Course guide
804245 - IAVJ - Artificial Intelligency

Last modified: 25/04/2024

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: 2024 **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

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
Self study	90,0	60.00
Guided activities	12,0	8.00
Hours large group	18,0	12.00
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

Exercises

Description:
Every week or every two weeks, an exercise will be given in class in which what has been discussed in theory is applied or implemented.
Some examples of these exercises will be:
- Application of the flocking algorithm
- Exercise on perception
- Animation control with state machines
- Behaviors with behavior trees
- Training of a neural network
- Formation movements

The different exercises will have 2 types of weighting (depending on their difficulty).
Of the exercises listed, the flocking algorithm and the behavior tree would have twice the weight of the rest.

Specific objectives:
All objectives of the course

Material:
Slides of the subject.

Delivery:
Implementation

Full-or-part-time: 34h 40m
Self study: 34h 40m

Project

Description:
Integration of the techniques that have been studied during the course in a free project.

Specific objectives:
All

Material:
Slides of the subject.

Delivery:
Implementation + video demo + Report

Full-or-part-time: 17h 20m
Self study: 17h 20m

GRADING SYSTEM

Exercises (60% weight):
Every week or every two weeks, an exercise will be given in class in which what has been covered in theory is applied.

Project (weight 30%):
The students will have to make a project in which the techniques that have been practiced during the course are integrated.

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:
- 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.
- Chollet, Francois. Deep Learning with Python. 2nd Edition. Manning, 2021.
- Lanham, Micheal. Hands-On Reinforcement Learning for Games. Packt, 2020.
- Newton, Peter L. i Feng, Jie. Unreal Engine 4 AI Programming Essentials. Packt Publishing, 2016. ISBN 978-1-78439-312-0.