# Automatic Programming

**Academic Year: ( 2021 / 2022 )** **Review date: 18-05-2020**

**Department assigned to the subject:**

**Coordinating teacher: ALER MUR, RICARDO**

**Type: Electives ECTS Credits : 3.0**

**Year : 1 Semester : 2**

## REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Although it is not necessary, it is useful to have taken subjects related to machine learning (data mining, neural networks, evolutionary computation, ...).

## OBJECTIVES

- To know the different types, techniques, and domains, of Automatic Programming (AP)
- To know how how AP techniques have been applied to some real domains
- To be able to do research work in PA
- To know the scientific method and being able to perform rigorous evaluation of results
- To be able to use AP and advanced machine learning tools
- To be able to understand and critically asses PA research articles
- To know the different types of publications in PA (surveys, empirical comparisons, original contributions, ...)
- To be able to present scientific contributions
- To be able to know if PA techniques can be applied to specific problems

## DESCRIPTION OF CONTENTS: PROGRAMME

1. Introduction
2. Deep Learning:
   2.1. Deep Neural Networks
   2.2. Recurrent Neural Networks
   2.3. Advanced topics in Deep learning
3. Evolutionary-computation
   3.1. Genetic Programming
4. Inductive Logic Programming/ILP
   4.1. Basic ILP techniques
   4.2. Relational Data Mining
5. Advanced reinforcement-learning
   5.1. Dynamic programming
   5.2. model-free and model-based methods
   5.3. Generalization in reinforcement-learning
   5.4. Knowledge-transfer in reinforcement-learning

## LEARNING ACTIVITIES AND METHODOLOGY

- Lectures
- Tutorials
- Student's individual work

## ASSESSMENT SYSTEM

a máximum of 10 marks will be awarded, by completing the following:

- 1 mark: Attendance
- 2 marks: Completion of one or two small assignments with tools related to lectures.
- 6.5 marks: Theoretical and/or practical assignment. Grading will depend on the complexity of the work. Theoretical works based on literatura review will obtain smaller grades than empirical works involving computational experiments.
- 0.5 marks: oral presentation of work (not compulsory)

The extraordinary evaluation will follow the same criteria as the ordinary one.

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

## BASIC BIBLIOGRAPHY


- Dzeroski S. and Lavrac Relational Data Mining., Springer-Verlag, 2001

- Ian Goodfellow, Yoshua Bengio and Aaron Courville Deep Learning, MIT Press (http://www.deeplearningbook.org), 2016

- Koza, John R Genetic programming : on the programming of computers by natural selection., MIT PRESS.

- Lavrac, N. and Dzeroski, S Inductive Logic Programming: Techniques and Applications, Ellis Horwood, New York, 1994

- Mitchell, T.M. Machine Learning, McGraw Hill, 1997

- R. Sutton y A. Barto.  Reinforcement Learning: an Introduction, The MIT Press, 1998


## ADDITIONAL BIBLIOGRAPHY


- Koza, John R. Genetic Programming II: Automatic Discovery of Reusable Programs, MIT PRESS.

- O-Reilly, Una-May et al. (eds.) Evolutionary Computation. Trends in Evolutionary Methods for Program Induction, MIT PRESS.

- Olsson, J. R. Inductive functional programming using incremental program transformation. Artificial Intelligence. Vol. 74:1, 55-83, Elsevier, 1995


## BASIC ELECTRONIC RESOURCES

- Ian Goodfellow and Yoshua Bengio and Aaron Courville . Deep Learning: http://www.deeplearningbook.org/

- Ricardo Aler . Automatic Inductive Programming tutorial (ICML 2006): http://www.evannai.inf.uc3m.es/et/icml06/aiptutorial.htm