RTU Course "Artificial Intelligence"

12307 Sistēmu teorijas un projektēšanas katedra

General data

Code	DSP422
Course title	Artificial Intelligence
Course status in the programme	Compulsory/Courses of Limited Choice
Course level	Post-graduate Studies
Course type	Academic
Field of study	Computer Science
Responsible instructor	Grundspeņķis Jānis
Volume of the course: parts and credits points	1 part, 4.0 Credit Points, 6.0 ECTS credits
Language of instruction	LV, EN, RU
Possibility of distance learning	Not planned
Abstract	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 course students acquire knowledge about a modern approach to artificial intelligence – development of intelligent agents. The course is focused on properties, environment, architectures and programs of intelligent agents, logical agents, ontologies, 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 course is to give theoretical knowledge and practical skills for development of agent-based intelligent computer systems.
Structure and tasks of independent studies	Students independently must work out the course work to consolidate acquired theoretical knowledge about modern approaches of intelligent system development; the workload is 16 hours. 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. The assessment of course work contributes 40% of the final assessment.
Recommended literature	1. Russell S. and Norvig P. Artificial Intelligence. A Modern Approach. Pearson Education, Upper Saddle River, New Jersay, 2003. (2006.gadā ir izdots grāmatas tulkojums krievu valodā) 2. Luger G.F. Artificial Intelligence. Structures and Strategies for Complex Problem Solving. Addison-Wesley, Harlow, England, 2005.
Course prerequisites	Basis strategies of state space search and knowledge representation schemas

Course outline

Theme	Hours
Definition and properties of intelligent agents	2
The structure of intelligent agents	2
Reflex agents and their varieties	2
Agent environments and their characteristics	2
Logical agents	2
Intelligent agents	4
Knowledge representation and construction of knowledge base for logical agents	2
Inference procedures of logical agents	2
Inference rules in first-order logic	2
General-purpose ontologies (categories and objects, situations and events, time and event calculus, intervals & actions	2
Uncertain knowledge and probabilistic reasoning	2
Bayesian networks, representing the full joint distribution, conditional independence relations	2
The basics of utility theory	2
Utility functions, dominance, preference structure and multiattribute utility	2
Searching	4
Decision networks and decision-theoretic expert systems	2
Sequential decision problems	2
Utilities of states and value iteration algorithm	2
Policy iteration	2
Planning	4
Learning agents and their components	2
Inductive learning and learning decision trees	2

Neural networks and their structures	2
Learning neural networks	2
Inductive learning	4
Perceptrons (single-layer feed-forward neural networks) and linearly separable functions	2
Multilayer feed-forward neural networks and back-propagation process	2
Principles of reinforcement learning	2

Learning outcomes and assessment

Learning outcomes	Assessment methods
Students understand properties of intelligent agents, agent architectures and environments	Definitions of agents and their properties must be given and agent architectures as well as properties of environment must be explained in exam
Students understand agent structures and behaviour	The first laboratory task or the corresponding individual task
Students know structure of logical agents, knowledge representation and inference procedures	Perceptions and actions of logical agent must be defined and formalized, knowledge base must be constructed and inference procedure implemented in examination
Students know general-purpose ontologies and basic principles of their development	Basic principles of category representation must be described in examination
Students can apply various search algorithms	The second laboratory task or the corresponding individual task
Students understand structure of planning agent and representation of planning problem using formal language	The third laboratory task or the corresponding individual task
Students know methods of uncertain knowledge processing based on probabilistic reasoning	Bayesian network must be built; basic principles of utility theory must be defined and used for construction of decision network in examination
Students can apply modelling methods of simple and complex decision making agents	Utilities of states must be calculated for stochastic environment in examination
Students know essence of inductive learning and can apply methods of learning for decision trees and neural networks	The fourth laboratory task or the corresponding individual task
Students can apply algorithms of reinforcement learning	Set of learning examples must be generated and algorithms of reinforcement learning (passive reinforcement learning and temporal difference learning) must be used in examination
Students can apply value iteration and policy iteration algorithms	The fifth laboratory task or the corresponding individual task

Study subject structure

Part	CP	ECTS	Hours per Week			Tests		
			Lectures	Practical	Lab.	Test	Exam	Work
1.	4.0	6.0	3.0	0.0	1.0		*	