Universidad Francisco de Vitoria UFV Madrid

Teaching guide

IDENTIFICATION DETAILS

Degree:	Business Analytics
Field of Knowledge:	Social and Legal Science
Faculty/School:	Law, Business and Governance
Course:	ARTIFICIAL INTELLIGENCE
Type:	Optional
ECTS credits:	6
Year:	2
Code:	5351
Teaching period:	Fourth semester
Area:	IT applied to Business Analytics
Module:	Disciplinary Training
Teaching type:	Classroom-based
Language:	English
Total number of student study hours:	150

Teaching staff	E-mail
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SUBJECT DESCRIPTION

The subject will be focused on the study of intelligent agents: how they receive percepts from the environment, reason and choose actions. We will study the concept of rationality, the nature of environments and different agents' structures. The subject will cover solving problems by searching, including classical, local and adversarial searching algorithms (deterministic and nondeterministic, under full and partial observability). Within adversarial search, we will cover optimal decision in games, including stochastic and partially observable environments. We will analyze knowledge, reasoning and planning of utility-based agents.

GOAL

The main goal of the course it to provide students with the knowledge required to understand, model and program computer agents that can learn, plan and solve problems autonomously, particularly (but not only) in business settings.

The specific aims of the subject are:

Understand the key concepts of artificial agent from the perspective of rationality, environment, actions and rewards.

Develop the necessary skills to quantitatively model problems and solve them through agent-based algorithms.

Learn to quantify uncertainty, reason probabilistically and understand the concepts of complex decision-making in environments under uncertainty.

PRIOR KNOWLEDGE

The subject will build on the knowledge acquired by the student in Introduction to Statistics and Probability, Algorithms, Programming and Algebra.

We will use Python as programming language. Prior of Python knowledge is not required, but the student should be familiar with algorithms and data structures in general and be familiar with at least one other programming language. Key concepts will be developed using pseudo-code, using Python code as a tool to show a particular implementation. The idea is to focus more on the structure of the programs that on the syntax and semantics of a particular language. By the end of the course, the student should be able to connect pseudo-code and its particular Python implementation and make small changes or extensions to functions or snippets.

COURSE SYLLABUS

Part I Artificial Intelligence
-Introduction to intelligent agents
Part II Problem Solving
-Classical Search
-Adversarial Search
Part III Uncertain Knowledge and Reasoning
-Probabilistic Reasoning
-Making Complex Decisions

EDUCATION ACTIVITIES

AI is demanding both in terms of conceptual understanding and programming (data structures and algorithms). Lectures will begin with a compelling case, and then approach it with a bottom up approach, starting with concepts and developing the solving strategy up to the pseudo-code.

Students are required to bring a computer to class with Python (most recent stable version), an IDE (PyCharm or similar) and Git installed. If you don’t’ have this environment, please install it before the first day of class. Code will be distributed using a dedicated GitLab repository (create an account if you don’t already have it). We will use live coding and build, modify, and extend code from the textbooks o created by the lecturer. Students are expected, at the beginning of each class, to have the environment open and access to a recent version of the repository.

Individual work will be required to prepare the class by reading the corresponding sections of the textbook and familiarizing with the code that will be discussed in class: the lecturer will assume some familiarity with the code that will be used during the lecture. It is therefore a requirement to study the main sections of the code BEFORE class, using a Flipped Learning Approach.

During the live coding sections of the class, students will sometimes work in pairs to develop or modify code.

There will be several graded Assignments and Class Quizzes throughout the term. Questions will refer to key concepts or pseudo-code discussed in earlier classes. The idea of the Assignments to provide early feedback both to the student and the professor.

Assignments are individual work and plagiarism will be controlled. A student may be asked, at any time, to reproduce the code submitted (with identical or similar data) and/or explain his or her code/answers. If the student is not able to do so, the University will consider that the student has not submitted original, individual work as required by this teaching guide for quizzes, assignments, and the final exam. Plagiarism rules contained in paragraphs 7 and 9 of the UFV Coexistence Regulations (Normativa de Convivencia) may apply at the discretion of the University.

DISTRIBUTION OF WORK TIME

CLASSROOM-BASED ACTIVITY	INDEPENDENT STUDY/OUT-OF-CLASSROOM ACTIVITY
60 hours	90 hours

SKILLS

Basic Skills

Students must have demonstrated knowledge and understanding in an area of study that is founded on general secondary education. Moreover, the area of study is typically at a level that includes certain aspects implying knowledge at the forefront of its field of study, albeit supported by advanced textbooks

Students must be able to apply their knowledge to their work or vocation in a professional manner and possess skills that can typically be demonstrated by coming up with and sustaining arguments and solving problems within their field of study

Students must have the ability to gather and interpret relevant data (usually within their field of study) in order to make judgments that include reflections on pertinent social, scientific or ethical issues

Students must be able to convey information, ideas, problems and solutions to both an expert and non-expert audience

Students must have developed the learning skills needed to undertake further study with a high degree of independence

General Skills

Capacity for achieving objectives, problem-solving and decision-making in the environment of quantative and qualititative mass data.

Capacity for critical, self-critical, analytical and reflexive thought.

Specific skills

Know how to manage quantative and computer tools for decision-making.

Be able to understand the basics, paradigms and techniques of intelligent systems, and analyse, design and build computer systems, services and applications which use these techniques in the field of big data.

Understand the function and market of company information intelligence systems and big data, and their main uses and components for providing information, and knowledge that allows for better decision-making in

companies.

LEARNING RESULTS

Understand the nature of intelligent agents, actions and environments and use the key concepts related to problem solving in AI.

Understand representations of complex environments and ability to define problems quantitatively

Capacity to describe and analyze how agents can develop policies through the interaction with the environment

Develop and apply AI models to solve simple problems and evaluate their performance.

LEARNING APPRAISAL SYSTEM

Evaluation items:

- Assignments and class quizzes (40%)
- Written exam covering theory and practice (50% of final grade)
- Participation (10%)

For students unable to attend classes (Erasmus, etc) or students repeating this course, grading will be done as follows:

- Assignments and class quizzes (50%)
- Written exam covering theory and practice (50% of final grade)

Please contact the professor if you are in this group.

Criteria to pass:

- Obtain at least a 5 in the written exam
- Obtain an average of at least of 5 in the class assignments.
- Assignments will have a due date. Students can submit late after this due date and up to two weeks before the last class of the term, but the grade of the late assignments will be reduced by 30% as a penalty. No submissions will be allowed after.
- Presenting all assignments and class quizzes is not a requirement, but the grade of a missed assignment will be zero and will be averaged with the rest of the submissions.

The appraisal system will in any case be subordinated to the appraisal norms established by the University.

Plagiarism and other forms of academic dishonesty are unacceptable and will make the students liable according to paragraphs 7 and 9 of the UFV Coexistence Regulations (Normativa de Convivencia).

In case new health care regulation results in changes that requires part of the in-class activity to be arrange remotely, the Professor will arrange synchronous classes during the same time and days. Assistance and active participation to these classes is compulsory and will be evaluated as described above, with the same weights.

Exams will be on-site, if heath care regulations allow it, but may be modified if need be to comply with the requirements of health care authorities. Class Assignments and the written exam may be arranged using online tools available in Virtual Classroom. Weights don’t change.

BIBLIOGRAPHY AND OTHER RESOURCES

Basic

Russel, S., Norvig., P., Artificial Intelligence: A Modern Approach (4th Edition) (Pearson Series in Artifical

Intelligence) 4th Edition, Prentice Hall (2020), including the online code and demos available in the GitHub repository http://aima.cs.berkeley.edu/code.html

Additional

Richard S. Sutton and Andrew G. Bartom Reinforcement Learning: An Introduction, Second edition MIT Press, Cambridge, MA, 2018 (2018), available here http://incompleteideas.net/book/the-book-2nd.html, including the code in the GitHub repository available here https://github.com/ShangtongZhang/reinforcement-learning-an-introduction
(We will use this book to go deeper in the chapters dealing with Reinforcement Learning)

Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning Data Mining, Inference, and Prediction Second Edition Springer (2017)
(Support for statistics, supervised and unsupervised learning)

For the brave, a good set of articles on AI and, specifically, RL, is available https://drive.google.com/drive/folders/1V9jAShWpccLvByv5S1DuOzo6GVvzd4LV (compiled by Richard S. Sutton and Andrew G. Bartom)