

Artificial Intelligence applied to Construction

Grau d'Arquitectura Tècnica i
Edificació

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TEACHING STAFF

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LEARNING OBJECTIVES OF THE COURSE

Knowledge of the main **applications** of artificial intelligence in the field of construction.

Use of existing tools to automate or facilitate common processes of companies in the construction sector.

Learning to **locate and handle the resources** necessary for the application of AI methods, and **incorporate** them into the execution processes in construction.

Understanding the **basics of AI**, as well as the **main ideas** that govern **machine learning algorithms**.

CONTENTS: presentation

Artificial intelligence: examples of applications to building construction.

Description:

General view of the subject, with examples of diagnosis of pathologies, valuation of properties, energy efficiency, estimation of construction costs,... which will be discussed along the course.

Specific objectives:

Introduce, through examples, applications of artificial intelligence in the field of construction.

Related activities:

Introductory lectures.

Full-or-part-time: 2h 40m

Theory classes: 1h

Self study : 1h 40m

CONTENTS: Generative AI

Generative artificial intelligence

Description:

Know and use different tools for the generation of texts, images, plans...

Specific objectives:

Know how to write prompts for the generation of quality texts and images.

Understand the benefits of different tools available in the field of generation with artificial intelligence.

Related activities:

We will define different processes of activities in the construction sector and use tools to automate or streamline these processes.

Full-or-part-time: 18h 55m

Theory classes: 2h 45m

Practical classes: 4h 30m

Self study : 11h 40m

CONTENTS: Predictive AI

Predictive artificial intelligence

Description:

Understand the importance of data collection in any business area and process and automate the interpretation of this data.

Specific objectives:

Learn about the possibilities offered by different tools to develop data collection applications.

Use artificial intelligence to train models and make predictions from a set of data.

Related activities:

Develop a data collection application and use artificial intelligence to analyze that data and make predictions.

Full-or-part-time: 18h 55m

Theory classes: 2h 45m

Practical classes: 4h 30m

Self study : 11h 40m

CONTENTS: machine learning algorithms

Idees bàsiques d'aprenentatge automàtic: regressió, xarxes neuronals artificials i altres algorismes.

Description:

Introduction of an overview of supervised learning versus unsupervised learning, and of classification problems versus regression problems.

Study of supervised learning problems using regression methods, both linear and multilinear.

Basic structure of an artificial neural network.

Elementary examples of artificial neural networks.

Analysis of network components in an application to building construction.

Other methods of artificial intelligence: genetic algorithms; unsupervised learning.

Specific objectives:

Distinguish between supervised and unsupervised learning.

Distinguish between classification and regression problems.

Understand the concepts and procedures needed to perform a (multi)linear regression from experimental data: regression model, cost functions, gradient descent method.

State the possibility of other type of regressions.

Understand the basic knowledge of artificial intelligence, as well as the main ideas that govern machine learning algorithms.

Know some relevant algorithms: neural networks, genetic algorithms, simulated annealing, transformers,...

Learn to locate and manage the resources needed for the application of artificial intelligence methods, and incorporate them into the execution processes in building construction.

Related activities:

Exercises to assimilate concepts, reading articles and modifying programming code. The block culminates with a practical application of using software to solve a classification or regression problem, based on data from construction-related problems.

Full-or-part-time: 34h 30m

Theory classes: 5h 30m

Practical classes: 9h

Self study : 20h

CHRONOGRAM

Monday 12AM-2PM		
1	ALL / JM PRESENTATION / GENERATIVE IA	9 september
2	JM GENERATIVE AI	16
3	JM GENERATIVE AI	30
4	JM GENERATIVE AI	7 october
5	JM GENERATIVE AI	14
6	JM / SG GENERATIVE / PREDICTIVE AI	21
7	SG PREDICTIVE AI	28
8	SG PREDICTIVE AI	4 november
9	SG / TG PREDICTIVE AI / REGRESSION	11
10	TG REGRESSION	18
11	TG NEURAL NETWORKS	26
12	TG OTHER ALGORITHMS	2 december
13	TG NEURAL NETWORKS IN DEPTH	9
14	TG NEURAL NETWORKS IN DEPTH	16
15	TG PRESENTATIONS (10-12h)	≈13 january

Last update: 202408291000

GRADING SYSTEM

BLOCKS 1 and 2: At the end of the topics "Generative artificial intelligence" and "Predictive artificial intelligence", a deliverable task will be proposed; each of them will be assessed with **25% of the grade of the course**.

BLOCK 3: Continuous evaluation, with:

- (a) delivery of the resolution of **3 exercises** to validate the knowledge acquired, with an assessment, which will count for **7.5%, 7.5% and 10%** of the course's grade, respectively;
- (b) completion of **a mini-project** applying artificial intelligence tools to a constructive problem, of which a short report and an oral presentation will be made, which will count for **25%** of the mark of the course. The mini-project will be presented in January, on the date set by the center's calendar (approx. Jan 13th).

Orientative date for the delivery of the 3 validation exercises: **26/11**, **09/12** and **07/01**. The mini-project will be presented in January (date to be determined together).

This course **does not have a final exam or re-evaluation exam**. In the event that a student does not pass the subject once the scheduled assignments have been evaluated, and their grade is between a 3 and a 5 over 10, a new deliverable mini-project will be proposed.

BIBLIOGRAPHY AND OTHER RESOURCES

- AI tools and/or reference texts (some articles) will be proposed in each block.
- In Block 3, AI packages from the Matlab program will be used.