Tárgy neve: Principles of artificial intelligence

Tárgyfelelős neve: Gregorics Tibor

Tárgyfelelős tudományos fokozata: PhD, egyetemi docens

Tárgyfelelős MAB szerinti akkreditációs státusza: AT

Az oktatás célja angolul:
a) **knowledge**
- In order to be able to perform their work in an innovative way and do research (when necessary) in their own IT specialization, they have comprehensive and up-to-date knowledge of general mathematical and computing principles, rules and relationships, particularly – depending on their chosen specialization – in the following areas: algebraic, linear algebraic and number theory methods and applications, special fields of mathematical analysis, numerical methods and their applications; discrete mathematics, graph theory, logic and their applications; theoretical basics and applications of stochastic modelling and statistics; first-order and second-order statistical analysis, operation research; algorithmic methods in mathematics, formal models and tools in computing science, complexity and efficiency theory of algorithms, and special algorithms of application fields..
- They have comprehensive and up-to-date knowledge and understanding of the general theories, contexts, facts, and the related concepts of IT, particularly – depending on their chosen specialization – in the following areas: algebraic, linear algebraic and number theory methods and applications, special fields of mathematical analysis, numerical methods and their applications; discrete mathematics, graph theory, logic and their applications; theoretical basics and applications of stochastic modelling and statistics; first-order and second-order statistical analysis, operation research; algorithmic methods in mathematics, formal models and tools in computing science, complexity and efficiency theory of algorithms, and special algorithms of application fields.
- They have comprehensive and up-to-date knowledge of the principles, methods, and procedures for designing, developing, operating, and controlling IT processes, particularly – depending on their chosen specialization – in the areas of program design methods; design, construction and management of complex software systems and databases in modern database management systems; service-oriented program design; the design, construction and management of information systems; the design and development of tools and services for the internet; the design, development and management of database systems; the design, construction and management of distributed systems, cryptography, data security and data protection.

b) **skills and abilities**
- They are able to apply their mathematical, computer science and informatics skills in a novel way in order to solve tasks in IT research and development.
- They are able to formalize complex IT tasks, to identify and study their theoretical and practical background and then to solve them.
- They are able to perform design, development, operation, and management tasks when operating complex software systems, database management systems, corporate information systems, decision support systems, and expert systems.
- They are able to comprehensively understand, plan, organize, manage and control processes related to their IT specialization at management level.
- They are able to analyze and apply new problem-solving methods and procedures related to their IT specialization.
- They are able to professionally use scientific and technical information sources to obtain knowledge necessary for solving a problem, and to critically interpret and evaluate it.

c) attitude
- They follow professional and technological developments in their IT field.
- They are committed to critical feedback and evaluation based on self-examination.
- They are committed to lifelong learning, and they are open to acquiring new IT competencies.
- They accept and make their co-workers apply the ethical principles of work and organizational culture as well as those of IT scientific research.
- They share their knowledge and consider it important to disseminate professional IT results.
- They are open to proactive collaboration with IT and other professionals.

d) autonomy and responsibility
- They take responsibility for their professional decisions made in their IT-related activities.
- They undertake to meet deadlines and to have deadlines met.
- They bear responsibility for their own work as well as for the work of their colleagues they work together with in a project.

Az oktatás tartalma angolul:

Modeling and search. Problem representation methods (state-space representation, problem decomposition, constraint satisfaction problems, logical representations) which make a problem possible to be viewed as a path-finding problem. Graph representation of a path-finding problem. AND/OR graphs. General scheme of the search system. Control strategy of search system and heuristics.

Heuristic search. Famous irrevocable strategies: hill-climbing search, tabu search, algorithm of simulated annealing. Tentative strategies: the backtracking algorithm and graph-search algorithms (A*, B, EMA*, etc.). Evolutionary algorithm.

Two-player games. Representation of the games. The winner strategy. Sub-tree evaluations: minimax algorithm and alpha-beta pruning.

Introduction to machine learning. Supervised learning and some examples (the k-nearest neighbor method, decision trees, random forest, deep learning). Unsupervised learning and some examples (k-mean algorithm, principal component analysis).

A számonkérés és értékelés rendszere angolul:

continuous assessment, examination

Idegen nyelven történő indítás esetén az adott idegen nyelvű irodalom:

Text book, compulsory:
- Stuart J. Russell and Peter Norvig: **Artificial Intelligence: A Modern Approach**. Pearson, Inc. 2010. ISBN: 0-13-604259-7
- N. J. Nilsson: Principles of Artificial Intelligence, Springer-Verlag, 1982.

Proposed further reading:
- N. J. Nilsson: Artificial Intelligence: a new synthesis, Morgan Kaufmann Pub. 1998.
- Mérő L.: Ways of thinking: the limits of rational thought and artificial intelligence. World Scientific Publishing Co. Pte. Ltd. 1990.