



Course guide

804245 - IAVJ - Artificial Intelligencey

Last modified: 27/07/2022

Unit in charge: Image Processing and Multimedia Technology Centre
Teaching unit: 804 - CITM - Image Processing and Multimedia Technology Centre.

Degree: BACHELOR'S DEGREE IN VIDEO GAME DESIGN AND DEVELOPMENT (Syllabus 2014). (Compulsory subject).

Academic year: 2022 **ECTS Credits:** 6.0 **Languages:** Catalan, English

LECTURER

Coordinating lecturer: Escudero, Gerard

Others: Escudero, Gerard
Ysard, Jordi

PRIOR SKILLS

Knowledge about graf theory and coding in C++

TEACHING METHODOLOGY

During each class, the lecturer will first show the students the theory behind the problem that needs solving. Together with the students, the lecturer will explore the different solutions that exist in the present that solve and simplify the complexities of real time applications like video games.

LEARNING OBJECTIVES OF THE SUBJECT

- Understand the basis of classic Artificial Intelligence areas like genetic algorithms and neural networks.
- Good knowledge of the most common AI techniques used in video games like hierarchical state machines and rule systems.
- Get familiar with advanced navigation tools like sectorization.
- Explore the newest methods in video game AI like Behavior Trees and Planners.

STUDY LOAD

Type	Hours	Percentage
Hours large group	18,0	12.00
Guided activities	12,0	8.00
Self study	90,0	60.00
Hours medium group	30,0	20.00

Total learning time: 150 h



CONTENTS

AI Agent navigation

Description:

Kinetic movement
Map Markup
Steering behaviors
Coordinating movement for groups

Full-or-part-time: 21h 30m

Theory classes: 8h

Self study : 13h 30m

Pathfinding systems

Description:

The base of Dijkstra, A*
Navigation Mesh and sectorization
Path beautification
Common improvements on A*

Full-or-part-time: 21h 30m

Theory classes: 8h

Self study : 13h 30m

Perception Systems

Description:

Simulating senses
Level Markup techniques

Full-or-part-time: 11h 30m

Theory classes: 4h

Self study : 7h 30m

Decision making for videogames

Description:

Hierarchical state machines
Rule systems
Fuzzy logic
Scripting

Full-or-part-time: 16h 30m

Theory classes: 6h

Self study : 10h 30m



Advanced systems for decision making

Description:

Sharing information with Blackboards
SmartObjects
Behavior Trees
Planners

Full-or-part-time: 16h 30m

Theory classes: 6h

Self study : 10h 30m

Tactic and strategic systems

Description:

Code Structure
Waypoints Markup
Tactical Pathfinding

Full-or-part-time: 16h 30m

Theory classes: 6h

Self study : 10h 30m

Learning systems

Description:

Reinforced Learning
Neural Networks
Genetic Algorithms

Full-or-part-time: 20h 30m

Theory classes: 14h 30m

Self study : 6h

AI game design

Description:

Shooters and 3rd person
Driving
RTS
RPGs & Turn Based

Full-or-part-time: 25h 30m

Theory classes: 12h

Self study : 13h 30m



ACTIVITIES

Project 1

Description:

Implementation of the behaviour of agents focusing on the concepts:

- Navigation system
- Pathfinding system
- Flocking

Specific objectives:

- Navigation system
- Pathfinding system
- Flocking

Material:

Slides of the subject.

Delivery:

Unity Project + Report

Full-or-part-time: 13h

Self study: 13h

Project 2

Description:

Implementation of the behaviour of agents focusing on the concepts:

- Decision Making

Specific objectives:

Behavior Trees

Material:

Slides of the subject.

Delivery:

Unity Project + Report

Full-or-part-time: 10h

Self study: 10h

Project 3

Description:

Implementation of an agent's behaviour using reinforcement learning with mlagents.

Specific objectives:

Reinforcement Learning.

Material:

Slides of the subject.

Delivery:

Unity Project + Report

Full-or-part-time: 13h

Self study: 13h



Project 4

Description:

Implementation of a tactical system and formation movement.

Specific objectives:

- Tactics
- Formation movement

Material:

Slides of the subject.

Delivery:

Unity project + Report

Full-or-part-time: 10h

Self study: 10h

Exercise 1

Description:

Implementation of the behavior of an agent with planning techniques with AIPlanner.

Specific objectives:

GOAP

Material:

Slides of the subject.

Delivery:

Unity project.

Full-or-part-time: 3h

Self study: 3h

Exercise 2

Description:

Quiz

Specific objectives:

Machine Learning

Material:

Slides of the subject.

Delivery:

Kahoot

Full-or-part-time: 3h

Self study: 3h



GRADING SYSTEM

Project that will be divided into 4 deliveries:

1. Movement and pathfinding with a weight of 20%
2. Decision making with a weight of 20%
3. Machine Learning with a weight of 20%
4. Tactics with a weight of 20%

Exercises of planners and machine learning with a weight of 10%.

Competence participation and learning attitude with a weight of 10%.

There will be no reevaluation test due to the practical approach of the subject

BIBLIOGRAPHY

Basic:

- Millington, Ian. AI for games . Third edition. Boca Raton : CRC Press, [2019]. ISBN 978-1-138-48397-2.

Complementary:

- Chollet, Francois. Deep Learning with Python. 2nd Edition. Manning, 2021.

- Lanham, Micheal. Hands-On Reinforcement Learning for Games. Packt, 2020.

- Géron, Aurélien. Hands-on machine learning with Scikit-Learn, Keras, and TensorFlow : concepts, tools, and techniques to build intelligent systems . Second edition. Sebastopol, CA : O'Reilly Media, Inc, September 2019. ISBN 9781492032649.