M. Mitchell An Introduction to Genetic Algorithms, MIT press, 1996

ADDITIONAL BIBLIOGRAPHY

- Gary William Flake The computational beauty of nature, MIT Press, 1998