

Course Specification Document

Title	Introduction to Artificial Intelligence and Machine Learning
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Credits	2.5 ECTS
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Aims	This course aims to introduce the basic concepts of expert systems and methods of knowledge representation. It also aims to present the intelligent research methods, the basic concepts of machine learning, and the general approach for solving problems based on machine learning methods.
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Intended learning outcomes

On successful completion of this course, the student will be able to:

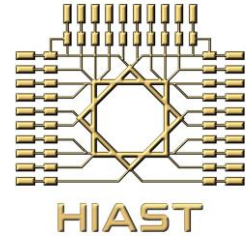
- Understand the basic concepts of expert systems and the methods of knowledge representation.
- Understand the basic methods of searching for a solution either with perfect information or with non-perfect information.
- Understand the general architecture of machine learning systems.
- Understand the most important methods of supervised learning.
- Understand the advantages and disadvantages of machine learning methods.
- Work with machine learning libraries implemented by Python to achieve the desired studied methodologies.
- Implement a machine learning system and evaluating its performance.
- Test the performance of the automatic learning methodology.

Syllabus

- **General introduction:** The history of the development of artificial intelligence, the intelligent agent, applications of artificial intelligence, the importance of knowledge engineering.
- **Knowledge Representation:** Presenting issues using the propositional calculus and predicate calculus, frames and scenarios.
- **Rule-based expert systems:** The basic components of expert systems, their importance, applications and trials (forward chaining and backward chaining)
- **Uncertainty in expert systems and resolving techniques:** Certainty factors, Bayesian reasoning.
- **Algorithms of searching for a solution:** Breadth first - best first - depth first - using Heuristic-A* and its variables, adversarial search and games.
- **Introduction to machine learning:** Basic concepts, general form of a machine learning system, machine learning methods, applications.

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- **Intelligent classification algorithms:** Bayes Optimal Classifier, Naive Bayes Classifier, Neural Network (Back Propagation).
- **Learning using regression models:** Linear regression, logistic regression.
- **Evaluation standards and strategies:** Estimation Strategy: Holdout method, Cross-validation, Evaluation Metrics: Confusion Matrix, Accuracy, Precision and Recall, F-score, Multiclass Classifier case.
- **Learning using decision trees:** ID3 algorithm.