INSTITUTO POLITÉCNICO DE BRAGANÇA

Course Unit	Artificial Intelligence			Field of study	Computing Science								
Bachelor in	Game Design			School	School of Public Management, Communication and Tourism								
Academic Year	2022/2023	Year of study	3	Level	1-3	ECTS credits	6.0						
Type	Semestral	Semester	1	Code	8309-414-3105-00-22								
Workload (hours)	162	Contact hours	T -	TP 15	PL 45	TC -	S -	E -	OT -	O -			

T - Lectures; TP - Lectures and problem-solving; PL - Problem-solving, project or laboratory; TC - Fieldwork; S - Seminar; E - Placement; OT - Tutorial; O - Other

Name(s) of lecturer(s): João Paulo Pereira de Sousa

Learning outcomes and competences

At the end of the course unit the learner is expected to be able to:
1. Discern when should use a classical solution and discern when should use an inductive solution
2. Establish a chronological and functional sight on the techniques of AI and its connections to other sciences
3. Know and understand the functioning of the artificial intelligence main models
4. Implement properly the AI knowledge in solving practical problems
5. Understand the limitations and advantages of the AI techniques
6. Adapt the AI techniques to specific case studies, for example: Pattern Recognition problems; path finding; games.

Prerequisites

Before the course unit the learner is expected to be able to:
1. Know how to implement algorithmic solutions in a classical mode.
2. Know the fundamentals of linear algebra and logic.

Course contents

Introduction to Artificial Intelligence. Chasing and evading. Pattern, flocking and potential function-based movement. Basic and A* pathfinding. Scripting. State machines. Fuzzy logic. Rule-based AI. Basic probability. Decisions under uncertainty. Neural networks. Genetic algorithms. Practical implementation of multiple cases. Designing game AI.

Course contents (extended version)

1. Introduction to Artificial Intelligence
2. Chasing and evading (in tiled and continuous environments)
   - Basic chasing and evading
   - Line-of-sight
   - Intercepting
3. Pattern movement (in tiled and continuous environments)
4. Flocking
   - Follow the leader
   - Obstacle avoidance using feelers
5. Potential function-based movement
   - Lennard-Jones potential function
   - Swarm movement
   - Obstacle avoidance using potential functions
6. Basic pathfinding (in tiled and continuous environments)
   - Random obstacle avoidance
   - Tracing around obstacles
   - Breadcrumb pathfinding
   - Waypoints
7. A* pathfinding
   - Search area
   - Path scoring
   - Finding dead ends
   - Terrain cost
   - Influence mapping
8. State machines
   - Basic state machine model
   - Finite state machines
   - Nested state machines
   - Hierarchical state machines
9. Fuzzy logic
10. Goal-Oriented Behavior.
11. Basic probability
   - Probability rules
   - Conditional probability
12. Decisions under uncertainty
   - Bayesian networks
13. Designing games IA
   - The Design
   - Shooters
   - Driving
   - Real-Time Strategy
   - Sports
   - Turn-Based Strategy Games
14. Neural networks and genetic algorithms.
15. Strategy

Recommended reading

1. Rabin S. (2017). Game AI Pro 3: Collected Wisdom of Game AI Professionals, 1st edition. A K Peters/CRC Press. 978-1498742580
2. Haykin S. (1999). Neural Networks: A Comprehensive Foundation. New York: Prentice Hall. 978-0132733502
3. Russell, S. J. , & Norvig, P. (2002). Artificial Intelligence: A Modern Approach. New York: Prentice Hall. 978-0137903955
4. Funge, J. , & Millington, I. (2019). Artificial Intelligence for Games, 3rd edition, New York: CRC Press. 978-1138483972
5. Bourg, D. M. , & Seemann, G. (2004). AI for Game Developers. O'Reilly Media. 978-0596005559

Teaching and learning methods

The theoretical-practical classes are performed at computer rooms (60 hours): There are exposure and explanation of concepts followed by computational experiments when appropriate. The non-presence period (98 hours): They are formed by individual or group study of selected topics accompanied by reading of literature and implementation of practical projects.

Assessment methods

1. Distributed assessment - (Regular, Student Worker) (Final, Supplementary, Special)
   - Practical Work - 65% (Four projects. Minimum score of 8. One of the works will be the Project between Curricular Units.)
   - Final Written Exam - 30% (Written test. Minimum score of 8 points.)
   - Projects - 5% (Project developed under the Interdisciplinary Week.)
2. Exchange students - (Regular, Student Worker) (Final, Supplementary, Special)
   - Practical Work - 65% (Four projects. Minimum score of 8. One of the works will be the Project between Curricular Units.)
   - Final Written Exam - 30% (Two written test. Minimum score of 8 points.)
   - Projects - 5% (Project developed under the Interdisciplinary Week.)

Language of instruction

Portuguese, with additional English support for foreign students.

Electronic validation

João Paulo Pereira de Sousa	Barbara Costa Vilas Boas Barroso	Elisabete da Anunciacao Paulo Morais	Luisa Margarida Barata Lopes
12-12-2022	05-01-2023	05-01-2023	15-01-2023