COURSE DESCRIPTION CARD - SYLLABUS

Course name
AI and games [S1SI1E>AIG]

Course

Field of study
Artificial Intelligence

Year/Semester
4/7

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
English

Form of study
full-time

Requirements
elective

Number of hours

Lecture
22

Laboratory classes
22

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

4,00

Coordinators

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Lecturers

Prerequisites

Programming skills. Basic mathematical knowledge from secondary school. Knowledge of basic algorithms and mechanisms of artificial intelligence.

Course objective

The aim of the course is to familiarize students with the problem of artificial intelligence in computer games, with particular emphasis on games taking place in real time. Students will learn solutions allowing to simulate intelligent behaviour of actors in games on the basis of professional solutions available e.g. in the Unreal Engine game engine.

Course-related learning outcomes

Knowledge:
K1st_W2: has a well-grouded knowledge of the problem of creating artificial intelligence in video games
K1st_W3: has well-structured, detailed theoretical knowledge of the key issues related to the creation of artificial intelligence in games, including the use of modern game engines and the use of components prepared there for the requirements of the created level for the needs of bots, and the very mechanisms of building intelligent behaviour and a way of presenting the game environment and

character movement
K1st_W4: knows basic techniques, methods and algorithms and tools for building intelligent behaviour of the character in the Unreal Engine environment
K1st_W7: has basic knowledge about the life cycle and processes occurring in software and hardware information systems with particular emphasis on artificial intelligence in games

Skills:
K1st_U3: is able to formulate and solve complex computer science problems with particular emphasis on programming character behaviour in a video game using appropriately selected engine components, scene queries, pathfinding mechanisms
K1st_U7: is able to critically analyse and evaluate the functioning of behaviour of an actor controlled by artificial intelligence scripts in a game
K1st_U8: is able to design - according to given specifications - and implement an algorithm simulating intelligent behaviour of various types of actors in the Unreal Engine
K1st_U9: is able to formulate and implement new algorithms controlling the behaviour of bots in different types of video games
K1st_U10: is able to acquire, analyse and process data of various types, synthesise it into knowledge and conclusions useful for improving the strategy of actors controlled by artificial intelligence scripts
K1st_U11: is able to use and adapt models of intelligent behaviour and is familiar with the components of the Unreal Engine used for this purpose

Social competences:
K1st_K1: understands that with regard to the subject matter of artificial intelligence in games, knowledge and skills quickly become out-of-date, recognizing the need for continuous education and improvement of own competences
K1st_K2: is aware of the significance of knowledge and scientific research connected with computer science and artificial intelligence in solving practical problems of key importance for the functioning of individuals and companies in such application areas as entertainment
K1st_K5: can think and act in an enterprising way
Translated with www.DeepL.com/Translator (free version)

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

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Lectures: Assessment test is conducted at the last lecture.
Labs: Part of the class on a selected topic students need to develop programs that control actors in games. These actors take part in tournaments organised for all students at once. The strategy of each solution should be documented in a report. Winners of the tournaments may be exempted from the lecture credit colloquium.

Programme content

The subject of the course concerns the design and implementation of actor behavior using mechanisms available in modern game engines, based on the example of Unreal Engine 5. As part of the course, students are responsible for programming bots in specially designed sample simulation environments.

Course topics

Introduction to the issue of artificial intelligence in computer games. Discussion of the basic types of mechanisms taking into account the game category. Characteristics and requirements for artificial intelligence in games.
Discussion of the evaLUAtion environment - a platform for learning to write scripts for artificial intelligence (bots) in games. Presentation of the board on which the game is played, basic control instructions. Presentation of LUA language characteristics. Presentation of how to implement such a solution.
The problem of actors movement in the given environment and used algorithms of path finding.
Modern game engines - what is a game engine anyway? Introduction to Unreal Engine. Discussing basic engine modules and class types. Programming with blueprints.
Presentation of artificial intelligence components in the engine. Presentation of how to create a

character controlled by artificial intelligence. Initialising input data and reacting to changing environments. Discussion of the Blackboard and BehaviourTree components.
Discussing the AI Racer platform - which is an environment based on the Unreal Engine enabling the creation of solutions controlling cars. Presentation of the basic elements of the platform and car control. Building a racetrack in the environment.
Discussion of the Environemt Query System mechanisms offered by the Unreal Engine. Presentation of system components. How to integrate the query system with the behaviour tree.
Tournament of fighting bots evaLUAtion - each student prepares scripts which constitute his team. These scripts then take part in a tournament, competing against the other teams.
AI Racer bot tournament - students prepare their scripts to control a car, which then take part in races on previously unknown race tracks.
Procedural generation of content e.g. maps.
Discussion of problems in creating artificial intelligence in games depending on the type of game.

Teaching methods

Lectures: multimedia presentations on selected topics combined with the presentation of selected modules of the discussed software.
Workshops: solving tasks presenting selected aspects of the discussed topics. Work on computers in dedicated environments.

Bibliography

Basic
Mark DeLoura, Game Programming Gems (Game Programming Series), Charles River Media, 2000
or
Mark DeLoura, tł. Rafał Jońca, Perełki programowania gier : vademecum profesjonalisty, T. 1, Helion, 2002
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Dante Treglia, Game Programming Gems 3 (Game Programming Series), Charles River Media, 2002
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Dante Treglia, tł. Rafał Jońca, Perełki programowania gier: vademecum profesjonalisty, T. 3, Helion, 2003
Mike Dickheiser, Game Programming Gems 6 (Game Programming Series), Charles River Media, 2006
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Mike Dickheiser, tł. Mikołaj Szczepaniak, Perełki programowania gier: vademecum profesjonalisty, T. 6, Helion, 2008
Mat Buckland, Programming Game AI by Example, Jones & Bartlett Learning, 2004
Joanna Lee, Unreal Engine: nauka pisania gier dla kreatywnych, Helion 2017
LUA reference manual LUA https://www.lua.org/docs.html
Unreal Engine documentation: https://docs.unrealengine.com/5.0/en-US/
Additional
Andrew Kirmse, Game Programming Gems 4 (Game Programming Series), Charles River Media, 2004
Kim Pallister, Game Programming Gems 5 (Game Programming Series), Charles River Media, 2005
Ian Millington, AI for Games, 3rd Edition, CRC Press, 2020

Breakdown of average student's workload

	Hours	ECTS
Total workload	100	4,00
Classes requiring direct contact with the teacher	44	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	56	2,00