MSc in ARTIFICIAL INTELLIGENCE

Study Guide 2024-2025

ΠΑΝΕΠΙΣΤΗΜΙΟ ΠΕΙΡΑΙΩΣ
UNIVERSITY OF PIRAEUS

DEPARTMENT OF DIGITAL SYSTEMS

ΔΗΜΟΚΡΙΤΟΣ
DEMOKRITOS

INSTITUTE OF INFORMATICS AND TELECOMMUNICATIONS

INTER-INSTITUTIONAL GRADUATE STUDIES PROGRAM

"ARTIFICIAL INTELLIGENCE"

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1 In few words…

The Inter-institutional Postgraduate Program "Artificial Intelligence" (II-MSC) was founded in the year 2019 with collaborating institutions the Department of Digital Systems of the University of Piraeus, and the Inst. of Informatics and Telecommunications of the NCSR "Demokritos" . The II-MSC operated for the first time in the academic year 2019-2020.

Artificial Intelligence is a well-recognized and internationally established scientific domain of computer science, and is a distinct subject of study in all Universities and Research Centers around the globe that have a technological/engineering/science direction of study.

The II-MSC deals with the field of Artificial Intelligence, as a distinct field of computer science and offers courses that cover a wide range of modern technologies in this field. The curriculum aims to train scientists who design, develop, evaluate and apply Artificial Intelligence methods to solve real-world problems in various fields of human activity and science, with an emphasis on the ethical use of technology, in an environment of interaction between research topics and fields of application.

This study guide concerns the academic year of study 2024-2025 and is a basic text to convey to students, as well as to the future candidates, of II-MSC our view of the curriculum we offer, the contexts in which we develop our academic activities, as well as other useful information that helps all members of the academic community of II-MSC to actively participate and develop activities towards common goals, with a commitment to quality.

2 Introduction

2.1 Purpose of the document

The main purpose of this study guide is to describe the offered study program of the II-MSC for the year 2024-2025, the people who support it, as well as explain the reasons it has developed in the way it is offered.
It is a basic guide of the academic activities developed at II-MSC, so that our students have a "map" of the opportunities they are given to develop their knowledge, critical thinking and skills in the development, application and evaluation of technologies in the field of Artificial Intelligence.
As a basic guide, it also describes the services offered to our students by the cooperating institutions that implement the II-MSC, as well as the basic rules that govern the operation of the II-MSC, with references to the texts that describe in detail its operating framework.

2.2 To whom it is addressed

The study guide is addressed to the entire academic community of II-MSC: Students, lecturers, academic staff, but also external organizations with whom II-MSC cooperates, and with whom it develops academic activities.
Mainly, however, it is addressed to the students of II-MSC, as a basic document of activities in which they join as members of the academic community of II-MSC.
It also concerns our prospective students to get to know II-MSC better and judge their choice to attend it.

2.3 Structure of the document

This document begins in Chapter 3 by explaining our vision for studying Artificial Intelligence, situating this scientific field in an international setting, and summarizing the objectives of the study program.
In Chapter 4 we explain the quality policy of II-MSC, and state our commitment to the quality of studies and services we offer, as well as the concrete quality objectives, as we perceive and pursue them.
In the same chapter we summarize the international experience from studies in Artificial Intelligence, and place the II-MSC in this international context, referring to the particular scientific areas that are taught and the particular academic goals we pursue.
In Chapter 5 we describe in detail the flow of the curriculum and list the description and objectives of each course. This chapter provides also succinct information about the lecturers.
In Chapter 6 we refer to key points of the study regulations of the II-MSC, while in chapter 7 on student mobility issues. In Chapter 8 we list information on supporting students through academic advice and complaints handling services.
Finally, in Chapter 9, we mention all the services offered , by the cooperating institutes that implement the II-MSC to our students, but also to the members of the academic community.

3 Why the specialization on Artificial Intelligence is necessary now more than ever?

Artificial Intelligence, as a specific domain in computer science, exists officially and with that name since the 50s. Today, it is a very well-defined field of science and technology that overlaps with many other domains besides those in computer science: philosophy, ethics, economics, statistics, linguistics, neuro-physiology, sociology, just to name a few.
It covers a multitude of topics: knowledge representation and reasoning, computational logic, natural language understanding/generation/processing, systems autonomy, artificial characters for education/entertainment, machine learning, computer vision, agents and multiagent systems, robotics and data analysis.
Therefore, today Artificial Intelligence is a well-recognized and internationally established scientific domain of computer science, while it is a well-defined subject of study in all Universities and Research Centres around the world.

Why now
Especially in today's era, appropriate conditions and special opportunities support and foster the development of Artificial Intelligence, which is a driving force for the digital and so called, knowledge economy. It is worth mentioning that as the capacities and potential of Artificial Intelligence methods increase day by day, there is a special emphasis on the risks and the ethical issues that these methods introduce.

The biggest opportunity for Artificial Intelligence today is the accessibility of low-cost computing power, as well as the availability of large amount of data that can be harnessed to support people in managing complexity, providing better services and thus, improve many areas of modern life.

The biggest challenges include (a) the existence of data that can be exploited, but it is not known "how" this can be done effectively, (b) the existence of important problems that require specialized knowledge that should be somehow acquired to support automation in problem solving, (c) the existence of problems with an inherent complexity, requiring methods that can cope with high-dimensionality, extremely large search spaces, and/or the participation of multiple "players" with particular interests and priorities and often with demands for optimal solutions, and finally (d) addressing ethical concerns on the use of artificial intelligence systems in real-world problems.

There are many expectations for Artificial Intelligence that are potentially achievable, but for sure Artificial Intelligence has developed mature methods that seem to respond successfully to solving real problems, without overlooking the fact that these technological developments can create problems if the technology is developed and deployed in an un-ethical manner.

We have to point out emphatically that the demand for human resources with knowledge,

competences and skills regarding Artificial Intelligence techniques and methods, is growing globally.

> The II-MSc on Artificial Intelligence aims to offer a comprehensive curriculum and a reach educational/learning experience through different academic activities, so as to educate students with the knowledge needed to deeply understand, successfully apply, analyse and provide support for solving real-life problems that demand artificial intelligence solutions, evaluate and create artificial intelligence methods, in a as broad as possible spectrum of topics and domains.

In any case, **the goal of II-MSC is to equip its graduates with a solid knowledge background and expertise, as well as the necessary competencies and skills, to leverage existing and develop new/innovative Artificial Intelligence techniques and methods.** In addition, the graduates of the II-MSC must be able to recognize the particularities of the problems they face, understanding the weaknesses and limitations of using Artificial Intelligence techniques and methods always in relation to the problems that need to address, within the framework of rules for the ethical use of technology. The ultimate goal is the promotion of science for the benefit of human, according to the needs of the Greek and European society, within the international environment of development and use of technology.

Professor George A. Vouros, Director of the MSc in Artificial Intelligence

4 Objectives of the MSc Program

4.1 Commitment to the quality of your studies

The II-MSC "Artificial Intelligence" (II-MSC) since its establishment, and through its quality policy, expresses its commitment to the quality of studies and services, and the processes that ensure it, as the main means of achieving a high level of academic and research work for the benefit of its entire academic community.
The academic community of II-MSC (staff, students, graduates and cooperating organizations) work and cooperate according to the values and goals of the cooperating institutes (Digital Systems Department of the University of Piraeus, and Inst. Of Informatics and Telecommunications of NCSR "Demokritos"), their mission and strategy. Community members adopt common policies, recognize good practices and participate in continuous improvement processes.
Based on its quality policy, II-MSC aims to ensure the quality of the Study Program it offers, responding to the Greek, European, and international challenges and requirements for quality higher education.
Specifically, the quality objectives it sets are the following:

- The II-MSC aims to offer a high-quality and coherently structured curriculum that supports the provision of specialized knowledge, skills, abilities and qualifications in Artificial Intelligence, reflecting international academic and research priorities in this field.

- The II-MSC seeks, through its educational activity, the development of knowledge, as well as the development of skills on the part of its students, but also of its lecturers, with the aim of promoting science and supporting the development process in relation to the subject of Artificial Intelligence, for the benefit of human, society and the Greek and European economy.

- The II-MSC promotes the upgrading of the quality and efficiency of its educational work in a variety of ways. Mainly, this is achieved by the continuous upgrading of the educational program through various teaching and learning activities, updating the structure and content of studies, supporting services and infrastructure for the implementation of the study program.

- The II-MSC aims at the continuous and substantial strengthening of the members of its academic community, so that they have a rich learning, teaching and research experience, by providing opportunities for cooperation with educational / research institutions as well as with productive organizations of the country and abroad.

- The II-MSC encourages and supports the continuous improvement of the qualitative and quantitative indicators of the research work and potential of the teaching staff, cultivating and spreading the necessary culture within the II-MSC and to all members of its academic community.

- The II-MSC attempts to connect teaching with research and production. It encourages the participation of students in the activities undertaken by the research laboratories of the institutes that implement it, but also participation in activities with productive organizations, which are completely related to the objectives of the II-MSC. The goal for the graduates of II-MSC is, under

the supervision of faculty members and researchers, to gain research and development experience, to enrich their knowledge, to deepen their knowledge in the subject they are examining, and to cultivate necessary skills.

● The II-MSC systematically seeks that the knowledge and skills offered to its graduates are compatible with the requirements of the labour market, facilitating their immediate absorption in private and public organizations in Greece, but also abroad.

● The II-MSC collaborates seamlessly with the University of Piraeus and the NCSR "Demokritos" for the utilization of the resources, for the development of a range of high- quality supporting services to its academic community, for the achievement of its goals.

● The II-MSC aims at the continuous evaluation of its work in all its dimensions, by all interested parties. The Curriculum Committee of the II-MSC supervises, inspects and improves the quality policy and quality assurance system of II-MSC .

4.2 MSC Studies in Artificial Intelligence.

The constant contact/participation of the members of the academic community of II-MSC with international committees, working groups, scientific bodies/groups, established international conferences, as well as their activities in the context of international competitive research projects, ensures the continuous flow of information to all the members of the academic community of II-MSC to the emerging challenges, research/development perspectives, but also to the emerging professional needs for skills, which shape the design of the learning outcomes of the II-MSC.
But beyond these, the Curriculum Committee of the II-MSC constantly monitors international standards and studies of well-known organizations regarding the developments of MSC curricula on AI, such as the recent Computing Curricula 2023 (Artificial Intelligence Knowledge Area) published by ACM as well as a recent report on postgraduate studies in Artificial Intelligence in Europe by the JRC.
Specifically, in the above JRC study (and in full harmonization with the ACM standard), the following knowledge areas for "competence-based EU AI curriculum" are mentioned:

Fundamentals	- Fundamentals of Computer Science and Informatics(*) - Fundamentals of Maths and Statistics(*)
AI General	General AI competencies(*)
AI Core areas	- Knowledge representation and reasoning(*) - Planning Search and Optimization(*) - Machine Learning (*) - Natural Language Processing (*)

	- Computational Perception (processing of audio and images) (*) - Robotics, Agents & Interaction (*) - Human Machine Interaction
AI Applied Areas	- AI Services - Philosophy & Ethics of AI (*)

The above areas are covered by the curriculum of the II-MSC, or, those marked with (*), are prerequisites for joining the II-MSC (fundamentals).

In accordance with international standards, the implementation of the study program of the II-MSC is designed so that the above areas result in learning outcomes (knowing "what"), skills (knowing "how") and dispositions (knowing "why"). The learning outcomes of the curriculum are formulated based on recall, understanding, application, analysis, evaluation and creation of specialized knowledge. General competencies refer to skills that are not related to Artificial Intelligence exclusively, such as critical thinking, creativity, cooperation and teamwork, ethical analysis, intercultural communication skills, leadership, mathematical skills, negotiation, communication and problem solving. The intended outcomes are presented and captured in the course outlines.

4.3 Studying AI in the II-MSc “Artificial Inteligence”

The orientation of II-MSC is that of scientific specialization, as it prepares graduates who are interested in acquiring knowledge and skills to utilize existing techniques and develop new/innovative techniques and methods of Artificial Intelligence, recognizing the particularities of the problems they face, understanding and recognizing the weaknesses and limitations of techniques and methods, within the framework of rules of ethical use of technology, promoting science for the benefit of humans.

In this way, the scientific specialization of II-MSC, in accordance with international standards and recent international studies, provides a comprehensive and coherent body of knowledge in specialized and advanced Artificial Intelligence topics, while also providing the training that can lead its students to the successful utilization of knowledge in applications or in research.

Specifically, the program aims to train scientists who design, develop, evaluate and implement:

- machine learning methods, with the aim of automating the decision-making process to the greatest extent possible by utilizing historical data,
- methods of knowledge representation and reasoning and their utilization in particular problems,
- methods of developing intelligent agents and robotic systems,
- combinatorial optimization methods,
- natural language processing methods
- machine learning methods on multimodal data (image, sound)

- scalable methods for Artificial Intelligence

with the aim of solving real-world problems in various fields of human activity and science, in an environment of interaction between research topics and fields of application.

The curriculum of the II-MSC AI is fully harmonized with the international standards for MSc studies in Artificial Intelligence and competes with the rest of Europe, as can be seen from the percentage of material covered per subject by the II-MSC courses.

In addition to the aforementioned objectives, the Study Program of the II-MSC also aims to general competencies which consist of the following skills that students should have acquired upon successful completion of their studies:

- Ability to analysis and synthesis of knowledge with regard to Artificial Intelligence Methods
- Ability to organize and plan work and manage time
- Ability to communicate effectively (orally and written)
- Ability to manage information
- Ability to solve problems with existing or by designing novel Artificial Intelligence Methods
- Ability to develop critical thinking and capacity for critical approaches
- Ability to work in a team
- Ability of interdisciplinary approaches
- Ability to work in an international environment
- Ethical commitment and individual responsibility
- Ability to apply theoretical knowledge regarding Artificial Intelligence methods in practice
- Ability to evaluate Artificial Intelligence techniques and methods in light of specific needs
- Ability to do research in Artificial Intelligence
- Ability to adapt Artificial Intelligence methods and techniques to new situations and conditions
- Ability to generate new ideas – Creativity
- Ability to undertake independent work
- Commitment to quality assurance
- Ability to continue studies at a higher academic level

The achievement of the above learning outcomes and competencies is a goal that characterizes the study program as a whole, and each particular educational activity developed within the study program.

5 The curriculum

5.1 Overview of the curriculum

The curriculum of the II-MSC is based on background knowledge offered in undergraduate degree programs, and focuses on topics of specialized scientific knowledge (by offering compulsory courses) and delves into cutting-edge technology in particular fields of interest, offering further specialization (by means of elective courses) in Artificial Intelligence areas of knowledge.

To obtain the Postgraduate Diploma from the II-MSC on AI, a total of ninety (90) credit units (ECTS) are required.
During their studies, postgraduate students are required to attend and successfully pass six-month postgraduate courses, conduct research and write scientific papers, etc., as well as to prepare a postgraduate thesis.

Specifically, the design of the II-MSC curriculum is as follows:
During the first semester of studies, it is ensured that postgraduate students acquire the necessary theoretical knowledge and practical training in specialized, advanced, but in any case, necessary areas of Artificial Intelligence. At the end of the first semester, postgraduate students have acquired a solid basis to understand and study in depth topics related to specialized areas of Artificial Intelligence, to understand techniques, to know AI techniques/methods capabilities and limits, and to be able to judge and to decide on their ethical use, based on the existing regulatory frameworks for the use and development of technology.

During the second semester, students acquire knowledge of cutting-edge technologies that are either (a) deemed necessary to meet current research and development needs, or (b) required to acquire the breadth of knowledge to apply the technology in various real-world problems, or finally, are (c) offered to complement the breadth of specialized areas of Artificial Intelligence that graduates wish to know, choosing own personal directions and scientific paths.

Finally, in the third semester they prepare their master's thesis, choosing from a wide range of research and development topics, which bring them closer to cutting-edge technologies, with an emphasis on the exploitation and development of techniques for solving real-world problems. In this context, they are given the opportunity to prepare theses, also in collaboration with productive organizations of the public and private sector in Greece or abroad that develop and/or apply AI technology.

5.2 Courses, learning outcomes and general competencies

The table below shows the courses offered per semester of study, as well as the possibilities for students to choose courses.

1st Semester Courses: One (1) Preparatory (P) and five (4) compulsory (C)		
Code (Type)	*Title*	*ECTS*
ΨΣ-TN- 101 (P)	Fundamentals and Background on Artificial Intelligence	5
ΨΣ-TN- 110 (C)	Machine Learning	5
ΨΣ-TN- 120 (C)	Knowledge Representation and Reasoning	5
ΨΣ-TN- 131 (C)	Intelligent Agents and Multiagent Systems	5
ΨΣ-TN- 102 (C)	Algorithmic methods in Artificial Intelligence	5
ΨΣ-TN- 141 (C)	Ethical and Trustworthy Artificial Intelligence: Theoretical approaches and Practical applications	5
1st semester ECTS		30
2nd Semester Offered courses: two (2) compulsory (C) and four (4) electives (E), from which students select the two (2).		
Code (Type)	*Title*	*ECTS*
ΨΣ-TN- 201 (C)	Deep Learning	7.5
ΨΣ-TN- 250 (Y)	Artificial Intelligence Applications	7.5
ΨΣ-TN- 210 (E)	Natural Language Processing	7.5
ΨΣ-TN- 221 (E)	Scalable Artificial Intelligence Methods	7.5
ΨΣ-TN- 230 (E)	Machine Learning on Multimedia Data	7.5
ΨΣ-TN- 260 (E)	Robotics	7.5
2nd semester ECTS		30
3rd Semester		
Code (Type)	*Title*	*ECTS*
ΨΣ-TN- 300 (C)	MSc Thesis	30
3rd semester ECTS		30

5.2.1 [ΨΣ-TN-101] Fundamentals and Background on Artificial Intelligence

Semester	A’
Course Type	Preparatory
ECTS	5

5.2.1.1 Contents

- Introduction to programming using the Python programming language: Python syntax, Creating scripts, Variables and data types, Python functions, File management, Modules and packages.
- Python libraries (eg Numpy, Scikit-learn, Matplotlib) for building Machine Learning tools, Creating and managing Numpy arrays, Basic array operations, Linear Algebra with Numpy, Linear Regression example with Numpy
- Introduction and installation of the PyTorch tool, Introduction to the PyTorch Automatic Differentiation system, Tensors, Operations with tensors, Data Loaders and data pre-processing, Creation and training of a Neural Network
- Introduction to Machine Learning Operations (MLOPs), Automating and managing Machine Learning models, Applications of MLOPs
- Arrays, operations on arrays, determinants, inverse and inverse of an array. Linear equations, methods of solving linear systems, Gaussian elimination, Cramer's rule. characteristic quantities, eigenvalues and eigenvectors, diagonalization of a matrix, similarity transformations. Vector spaces and subspaces, addition, multiplication, inner product of vectors, linear combination, measure and distance of vectors. Linear inequalities, linear programming.
- Linear-multiple linear regression, logistic regression, inverse normal regression (Probit regression), Crest Regression, Static/Dynamic Autoregression and Spectral Analysis.
- Spectral regression, multivariate analysis of variance (ANOVA-MANOVA). Exploratory factor analysis. Database mining and advanced prediction techniques. Regression-based predictive modelling .
- Linear Regression, Logistic Regression, Ridge regression, Supervised Workflow and Algorithms, Supportive Machine Learning, Supervised Learning, Unsupervised Learning.
- Propositional and categorical logic: Syntax, entailment rule, interpretations and models, quantification.
- Inference and reasoning: Resolution rule, production, substitution, integration, forward and backward execution chain, open and closed world assumptions, non-monotonic inference, predicate completion.
- Inference and reasoning in various logics (Kripke, Fuzzy, Lukasiewicz) and in numerical fields..

5.2.1.2 Evaluation/Assessment

The course is examined with compulsory assignments.

5.2.1.3 Learning outcomes and general competencies

Upon successful completion of the course, the student will be able to possess

- The body of theoretical and practical basic knowledge for continuing studies in the MSc
- Fundamental concepts, basic theories and programming practices

Specifically, the course covers the following topics aiming at the learning outcomes mentioned above.

- Probability theory
- Calculus
- Linear algebra
- Computational logic
- Programming, libraries, core practices and processes for machine learning

This is achieved through the critical consideration of the methods taught, the solving of exercises and the implementation of exemplary systems, with the aim of understanding, designing and building effective Artificial Intelligence methods.

In addition, the course aims at the following general abilities of the students

- Ability to search and delve into specific theoretical and practical topics to meet the specific needs of the curriculum courses
- Ability to solve problems
- Ability to develop critical thinking and capacity for critical approaches
- Ability of interdisciplinary approaches
- Ability to apply theoretical knowledge in practice
- Ability to adapt methods and techniques to new situations and conditions

5.2.2 [ΨΣ-TN-110] Machine Learning

Semester	A’
Course Type	Compulsory
ECTS	5

5.2.2.1 Contents

- Introduction to machine learning.
- Linear Regression.
- Decision trees
- Logistic Regression
- Clustering and valuation metrics
- Naive Bayes, Support Vector Machines
- Methodology for applying machine learning algorithms
- Engineering/Feature selection, dimensionality reduction, ensembles
- Introduction to reinforcement learning and basic policy learning algorithms in discrete state-action space
- Reinforcement learning in partial perception environments and multi-agent reinforcement learning

Case studies, example problems and methods for solving them are presented.

5.2.2.2 Evaluation/Assessment

The course is examined by the preparation of two compulsory assignments that the students hand in at the end of the semester

5.2.2.3 Learning outcomes and general competencies

Upon successful completion of the course, the student will be able to

- Explain fundamental concepts and fundamentals regarding machine learning and the parameterization/implementation/evaluation of machine learning algorithms on datasets.
- Know, configure and apply the most basic machine learning algorithms per problem type category (regression, classification, clustering).
- Combine algorithms to generate solutions to real problems.
- Know the methodology of applying machine learning algorithms to data, comparing and choosing the appropriate algorithm.
- Select, analyze and compare algorithms for application to real problems
- Analyze, visualize and process datasets to find appropriate features to represent problems.
- Communicate machine learning ideas in a clear, concise and formal manner.

Aiming to apply and evaluate machine learning algorithms to problems, and explain their operation

Also, the course targets to the following general competencies:

- Ability to organize and plan work and manage time effectively
- Ability to document and communicate effectively (oral and written)
- Ability to solve problems
- Ability to develop critical thinking and capacity for critical approaches
- Ability to work in a team
- Ability of interdisciplinary approaches
- Ability to apply theoretical knowledge in practice
- Ability to research
- Ability to adapt methods and techniques to new situations and conditions
- Ability to generate new ideas – Creativity

5.2.3 [ΨΣ-TN-120] Knowledge representation and reasoning

Semester	A’
Course Type	Compulsory
ECTS	5

5.2.3.1 Contents

- Introduction to Logic Programming: Facts, rules and queries, recursion, lists and functional terms, reversible predicates
- LP for AI: Non-deterministic programming, generate-and-test, searching in Prolog
- Approaches to negation: Negation-as-failure, stratification, well-founded negation in non-stratified knowledge bases
- Representing incomplete knowledge: Answer Set Programming, integrity constraints, stable models, satisfiability, enumeration, answer set solving
- Representing preferences: quantitative vs. qualitative preferences, logical formalisms for qualitative preference representation, preferences between sets
- KRR for the Semantic Web: data integration and the semantics of atomic symbols, representing Web semantics, Resource Description Framework (RDF), ontologies and knowledge graphs (KG), OWL 2, Description Logics and equivalence with RDFS/OWL 2, reasoning over RDFS/OWL 2
- Representing and reasoning over spatial and numerical knowledge: Many-valued logics, Satisfiability Modulo Theories (SMT), geospatial data and inference, 3D data and inference

5.2.3.2 Evaluation/Assessment

The course is examined by the preparation of compulsory assignments that the students hand in at regular intervals.

5.2.3.3 Learning outcomes and general competencies

Upon successful completion of the course, the student will be able to

- Understand fundamental concepts for knowledge representation such as logic program, negation and negation as failure, open and closed world hypothesis, knowledge graphs, ontologies.
- Recognize and understand Knowledge Representation techniques and their utilization in problem solving / application contexts.
- It points out the specificity of individual reasoning problems, the selection and adaptation to them of appropriate search techniques, constraint solving, answer set solving and preferences.
- Plan the evaluation of the methods in comparison with each other, recognizing the possibilities and limitations of each method.
- Understand the structure of the semantic web and how its basic tools work.
- Communicate ideas related to the application of knowledge representation techniques and reasoning in a clear, concise and formal manner.

The student must be able to design, build and evaluate knowledge representation and reasoning systems for solving real-world problems, and to explain their operation.

Also, the course targets to the following general competencies:

- Ability to organize and plan work, and manage time effectively
- Ability to communicate orally and in writing
- Ability to solve problems
- Ability to develop critical thinking and capacity for critical approaches
- Ability to apply theoretical knowledge in practice
- Ability to adapt methods and techniques to new situations and conditions
- Exercise criticism and self-criticism
- Promotion of free, creative and inductive thinking

5.2.4 [ΨΣ-TN-131] Intelligent Agents and Multiagent Systems

Semester	A’
Course Type	Compulsory
ECTS	5

5.2.4.1 Contents

- Introductory aspects for intelligent agents and main architecture paradigms, and multiagent systems
- Multiagent interactions: Preferences and utilities
- Non-cooperative game theory, normal form games, examples of games, solution concepts and equilibria
- Distributed problem solving: Constraint satisfaction
- Distributed problem solving: optimization
- Markovian Decision Processes
- Auctions
- Negotiation/Argumentation
- Agents’ Communication
- Learning and Teaching in multiagent settingsFictitious play
    - Rational Learning
    - Reinforcement Learning
    - No-regret learning, Targeted learning, evolutionary learning

5.2.4.2 Evaluation/Assessment

The course is examined by the preparation of compulsory assignments delivered by the students, and presentation of the material assigned to them for contemporary study.

5.2.4.3 Learning outcomes and general competencies

Upon successful completion of the course, the student will be able to

- Recall, understand and explain fundamental concepts regarding intelligent agents, multi-agent systems, to recognize the particular characteristics of their environment and agents.
- Decide how the characteristics and requirements of the problem determine the design, required functionality, and the selection of appropriate techniques for implementing agents and interactions between multiple agents.
- Know, understand, design, analyze, evaluate algorithms related to distributed problem solving, distributed optimization, achieving goals through competitiveness or agent coordination and cooperation.
- Know, understand, design, analyze, evaluate algorithms related to multi-agent distributed learning.
- Select, develop, adapt / evolve, creatively evaluate algorithms related to distributed problem solving, distributed optimization, negotiation, learning in multi-agent environments, possessing fundamental knowledge about their design
- Communicate ideas related to agents and multi-agent systems in a clear, concise and formal manner, in writing and orally,

The aim is students to be able to build and evaluate agent and multi-agent systems in predefined environments, and to explain-justify their operation

Also, the course targets to the following general competencies:

- Ability to organize and plan work and manage time
- Ability to communicate orally and in writing
- Ability to solve problems
- Ability to develop critical thinking and capacity for creative approaches
- Ability to work in a team
- Ability of interdisciplinary approaches
- Ability to apply theoretical knowledge in practice
- Ability to evaluate algorithms, analyze and explain results, and further research
- Ability to adapt methods and techniques to new situations and conditions
- Ability to generate new ideas – Creativity

5.2.5 [ΨΣ-TN-102] Algorithmic methods in Artificial Intelligence

Semester	A’
Course Type	Compulsory
ECTS	5

5.2.5.1 Contents

- Elements of Convex Optimization
- Algorithms for Minimizing Convex Functions
  Gradient Descent, Newton-Raphson, Conjugate Gradient, Applications in Machine Learning
- Linear Programming
  Linear Programming Theory, Simplex, Duality, Examples
- Integer Programming
  Modeling Examples, Linear Relaxations, Global Optimization Algorithms.
- Elements of Approximation Algorithms
  NP-hard Problems, Approximation via Linear Programming, Rounding, Primal-Dual and Dual-Fitting Approximations
- Online Decision Making Algorithms with Statistical Information
  Online Algorithms, Secretary Problem, Prophet Inequalities, other related models.
- Online Machine Learning Algorithms
  No-Regret Learning, Experts Learning, Bandits Learning

5.2.5.2 Evaluation/Assessment

Performance Evaluation / Assessment is carried out via obligatory exercises / projects that the students have to deliver, and via written exam.

5.2.5.3 Learning outcomes and general competencies

The course concerns theory and algorithms for dealing with optimization and decision making problems arising in Artificial Intelligence. The theoretical foundations of algorithms for global and approximate optimization are established, with a focus on theoretical performance guarantees, which find application in machine learning and optimum decision making. Models for online decision making are also investigated, with a separate focus on exploiting statistical prior information. Upon successful completion of the course, the students will be in position to:

- develop formal mathematical representation models for optimization and decision making problems,
- choose appropriate methods for global or approximate solving methods, for a given mathematical problem model,
- evaluate the solution to a mathematical optimization model and the performance of a solving method,
- design and apply algorithmic techniques for online decision making, using available statistical information or online machine learning.

Also, the course targets to the following general competencies:

- Search for, analysis and synthesis of data and information by the use of appropriate technologies,
- Adapting to new situations,
- Decision-making,
- Individual/Independent work,
- Group/Team work,
- Critical thinking,
- Introduction of innovative research,
- Development of free, creative and inductive thinking.

5.2.6 [ΨΣ-TN-141] Ethical and Trustworthy Artificial Intelligence: Theoretical approaches and Practical application

Semester	A’
Course Type	Compulsory
ECTS	5

5.2.6.1 Contents

- Introduction to AI ethics; Definition of ethics, Working context for developing ethical AI
- Defining moral values: Experiential workshop based on the methodology developed by the EU research project VAST (link is external)
- Data Governance
- AI systems and the Alignment Problem
- Legal framework; A description of the legal taxonomy: GDPR, AIAct, Data Governance Act.
- Impact and Risk assessment; Methods and tools.
- AI ethics prototypes
- Moral dilemmas in complex systems; description of moral theories.
- Use case 1: Application of AI impact assessment tools
- Use case 2: Application of AI impact assessment tools *Παρουσιάζονται μελέτες περίπτωσης, παραδειγματικά προβλήματα και μέθοδοι επίλυσης αυτών κοκ* .

5.2.6.2 Evaluation/Assessment

The course is examined by the preparation of compulsory assignments that the students hand in at regular intervals.

5.2.6.3 Learning outcomes and general competencies

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

- Understand the importance of ethical and reliable Artificial Intelligence (AI), the ethical challenges and ethical questions raised when developing an AI system.
- Understand key concepts that describe reliable AI and how these can be put into practice during the development of AI methods
- Understand the difficulties that the interaction of humans with AI imposes on the development of AI algorithms
- Get a complete picture of the regulatory framework concerning or related to IT through a detailed legal taxonomy.
- Know and apply evaluation methods for the compliance of a system with the principles of ethical and reliable AI.

Also, the course targets to the following general competencies:

- Ability to organize and plan work and time management
- Ability to communicate effectively (orallyl and written)
- Ability to solve problems
- Ability to develop critical thinking and capacity for critical approaches
- Ability to work in a team
- Ability of interdisciplinary approaches
- Ability to apply theoretical knowledge in practice
- Ability to research
- Exercise criticism and self-criticism

5.2.7 [ΨΣ-TN-201] Deep Learning

Semester	B’
Course Type	Compulsory
ECTS	7.5

5.2.7.1 Contents

- An introduction to deep learning.
- Feed-Forward Neural Networks.
- Convolutional Neural Networks.
- Autoencoders and Data Augmentation.
- Recurrent and Recursive Neural Networks.
- GRU/LSTMs & Attention
- Deep Reinforcement learning: Introduction and algorithms.
- Imitation learning.
- Policy gradient, value-based & actor-critic algorithms.

Case studies, example problems and methods for solving them are presented.

5.2.7.2 Evaluation/Assessment

The course is examined by the preparation of two compulsory assignments that the students hand in at the end of the semester.

5.2.7.3 Learning outcomes and general competencies

Upon successful completion of the course, the student will be able to

- Explain fundamental concepts and principles regarding deep machine learning and the parameterization/implementation/evaluation of deep machine learning algorithms on datasets.
- Know, configure and apply the most basic deep machine learning algorithms per problem type category (regression, classification, clustering, policy optimization).
- Know the methodology of applying and evaluating deep machine learning algorithms to data, comparing and choosing the appropriate algorithm.
- Understand algorithms, select, design or adapt the most appropriate and apply/evaluate to areas of interest
- Communicate deep machine learning ideas in a clear, concise and formal manner.

Aiming to parameterize, apply and evaluate deep learning algorithms to problems, and explain their operation.

Also, the course targets to the following general competencies:

- Ability to organize and plan work, and manage time effectively
- Ability to communicate effectively (orally and written)
- Ability to solve problems
- Ability to develop critical thinking and capacity for critical approaches
- Ability to work in a team
- Ability of interdisciplinary approaches
- Ability to apply theoretical knowledge in practice
- Ability to research
- Ability to adapt methods and techniques to new situations and conditions
- Ability to generate new ideas – Creativity

5.2.8 [ΨΣ-TN-250] Artificial Intelligence Applications

Semester	B’
Course Type	Compulsory
ECTS	7.5

5.2.8.1 Contents

- Applications of machine learning graph data (machine learning on graph data). Graph representation, feature engineering, community extraction from graphs.
- Recommender systems: basic approaches and new outcome evaluation metrics.
- Medical Information coding, standards, digital representation of biomedical signals and data.
- Knowledge Representation in Biomedicine, Biomedical Systems with Context Aware Features, Biomedical Signal and Data Processing for Feature Extraction.
- Decision Support Systems in Biomedicine, Biomedical Image and Signal Analysis, Using Deep Learning for Medical Image Characterization, Case Studies.
- Applications of Semantic Web technologies.
- Automated software synthesis.
- Applications of reinforcement learning and imitation learning in traffic management.
- Explainability and interpretability of reinforcement learning methods in critical problems
- Artificial intelligence in the natural sciences.

5.2.8.2 Evaluation/Assessment

The course is examined by the preparation of an assignment (report / implementation concerning the application of Artificial Intelligence Techniques to solve a specific problem) delivered by the students and the presentation of study material assigned to them.

5.2.8.3 Learning outcomes and general competencies

Upon successful completion of the course, the student will be able to

- Recognize opportunities, limitations and possibilities of applying Artificial Intelligence techniques in various areas of modern life.
- Point out the specificity of individual problems, the selection and adaptation to them of appropriate techniques
- Plan to evaluate alternative methods in comparison with each other to solve specific problems, recognizing the possibilities and limitations of each method/technique
- Communicate ideas related to the application of Artificial Intelligence techniques in a clean, clear and formal manner.

The overall aim is students to design, build and evaluate Artificial Intelligence systems to solve real-world problems, and explain their operation.

Also, the course targets to the following general competencies:

- Ability to organize and plan work and time management
- Ability to communicate effectively (orally and written)
- Ability to solve problems
- Ability to develop critical thinking and capacity for critical approaches
- Ability to work in a team
- Ability of interdisciplinary approaches
- Ability to apply theoretical knowledge in practice
- Ability to do research
- Ability to adapt methods and techniques to new situations and conditions
- Ability to generate new ideas – Creativity

5.2.9 [ΨΣ-TN-210] Natural Language Processing

Semester	B’
Course Type	Elective
ECTS	7.5

5.2.9.1 Contents

- Introduction to natural language processing: basic concepts, layers of linguistic analysis, application examples.
- Morphological analysis, text tokenization, sentence splitting, subword tokenization, regular expressions, text normalization, statistical properties of text and corpora.
- Language modeling: n-gram models, smoothing techniques, neural language models, evaluation of language models.
- Vector representation of words and texts, topic models, static embeddings.
- Pre-trained language models and deep learning, contextualized embeddings.
- Sequence to sequence (seq2seq) methods, Encoder-decoder models, Machine translation, Text summarization.
- Sequence classification: methods and applications.
- Sequence labeling, named-entity recognition and part-of-speech tagging.
- Syntactic analysis: context-free grammars, probabilistic grammars, dependency parsing, full and partial parsing.
- Semantic analysis, word sense disambiguation, semantic role labelling.

5.2.9.2 Evaluation/Assessment

The course is examined by the preparation of mandatory assignments that the students hand in at specific time intervals, and presentation of the material assigned to them for study.

5.2.9.3 Learning outcomes and general competencies

Upon successful completion of the course, the student will be able to

- Understand the levels of Natural Language Analysis and Processing (NLP)
- Recognize, understand, explain NLP techniques in combination with corresponding applications
- Highlight the specificity of individual NLP problems, the selection and adaptation to them of appropriate techniques
- Plan the evaluation of the methods in comparison with each other, recognizing the possibilities and limitations of each NLP method.
- Communicate ideas related to the application of NLP techniques in a clear, concise and formal manner.

The overall aims is students to be able to design, build and evaluate NLP systems to solve real-world problems, and explain their operation.

Also, the course targets to the following general competencies:

- Ability to organize and plan work and manage time effectively
- Ability to communicate effectively (orally and written)
- Ability to solve problems
- Ability to develop critical thinking and capacity for critical approaches
- Ability to work in a team
- Ability of interdisciplinary approaches
- Ability to apply theoretical knowledge in practice
- Ability to evaluate algorithms, analyze and explain results
- Ability to research
- Ability to adapt methods and techniques to new situations and conditions
- Ability to generate new ideas – Creativity

5.2.10 [ΨΣ-TN-221] Scalable Artificial Intelligence Methods

Semester	B’
Course Type	Elective
ECTS	7.5

5.2.10.1 Contents

The recent developments in the field of generative AI (Generative AI - GenAI) have highlighted, more strongly than ever, concerns regarding the role of scalability in the development of AI systems, but also the reliability of such systems. On the one hand the huge sizes of the training data and the multitude of parameters are largely responsible for the recent impressive successes in AI. On the other hand, these approaches show serious reliability problems, which significantly limit their usefulness in critical applications.

The aim of the course is to familiarize the students with the relevant concerns and the current debate about the role of scalability and reliability in AI. At the same time, the familiarity with "hybrid" AI techniques, which seek to combine methods from different areas of AI, with the aim of developing reliable AI systems, scalable at multiple levels (e.g. both large and small data sets). These techniques run through almost the entire AI "arsenal", including (deep) machine learning, knowledge representation and inference, optimization and formal methods. Therefore, the course also offers an overview of these different fields of AI and their combinations in applications with particular scalability and reliability requirements.

Course content:

- Introduction: scalability and reliability problems in AI. How far can we go with "big data" and how can we trust the behavior of an AI system trained on it? Trustworthy AI and its international standardization. Transparency, robustness, reliability, fairness etc. Overview of complex AI systems and applications with increased scalability and reliability requirements (eg autonomous systems, medical decision support systems, etc.).
- Scalability in large volumes of data (scale-out, scale-up). Real-time AI methods. Big Data manipulation and pattern recognition in data streams. Distributed pattern recognition. Handling concept drift.
- Scalability in small volumes of data (scale-in) and in conditions of scarce computing resources. Introduction to frugal machine learning (Frugal ML). Evaluation of AI methods considering limitations in the amount of available data and computing resources.
- Overview of symbolic techniques. Logic, knowledge representation and inference, formal languages and automata. SAT-based techniques and combinatorial optimization, standard methods. Scalability of symbolic techniques and their role in Trusted AI.
- Interpretability of models (interpretable ML) and explainability of predictions (explainable AI - XAI). Overview of basic XAI methods (LIME, SHAP, logic-based), examples and applications. Scalability of explanatory techniques.
- Overview of machine learning (neural, statistical, symbolic) and scalability and reliability issues. Robustness issues in (deep) machine learning. Formal verification of neural models. Robustification through training with verification counterexamples.
- Techniques for combining learning and logical-probabilistic inference, Introduction to neuro-symbolic AI. Algebraic view of logical inference and differentiable inference. End-to-end training of neural models with symbolic knowledge.
- Neuro-symbolic techniques for learning from less data and imposing plausible behavioral constraints on neural models. Examples of functional constraints on correctness, security, and impartiality.
- Neuro-symbolic techniques and Generative AI. Scalability, interpretability and correct behavior.
- Standard verification of neuro-symbolic models and complex systems. From individual component reliability to system reliability. Standard verification of high-level properties (verification of system-level properties).

5.2.10.2 Evaluation/Assessment

The course is examined by the preparation of a compulsory assignment that the students hand in during the course. Students also present material assigned to them for study.

5.2.10.3 Learning outcomes and general competencies

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

- Understand the complexity of the basic methods of artificial intelligence (inference, machine learning), combined with the needs of modern applications, which require the management of volumes of data at multiple scales.
- Choose the most appropriate AI method (and also data pre-processing) according to the requirements of the given problem, based on the volume of available data and the abundance (or scarcity) of computing resources.

- Understand and identify the sources of error and biased decisions of an AI system, as well as provide a quantified evaluation of it in terms of the volume of data it requires and the effects that increasing/decreasing the volume has on accuracy, (computational) cost, reliability and its interpretability.
- Understand and use artificial intelligence formalisms that enable human-machine synergy to solve artificial intelligence problems, through the construction of interpretable, verifiable and reliable machine learning models (interpretable vs. black-box models).

Also, the course targets to the following general competencies:

- Ability to organize and plan work and manage time effectively
- Ability to communicate effectively (orally and written)
- Ability to solve problems.
- Ability to develop critical thinking and capacity for critical approaches.
- Ability to work in a team.
- Ability to apply theoretical knowledge in practice

5.2.11[ΨΣ-TN-230] Machine learning on multimedia data

Semester	B’
Course Type	Elective
ECTS	7.5

5.2.11.1 Contents

- Signal and image analysis topics.
- Audio representations and feature extraction.
- Audio signal characterization: classification, segmentation, clustering, matching.
- Voice recognition.
- Introduction to image data, coding and representation, basic machine vision concepts.
- Image processing with machine learning: segmentation, edge detection, alignment, feature extraction classification, search and retrieval.
- Video analysis: motion and flow analysis, time-dimensional event recognition, video metadata and annotation, search and retrieval.
- Using deep learning for image and video classification, convolutional neural networks, visualization and understanding, transfer learning.
- Using temporal representation models for video analysis.

5.2.11.2 Evaluation/Assessment

The course is examined by the preparation of a compulsory group work which the students submit at the end of the semester and the presentation of study material during the semester at regular intervals.

5.2.11.3 Learning outcomes and general competencies

Upon successful completion of the course, the student will be able to

- Identify and recognize opportunities, limitations and possibilities of applying multimedia signal analysis and recognition techniques in various areas of modern life.
- Point out the specificity of the individual problems, the selection and adaptation to them of the appropriate techniques of analysis and recognition of multimedia signals
- Plan the evaluation of machine learning methods in comparison with each other, to recognize the possibilities and limitations of each method/technique, always taking into account the specificities of the multimedia data under analysis
- With the ultimate goal of being able to design, build and evaluate multimedia data content segmentation, analysis, recognition and visualization systems.

Also, the course targets to the following general competencies:

- Ability to organize and plan work and manage time effectively
- Ability to communicate effectively (orally and written)
- Ability to solve problems
- Ability to develop critical thinking and capacity for critical approaches
- Ability to work in a team
- Ability to apply theoretical knowledge in practice
- Ability to research
- Ability to adapt methods and techniques to new situations and conditions

5.2.12[ΨΣ-TN-260] Robotics

Semester	B’
Course Type	Elective
ECTS	7.5

5.2.12.1 Contents

- Description of robotic systems in space and Robot Operating System (ROS) basic concepts
- Description of the movement of a robotic system in space and time.
- Scene perception (sensors and data fusion)
- Localization and Mapping
- Navigation
- Human-Robot interaction: Problem definition
- Robot perception of people, human intentions and actions
- Cognitive architectures
- Robot motion in human populated environments
- Examples of deep learning in robotics

5.2.12.2 Evaluation/Assessment

Το μάθημα εξετάζεται με γραπτές εξετάσεις στις εξεταστικές εντός του έτους και με υποχρεωτικά φυλλάδια ασκήσεων, παρουσιάσεις υλικού μελέτης που παραδίδουν οι φοιτητές σε τακτά χρονικά διαστήματα.

5.2.12.3 Learning outcomes and general competencies

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

- Understand: a) basic concepts related to the description of solid bodies (and therefore robotic systems) in space, b) the difficulties imposed by the physical nature of robots in the application of Artificial Intelligence (AI) in real space and time, c) the requirements that human-robot interaction imposes on the design and development of Artificial Intelligence applications.
- Communicate ideas related to robotic systems and interaction.
- Analyze, select and apply appropriate Artificial Intelligence methods to robotics applications.
- Evaluate the application and results of methods aimed at developing AI applications for robotics that meet the requirements of ethical and reliable Artificial Intelligence.
- Design and experiment in simulated environments.

Also, the course targets to the following general competencies:

- Ability to organize and plan work and manage time effectively
- Ability to communicate effectively (orally and written)
- Ability to solve problems
- Ability to develop critical thinking and capacity for critical approaches
- Ability of interdisciplinary approaches
- Ability to apply theoretical knowledge in practice
- Ability to research
- Ability to adapt methods and techniques to new situations and conditions
- Ability to generate new ideas – Creativity

5.2.13[ΨΣ-TN-300] MSc Thesis

Semester	C’
Course Type	Compulsory
ECTS	30

5.2.13.1 Contents

At the end of the second semester of each study cycle, the lecturers of the MSc program submit to the Director lists of thematic areas for MSc theses, which are made public to the students under the responsibility of the Director. The thematic areas must be part or a combination of different knowledge areas comprising the curriculum. Postgraduate students choose a subject area and a supervisor, where, with his approval, they submit a relevant application to the Secretariat.
Examples of MSc Thesis topics can be found in the website.

5.2.13.2 Evaluation/Assessment

The MSc thesis is evaluated based on the master's thesis documentation, the public presentation before the 3-member examination committee made by the student, as well as on the answers to questions put to him/her during the examination.
The criteria concern the completeness and the originality of the theoretical study, as well as the development and application of AI methods, in the context of a theoretical or practical problem, based on the current and existing knowledge of the scientific community internationally.

5.2.13.3 Learning outcomes and general competencies

The master's thesis is a compulsory part of the academic curriculum of the MSc and its subject must be part or a combination of different knowledge areas comprising the curriculum. It must prove the theoretical knowledge, practical skills, critical thinking, ability to analyze and synthesize problems and research ability of the master's student.
It may refer to empirical, theoretical or applied topics and be carried out in collaboration with a private or public body dealing with related AI subjects.
Also, the MSc thesis targets the following general competencies:

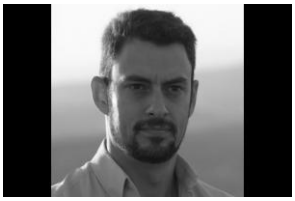
- Ability to organize and plan work and manage time effectively
- Ability to communicate effectively (orally and written)
- Ability to solve problems
- Ability to develop critical thinking and capacity for critical approaches
- Ability to work in a team
- Ability of interdisciplinary approaches
- Ability to apply theoretical knowledge in practice
- Ability to evaluate algorithms, analyze and explain results
- Ability to research
- Ability to adapt methods and techniques to new situations and conditions
- Ability to generate new ideas – Creativity

6 Lecturers and Staff

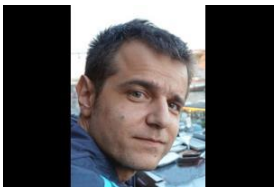
Elias Alevizos
NCSR Demokritos
Complex Event Recognition, Big Data Processing

Alexandros Artikis
Univ. of Piraeus
Mathematical logic, Multi-agent systems, Maritime information systems, Game theory, and statistics, probability theory

George Vouros
Univ. of Piraeus
Knowledge Representation and Reasoning, Ontologies, Reinforcement Learning, Agents and Multiagent Systems



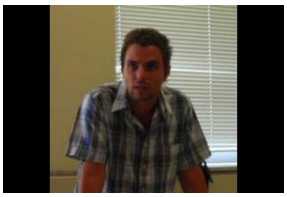
George Giannakopoulos
NCSR Demokritos
Natural Language Processing, Machine Learning, Data Mining, Biomedical Informatics.



Theodore Giannakopoulos
NCSR Demokritos
Machine Learning

Maria Dagioglou
NCSR Demokritos
Robotics, Ethical and Trustworthy AI

Vangelis Karkaletsis
NCSR Demokritos
Natural Language Processing, Intelligent, personalised Human-Computer Interface, Multimedia and multi-source search, extraction and fusion



Nikolaos Katzouris
NCSR Demokritos
Machine learning, knowledge representation & reasoning, complex event processing and recognition

Stasinos Konstantopoulos
NCSR Demokritos
Artificial intelligence and computational logic, decisional autonomy for machines, multi-dimensional data indexing, optimization of distributed data processing, autonomous robot perception and navigation

Elias Maglogiannis
Univ. of Piraeus
Pattern Recognition
Multimedia Communications
Telemedicine
Digital Image Processing

Alexandros Noussias
NCSR Demokritos
Applied Data Ethics and Legal Compliance

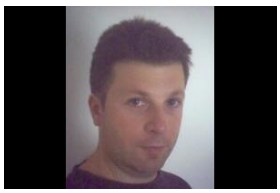
Georgios Paliouras
NCSR Demokritos
Machine learning, knowledge discovery, bioinformatics, personalization, user modelling, information filtering, information extraction, event recognition, ontology, grammar learning, web mining.

Georgios Petasis
NCSR Demokritos
Natural Language Processing, knowledge representation, Machine learning, ontology learning, linguistic resources, grammatical inference, speech synthesis

Christoforos Rekatsinas
NCSR Demokritos
Reinforcement Learning for Structural Design applications, Neural Networks applications on the Structural Health Monitoring of Composite Structures

Vasiliki Rentoumi
NCSR Demokritos
Applied linguistics, lexicography, syntax, semantics, language technology, natural language processing and computational linguistics

George Stavrinos
NCSR Demokritos
Robots under zero-gravity (microgravity) conditions (rovers or humanoids), Autonomous spacecraft, Flying robots (autonomous UAVs), Navigation autonomy, Dynamics, and kinematics analysis and motion planning.



Efstathios Stamatatos

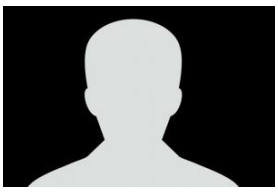
Univ. of the Aegean

Text mining, Intelligent information retrieval, Natural language processing, Machine learning, Computer music

Christos Spatharis

NCSR Demokritos

Reinforcement Learning, Deep Learning, Generative AI, Multiagent systems



Orestis Telelis

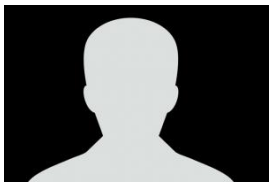
Univ. of Piraeus

Algorithms Design and Analysis, Computational Complexity, Algorithmic Game Theory

Antonis Troumpoukiis

NCSR Demokritos

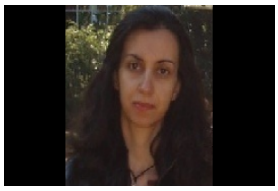
Knowledge representation, the semantics and implementation of programming languages, applications to data management



Michael Filippakis

Univ. of Piraeus

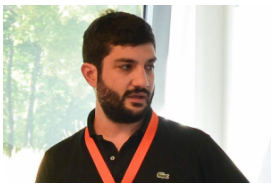
Nonlinear boundary value problems with partial differential equations, evolution equations, optimization and optimal control, mathematical economics, game theory, simulation of communication systems, image processing.



Maria Halkidi

Univ. of Piraeus

Learning and Data Mining Techniques, Data Mining in Distributed environments, WWW & Databases



Aggelos Charalambidis

Harokopio Athens University

7 Basic terms of the operating regulation

The II-MSC operating regulations presents the administrative bodies of the II-MSC and their responsibilities, so that the students know where they should turn each time for issues that concern them.

It also regulates, among other things:

- The conditions for awarding a MSc Degree (diploma),
- The duration of studies, and temporary interruption of studies (for reasons of health, force majeure, or other reasons),
- The organization of teaching, exams and grading/evaluation,
- The obligations of students and of lecturers,
- The establishment of prizes, scholarships and remunerative scholarships,
- The possibility of student mobility,
- It also ensures fair and equal examination/assessment of all students.

The students of II-MSC upon entering the II-MSC must be acquainted with the study regulation which constitute the basic operating framework of the II-MSC, in accordance with the legal framework of postgraduate studies in Greece.

8 Students' mobility

The students of II-MSC can participate in the following mobility programs:
● Internship within the framework of ERASMUS+ and which concerns the acquisition of research/professional experience and is not related to attending courses and matching them with D.P.M.S courses.
● Placement in a public/private organization for the preparation of a postgraduate thesis or for practical work.

The Academic Coordinator for students mobility is designated by the Curriculum Committee of the II-MSC and has the following responsibilities:

- He/She is responsible for the bilateral agreements with European Universities and agencies following the proposals of the teachers of II-MSC.
- He/She is responsible for publishing the places offered for student mobility and all related details.
- He/she recommends to the Curriculum Committee of the II-MSC on students' mobility for the next academic year.

The Mobility Regulation of the II-MSC specifies the conditions and procedures by which postgraduate students can participate in mobility programs related to II-MSC

The mobility of students takes place only through the bilateral agreements that have been concluded and are valid for the specific academic year in accordance with the mobility and internship regulation of the II-MSC "Artificial Intelligence".
This activity is supported by the Department of International and Public Relations of the University of Piraeus.

Website: http://www.unipi.gr/unipi/el/erasmus-plus.html

9 Academic advisor and management of complaints

The provision of information on the learning/educational process per course is done by the course lecturers who guide students on how to study the subject of each course of the curriculum, with the suggestion of exercises/assignments (probably in addition to the graded assignments) and additional bibliography.

In addition to the above basic but essential and fundamental process, the II-MSC has established the "Academic Advisors", starting from the year 2022-2023: Academic Advisors are tasked with guiding students in all matters of their studies, providing them with the necessary information and the necessary help to settle issues related to their studies but also their further academic and professional career.

The Academic Advisors inform the Curriculum Committee of their activity and of any findings that are useful in facilitating the objectives of the II-MSC, in order to ensure the maximum possible success of the objectives of the II-MSC

In addition, each student can request the resolution of any problem that arises during the educational/learning process from the bodies of the II-MSC following the procedure detailed in the complaints management regulation of the II-MSC.

10 Services to the students

10.1 Academic account and email services at the University of Piraeus

The Institutional Account is activated through the uregister.unipi.gr service. Before starting the process, the user should have his/her mobile phone number or email address, AMKA, VAT number and date of birth registered with the Secretariat of the Department.
Please refer to the detailed instructions for using the uregister.unipi.gr service for more help.
For support regarding the Institutional Account, users are requested to send an email to the address helpdesk@unipi.gr.
The University of Piraeus provides postgraduate students with an email service in the format @unipi.gr. It is accessed with their institutional account details (acquired through the uRegister process). To activate it, it is enough to connect to Webmail (The username in this application is @webmail.unipi.gr). Details about settings are provided at the following address: https://www.unipi.gr/unipi/el/hu-proxh-mail.html

10.2 Library and study rooms

The Library of the University of Piraeus addresses professors, researchers and students and its mission is to support education and research.
The library's opening hours are from 8:00 a.m. to 8:00 p.m., daily, on all working days.
The reading room is also accessible for the disabled.
The library is housed in the main building of the University. Its entrance is on the central circular staircase in the middle of the ground floor. Also, for the disabled, the elevator on the left side of the building is used.
The library consists of three main areas:
The Reception Area, where the movement area of the material, the closed collection, rare collections and the computers for searching the catalog and information sources are located,
The Library, which houses the entire print collection of the library, the photocopier and computers for readers, and
The Reading Room, where there are dictionaries, displays with the latest issues of printed magazines and other informational material.
Website: www.lib.unipi.gr

10.3 Digital services

Access to the full text of approximately 7,500 scientific journals is provided over the Internet. Access to these journals is possible thanks to the library's participation in the HEAL-Link Hellenic Network of Academic Libraries.
Electronic books: They concern the subject areas of the University of Piraeus and come from the publishing houses Cengage learning, Oxford Scholarship online, Sage, Science Direct, Taylor and Francis, Wiley Interscience and from Heal-link.

Databases: International Trade by Commodity Statistics (ITCS), Shipping Intelligence Network, Classification Web, Computer & Applied Sciences Complete, ECONLIT, ICAP, International Financial Statistics Online Service, JSTOR, Journal Citation Reports 2008 Edition, MathScience, LAW, and Databases Open Access..

10.4 Repositories

1. The digital repository of the scientific journal of the SPOUDAI Foundation, which has been published since 1950 and publishes articles in the fields of interest of the University of Piraeus (spoudai.unipi.gr/index.php/spoudai).
2. The Dioni Institutional Repository, where the postgraduate theses and doctoral theses of the institution's departments are stored, indexed, preserved and retrieved in digital form. Papers are accessible via the Internet, subject to permission granted by each author. The collection is enriched daily (dione.lib.unipi.gr).
3. The digital repository of the European Documentation Centers of Greece KETlib, with material of European interest produced by Greek scientific and political organizations and by the EU institutions. (ketlib.lib.unipi.gr/xmlui/).

10.5 Students' counselling center

The University of Piraeus Counselling Center (SY.KE.PP.) was founded in 1995 and functions as a meeting, support, communication and intervention space. The staff of the Counselling Center, recognizing the particularity of the difficulties that students may face, negotiate issues that are important for everyone and concern:

- Active learning
- Successful adaptation to new needs and requirements
- Social skills, relationships and family
- Dealing with stressful situations
- Prevention and Health
- Ways of creative expression and entertainment
- Development of skills necessary for a successful course

The intervention and treatment of the resulting needs can be done either through individual and group psychological counseling, or through conducting seminars focusing on promoting the academic adjustment of the student population.

The SY.KE.P.P. is located on the ground floor of the main building of the University of Piraeus, room 018.

Contact numbers: 210-4142042
Email: sykep@unipi.gr
Contact hours with students: 9:00 a.m.-3:00 p.m. Monday to Friday

10.6 Medical Services

Based on article 31 of Law 4452/2017, undergraduate and postgraduate students and doctoral candidates, who have no other medical and hospital care, are entitled to full medical and hospital care in the National Health System (NHS), with coverage of the relevant costs by the E.O.P.Y.Y., pursuant to the corresponding application of article 33 of Law 4368/2016.
Tel.: 2104142065, 2104142089, 2104142088

In the central building of the University there is a clinic that provides primary health services. It operates daily on the ground floor of the main building, office 003.
The clinic is fully equipped with medical equipment (cardiograph, defibrillator, oxygen, wheelchair, medicinal material for intravenous, intramuscular or oral treatment).

A Specialist Pathologist and a nurse serve the University's population on a daily basis, while occasionally a Gynecologist also visits.

Tel.: 210 4142166

10.7 Academic Secretariat and services

The Secretariat building of the Department of Digital Systems of the University of Piraeus is located in Piraeus at 80-82 Zeas Street (2nd floor). The Secretariat of the Graduate Studies Program is housed in the same space and serves postgraduate students every Monday-Wednesday-Friday from 11:30-14:00 and Tuesday-Wednesday-Thursday from 14:30-18:00
Email: gramds@unipi.gr
Phone: 210 4142235, 210 4142426

In addition, the II-MSC is supported secretarially, mainly in terms of its current management obligations, by the secretariat housed in the NCSR Dimokritos (Patriarchou Grigoriou V' & Neapoleos 27, 15341 Agia Paraskevi), in the Institute of Informatics and Telecommunications, building 26. The Graduate Studies Program Secretariat serves postgraduate students every Monday - Friday from 14:30-18:00.
Email: ai@iit.demokritos.gr
Phone: 210 6503216

At the address sis-portal.unipi.gr there is an online application that covers the study subjects. From this application, students can:

- be informed about the courses of the curriculum, the lecturers, the proposed writings as well as the announcements issued by the Secretariat and the lecturers.
- be informed about the score in the courses that have been examined
- submit the course declarations of each semester electronically
- receive attendance certificates immediately and in electronic form
- submit applications for certificates

Access to this application is through each student's personal account.

Η κινητικότητα των φοιτητών γίνεται μόνο μέσω των διμερών συμφωνιών που έχουν συναφθεί και ισχύουν για το συγκεκριμένο ακαδημαϊκό έτος σύμφωνα με τον κανονισμό κινητικότητας και πρακτικής άσκησης του Δ.Π.Μ.Σ. «Τεχνητή Νοημοσύνη».
Η δραστηριότητα αυτή υποστηρίζεται από το Τμήμα Διεθνών και Δημοσίων Σχέσεων του Πανεπιστημίου Πειραιώς.
Website: http://www.unipi.gr/unipi/el/erasmus-plus.html

11 References

[1] Operating Regulation of MSc in Artificial Intelligence
[2] Mobility Regulation of MSc in Artificial Intelligence
[3] Academic Advisor Regulation of MSc in Artificial Intelligence
[4] Complaints Management Regulation of MSc in Artificial Intelligence