RTU Course "Artificial Intelligence"

33000 Faculty of Computer Science, Information Technology and Energy

General data

Code	DE0478
Course title	Artificial Intelligence
Course status in the programme	Compulsory/Courses of Limited Choice
Responsible instructor	Jānis Grundspeņķis
Volume of the course: parts and credits points	1 part, 6.0 credits
Language of instruction	LV, EN
Annotation	Artificial intelligence is developing towards four goals – to create systems that think or act like humans, as well as systems that think or act rationally. In this study course students acquire knowledge about a modern approach to artificial intelligence – development of intelligent agents. The study course is focused on properties, environment, architectures and programmes of intelligent agents, logical agents, planning, uncertain knowledge and reasoning, making simple and complex decisions, inductive learning, learning decision trees, neural networks and reinforcement learning. In development of a course work students must use their theoretical knowledge for implementation of agent based intelligent systems and analysis of their performance.
Goals and objectives of the course in terms of competences and skills	The goal of the study course is to give theoretical knowledge and practical skills for development of agent-based intelligent computer systems. The objectives of the study course are: 1) present the intelligent agent paradigm, agent properties, architectures, structure and behaviour; 2) develop skills to use knowledge representation schemas and methods of knowledge processing; 3) provide knowledge about modelling of decision making and planning agents; 4) develop skills to use machine learning algorithms.
Structure and tasks of independent studies	Students independently must work out the study course work to consolidate acquired theoretical knowledge about modern approaches of intelligent system development. The report of the course work must include theoretical and practical part. The course work consists of five laboratory tasks (Intelligent agents, Search, Planning agents, Inductive learning, Complex decision making). Students have rights to replace no more than three laboratory tasks with individual tasks with the same workload, implementation of which requires development of software.
Recommended literature	Obligāta/Obligatory: 1. Russell S., Norvig P. Artificial Intelligence: A Modern Approach (4th edition). Pearson, 2020. (Var izmantot jebkuru no 4 izdevumiem/Any of the 4 editions can be used, 2006. gadā ir izdots grāmatas tulkojums krievu valodā) Papildus/Additional: 1. Luger G. F. Artificial Intelligence: Structures and Strategies for Complex Problem Solving (6th edition). Pearson, 2009. 2. Padgham L., Winikoff M. Developing Intelligent Agent Systems: A Practical Guide. Wiley, 2004. 3. Wooldridge M. An Introduction to Multiagent Systems (2nd edition). Wiley, 2009. 4. Engelbrecht A. P. Computational Intelligence: An Introduction (2nd edition). Wiley, 2007.
Course prerequisites	Basis strategies of state space search and knowledge representation schemas.

Course contents

Content	Full- and part-time intramural studies		Part time extramural studies	
	Contact Hours	Indep. work	Contact Hours	Indep. work
Definition and properties of intelligent agents.	2	2	0	0
The structure of intelligent agents.	2	2	0	0
Reflex agents and their varieties.	2	2	0	0
Agent environments and their characteristics.	2	2	0	0
Logical agents.	2	2	0	0
Intelligent agents.	4	8	0	0
Searching.	0	8	0	0
Knowledge representation and construction of knowledge base for logical agents.	2	2	0	0
Inference procedures of logical agents.	2	2	0	0
Inference rules in first-order logic.	2	2	0	0
Uncertain knowledge and probabilistic reasoning.	4	4	0	0
Bayesian networks, representing the full joint distribution, conditional independence relations.	2	2	0	0
The basics of utility theory.	2	2	0	0
Utility functions, dominance, preference structure and multiattribute utility.	2	2	0	0
Decision networks and decision-theoretic expert systems.	2	2	0	0
Sequential decision problems.	4	8	0	0
Utilities of states and value iteration algorithm.	2	4	0	0

Policy iteration.	2	4	0	0
Planning.	4	8	0	0
Learning agents and their components.	2	2	0	0
Inductive learning.	4	8	0	0
Learning decision trees.	2	4	0	0
Neural networks and their structures.	2	2	0	0
Learning neural networks.	2	4	0	0
Perceptrons (single-layer feed-forward neural networks) and linearly separable functions.	2	2	0	0
Multilayer feed-forward neural networks and back-propagation process.	2	2	0	0
Principles of reinforcement learning.	4	4	0	0
Total:	64	96	0	0

Learning outcomes and assessment

Learning outcomes	Assessment methods
Understands properties, architectures, environments and behaviour of intelligent agents.	The first laboratory task or the corresponding individual task. Exam.
Knows structure of logical agents, knowledge representation and inference procedures.	Exam.
Can apply various search algorithms.	The second laboratory task or the corresponding individual task.
Understands structure of planning agents and representation of planning problems using formal languages.	The third laboratory task or the corresponding individual task.
Knows methods for uncertain knowledge processing and can apply modelling methods of decision-making agents.	Exam.
Can apply methods for learning decision trees and neural networks.	The fourth laboratory task or the corresponding individual task.
Can apply algorithms of reinforcement learning.	The fifth laboratory task or the corresponding individual task. Exam.

Evaluation criteria of study results

Criterion	%
Course work, including laboratory tasks	50
Exam	50
Total:	100

Study subject structure

Part	CP	Hours			Tests		
		Lectures	Practical	Lab.	Test	Exam	Work
1.	6.0	48.0	0.0	16.0		*	