Master's Degree in Artificial Intelligence (AI)
ماستر في الذكاء الاصطناعي
Master en Intelligence Artificielle

2023 - 2024

École supérieure d'ingénieurs de Beyrouth (ESIB)

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1. Presentation

- **General Information**

Artificial Intelligence (AI) is a broad area of **Computer Engineering** that can create machines and software that can accomplish some tasks that only intelligent beings are deemed able to do. In some instances, these artificial intelligent agents can also improve themselves. Today, intelligent systems can identify some types of objects and patterns better and faster than humans, perform real-time natural language processing and translation, provide decision support, play logical games and many other things. AI-based technologies are changing the labor market and industries themselves, just as the industrial revolution did 200 years ago.

The job of « AI specialist » is currently one of the most demanded jobs and is projected to be in the top position for the next decade. The need of national, regional and international markets for AI experts is growing exponentially. In fact, until recently companies were investing in AI to give them an edge over their competitors.

- **Scientific and Educational Objectives**

The Master in AI is part of a professional program to prepare specialists capable of developing intelligent software and systems to be implemented in different industries for the better of mankind.
It is a professional master program that meets the needs of the job market. Furthermore, the theoretical basis that this program provide, allows students to pursue a doctoral thesis in this domain.

This Master program aims to train:

- High-level professionals capable of designing and implementing new AI tools for industrial use. The applications include and are not limited to the fields of healthcare, robotics, industry, economy, environment and self-driving cars,
- scientific researchers in computer engineering, computer science, and optimization.
- Multidisciplinary consultants able to turn information into decision support tools within a company.

- **General Organization of the Master's Degree**

The Master in AI is based on the state of the art development and research in the fields of AI, Machine learning, optimization and data science. It consists of 120 credits for a duration of two years, spread over 4 semesters S1, S2, S3 and S4 over the course of 2 years M1 and M2. The program features:

- Theoretical and practical lectures,
- Extensive hands on experience,
- An internship in a company or a research internship leading to the writing of a thesis and a defense.

Since one of the main objectives of this program is to train professionals in the field of AI, who can integrate the industry upon graduation, a major part of the program is devoted to intensive programming tasks for implementation of efficient solutions to several real life problems at hand.

- **Opportunities and Doctoral studies**

The AI domain is a huge reservoir of jobs for years to come. It presents a wide range of opportunities in the following sectors:

- Robotics
- Computer game development
- Self-driving cars
- Fintech
- Healthcare and medical applications
- Internet of Things (IoT)
- Economy
- Machine learning
- Deep learning
- Human-centered problems
- Language processing
- Intelligent tutoring systems
- Expert systems
- etc.

This program also initiates the students into AI. In fact, students who have successfully completed the Master's Degree will be eligible to pursue a PhD.

2. Admission and Registration

- **Admission**

Admission of students is based on their file and an interview might be required.

1- Admission to the first semester of the Master's program (S1)

To be authorized to submit application files, students must satisfy one of the following conditions:

- Hold a BS Degree in Computer and Communications engineering, or Computer Science, telecommunications,
- Hold an equivalent Degree recognized by USJ.

2- Admission to the third semester of the Master's program (S3)

To be authorized to submit application files, students must satisfy one of the following conditions:

- Hold a BE Degree in Computer and Communications Engineering or being a CCE Program Student at ESIB and earned at least 120 credits in Engineering Cycle.
- Hold a Master Degree in Computer Science, or Computer and Communication, or Informatics.
- Hold an equivalent Degree recognized by USJ.

The documents required when submitting the application form are specified in the common admission file specific to Saint Joseph University of Beirut.
The submitted files will be examined by the Scientific Committee, of the engineering Faculty, which will subsequently establish the list of admissible candidates. The Scientific Committee will decide for each application the teaching units (teaching units) validated according to the program and the results obtained previously. The selected candidates might be interviewed before their final admission. The application file is downloadable from the site of Saint Joseph University of Beirut [1] and is to be deposited in:

Faculty of Engineering (ESIB) at USJ
Mar Roukos, Mkalles
Tel: (01) 421317

[1] https://www.usj.edu.lb/intranet/actu/pdf/9398_1295.pdf

3. Degree and regulation

- **Language**

All the courses are offered in English. The file of each candidate must include a written statement certifying that the student has high proficiency in English language (written by the candidate if he does not have an official certificate). If deemed necessary, the Scientific Committee might check the English level of the candidate and might require, if necessary, some remedial courses.

- **Degree requirements**

The AI Master's Degree is awarded to candidates who have successfully passed the evaluations of the theoretical and practical Teaching Units (courses) and who show excellent level during their thesis defense. There is no provision for makeup exams in case of a missed exam or test. In the event of a serious accident, duly and seriously justified, the case will be examined by the jury to take the measures deemed appropriate.

- **Attendance**

Student attendance is compulsory for all teaching activities.

- **Conditions**

Each Teaching Unit is given a grade. Following the exam period, the jury finalizes the results. The GPA is calculated based on the courses weighted by the number of credits. A Teaching Unit, with the exception of the Master's Thesis, is validated if its grade is greater than 10/20. Successful completion of 90 credits for semesters 1, 2 and 3 is mandatory in order to present the Master Thesis report. The priority in the choice of Master Thesis is based on the overall GPA. The Master Thesis is validated if its grade is greater than or equal to 12/20.

- **Degree**

The Master's Degree in AI is awarded to admitted students having validated all the Teaching Units of the 4 semesters M1-S1, M1-S2, M2-S3 and M2-S4. The scoring system is defined by the internal regulations of Saint Joseph University of Beirut.

4. Skills and Learning Outcomes

Upon graduation, students will be able to:

I. Compare AI with human intelligence and traditional information processing and discuss its strengths and limitations and its application to complex and human-centered problems.
II. Discuss the core concepts and algorithms of advanced AI, graphical models, decision making, multiagent, inductive learning, statistical learning, reinforcement learning, deep learning, natural language processing, robotics, and so on.
III. Apply the basic principles, models, and algorithms of AI to recognize, model, and solve problems in the analysis and design of information systems.
IV. Analyze the structures and algorithms of a selection of techniques related to searching, reasoning, machine learning, and language processing.
V. Design AI functions and components involved in intelligent systems, such as computer games, expert systems, semantic web, information retrieval, machine translation, mobile robots, decision support systems, and intelligent tutoring systems.
VI. Review research articles from well-known AI journals and conference proceedings regarding the theories and applications of AI.
VII. Perform research project and write research proposal, report and paper.

Student Outcome SO	**Key Performance Indicator KPI**
a) Ability to apply knowledge of mathematics, physics in problem solving	a1. Apply knowledge of mathematics to solve problems
	a2. Apply knowledge of physics to solve problems
b) Ability to design, conduct experiments, analyze and interpret data	b1. Plan experiments by applying theoretical knowledge and selecting appropriate data to measure
	b2. Perform experiments by correctly manipulating tools and measuring data
	b3. Analyze the data using the appropriate tools, and interpret the results
c) An ability to design a system, component, or process that meets the needs and realistic constraints of economic, environmental, social, political, ethical.	c1. Develop a design strategy by analyzing needs and respecting technical and non-technical constraints
	c2. Propose a solution adapted to needs, and compare it to alternative solutions
	c3. Test, improve, and implement using the appropriate tools such as modeling, prototyping, and performance testing
d) An ability to identify, formulate and solve an AI problem	d1. Identify an AI problem by selecting the information used and needed
	d2. Formulate a problem by adopting an appropriate model
	d3. Solve the problem by using appropriate tools and applying technical knowledge

e) An understanding of professional and ethical responsibility	e1. Describe the professional code of conduct such as responsibility to the different actors: customers, employees, administration, society, environment
	e2. Understand the legal and security responsibilities of the AI specialist profession
f) Education needed to understand the impact of AI in a global, economic, environmental and societal context	f1. Describe the local and global impact of AI on individuals and society, identifying relevant resources and making informed judgment
g) Knowledge of contemporary subjects	g1. Quote recent developments related to the field of data analysis
h) Ability to use the modern techniques, skills, and tools needed for AI	h1. Use techniques necessary for professional practice such as design, prototyping and simulation
	h2. Use the skills needed to practice the profession, such as programming and tool manipulation

5. Program

The Master program is spread over 2 years. The Teaching Units (courses) are distributed over semesters S1, S2, S3 and S4. Following the ECTS standards, 1 ECTS accounts for a workload of 25 hours.
The Master program and the student's workload are depicted in the following tables where:

- C: Course work in hours
- L: Laboratory work in hours
- H: Personal work (Homework, study, projects)

Semester 1 (S1)	**C**	**L**	**H**	**Total**	**Credits**
Graph Theory and Operational Research (020IAGOM2)	30	5	65	100	6
Foundation of Artificial Intelligence (020IAAIM1)	30	5	65	100	6
Mathematics for AI & Machine Learning (020IAMAM1)	30	5	65	100	6
Programming for AI & Machine Learning (020IAOOM1)	30	5	65	100	6
Statistics for AI & Machine Learning (020IASTM1)	30	5	65	100	6
	150	**25**	**325**	**500**	**30**

Semester 2 (S2)	**C**	**L**	**H**	**Total**	**Credits**
Game Theory (020IAGTM2)	20	5	35	60	4
Foundations of Decision modeling (020IADMM1)	30	5	65	100	6
Industrial AI	20	5	35	60	4
Machine Learning and Deep Learning (020IAMLM2)	30	5	65	100	6
Big Data Frameworks (020IABDM2)	20	5	35	60	4
Parallel Computing (020IAPCM2)	30	5	65	100	6
	150	**25**	**300**	**480**	**30**

Semester 3 (S3)	**C**	**L**	**H**	**Total**	**Credits**
AI based Control Systems (020IARBM3)	30	5	65	100	6
AI in Computer Vision (020IACVM3)	30	5	65	100	6
AI in Cybersecurity (020IACSM3)	20	5	50	75	4
AI in Financial Technology (020IAFIM3)	20	5	50	75	4
AI in Natural Language Processing (020IANLM3)	20	5	50	75	4
AI in Robotics (020IAROM3)	20	5	50	75	4
Legal, Policy and Ethical considerations for Data scientists and AI (020IALPM3)	20		20	40	2
	160	**30**	**350**	**540**	**30**

Semester 4 (S4)	**Credits**
Master Thesis (020IAINM4)	**30**

6. Program Content

The Master program in AI is designed to prepare AI leaders. AI became a game changer of our life. The aim of this program is to provide the foundations and the most advanced techniques in the field so that enrolled students have the opportunity of becoming technical and innovative leaders of this profound scientific and societal transformation.
Our program is unique in terms of the provided curriculum in that it encircles the field both with model/symbolic-driven and data-driven artificial intelligence methods as well as their applications to critical domains like natural language processing, visual computing, internet, medical imaging and financial technology.

This unique end-to-end from theory to practice program entirely offered in English with of classes and instructors of outstanding quality offers you a unique opportunity of excellence in terms of curriculum towards becoming an artificial intelligence specialist and gaining amazing career perspectives in the hottest discipline of this century.

Semester S1 (30 credits)

Foundations of Artificial Intelligence (020IAAIM1 - 6 credits)

Study of intelligent agents: problem solving, length and width search algorithms, game programming: minimax, exptimax, knowledge and reasoning, planning, learning, natural language processing, vision, robotics, inference mechanisms, Bayes networks, Markov processes, Reinforcement learning and their algorithms: TD and Q.
Content:

- Reinforced learning
- Intelligent agents
- Uncertainty, knowledge and reasoning
- Learning: Knowledge bases
- Observation learning
- Games planning, research and programming
- Problem solving
- Decision making

Graph Theory and Operational Research (020IAGOM2 - 6 credits)

This teaching unit introduces graph theory and operational research as modeling and decision-making tools for engineers.
At the end of this teaching unit students will be able to:

- Make a mathematical and computer representation of graphs
- Apply graph traversal algorithms
- Know how to calculate the shortest way
- Know how to maximize a flow problem
- Apply graphs to project management
- Understand the Simplex algorithm and linear programming

Mathematics for AI & Machine Learning (020IAMAM1 - 6 credits)

Artificial Intelligence has gained importance in the last decade with a lot depending on the development and integration of AI in our daily lives. The progress that AI has already made is astounding with the self-driving cars, medical diagnosis and even betting humans at strategy games like Go and Chess.

The future for AI is extremely promising and it isn't far from when we have our own robotic companions. This has pushed a lot of developers to start writing codes and start developing for AI and ML programs. However, learning to write algorithms for AI and ML isn't easy and requires extensive programming and mathematical knowledge.

Mathematics plays an important role as it builds the foundation for programming for these two streams. This course will help students master the mathematical foundation required for writing programs and algorithms for AI and ML.

The course covers three main mathematical theories: Linear Algebra, Multivariate Calculus and Probability Theory.

Probability Theory – The theories are used to make assumptions about the underlying data when we are designing these deep learning or AI algorithms. It is important for us to understand the key probability distributions, and we will cover it in depth in this course.

It covers topics such as: Elements of Probability - Random Variables – Distributions - Variance and Expectation - Special Random Variables

Linear Algebra – Linear algebra notation is used in Machine Learning to describe the parameters and structure of different machine learning algorithms. This makes linear algebra a necessity to understand how neural networks are put together and how they are operating.

It covers topics such as: Scalars, Vectors, Matrices, Tensors - Matrix Norms - Special Matrices and Vectors - Eigenvalues and Eigenvectors

Multivariate Calculus – This is used to supplement the learning part of machine learning. It is what is used to learn from examples, update the parameters of different models and improve the performance.

It covers topics such as: Derivatives – Integrals – Gradients - Differential Operators - Convex Optimization

Programming for AI & Machine Learning (020IAOOM1 - 6 credits)

The main purpose of this teaching unit is to give students the necessary tools for the development of advanced level programs in their programs. This program focuses on the fundamental building blocks you will need to learn in order to become an AI practitioner. Specifically, students will learn programming skills, and essential math for building an AI architecture. They will even dive into neural networks and deep learning.

This course covers the following topics:

- Introduction to Python: Start coding with Python, drawing upon libraries and automation scripts to solve complex problems quickly
- Tools for working with data in Python: Learn how to use all the key tools for working with data in Python: Jupyter Notebooks, NumPy, Anaconda, Pandas, and Matplotlib.

- Linear Algebra Essentials: Learn the foundational linear algebra you need for AI success: vectors, linear transformations, and matrices as well as the linear algebra behind neural networks
- Calculus Essentials: Learn the foundations of calculus to understand how to train a neural network: plotting, derivatives, the chain rule, and more. See how these mathematical skills visually come to life with a neural network example.
- Neural Networks: Gain a solid foundation in the hottest fields in AI: neural networks, deep learning, and PyTorch.

Statistics for AI & Machine Learning (020IASTM1 - 6 credits)

This course provides a basic high-level introduction to the mathematics and statistics that underpin many of the modern machine learning and AI algorithms. This course will cover two broad areas of statistics: inference and prediction:

- The inference portion will introduce common statistical concepts that allow us to understand a population and test hypotheses (such as perform A/B tests, calculate and interpret p-values).
- The prediction section will begin with the simplest of algorithms (linear regression) and gradually touch upon more advanced topics such as random forests and cross validation.

Real world examples will be used from the fields of healthcare, genetics, marketing and manufacturing.

Semester S2 (30 credits)

Big Data Frameworks (020AIFRM2 - 4 credits)

Conceptually, the course is divided into two parts:

- The first covers the fundamental concepts of MapReduce parallel computing, through the eyes of Hadoop, MrJob and Spark, while delving deep into Spark, data frames, Spark Shell, Spark Streaming, Spark SQL, MLlib. Students will use MapReduce for industrial applications and deployments for various fields, including advertising, finance, health, and search engines.
- The second part focuses on algorithmic design and development in parallel computing environments (Spark), development of algorithms (learning decision tree), graphics processing algorithms (pagerank / short path), Newton algorithms, and support vector machines.

Foundation of Decision Modeling (020IADMM1 - 6 credits)

Preferences are present and pervasive in many situations involving human interaction and decisions. Preferences are expressed explicitly or implicitly in numerous applications and relevant decision should be made based on these preferences. This course aims at introducing preference models for multicriteria decisions. We will present concepts and methods for preference modelling and multicriteria decision making. The course also presents stochastic processes and estimators.

Game Theory (020IAGTM2 - 4 credits)

This course will initially present the main principles concerning decision under uncertainty, and the use of graphical models when making decision under uncertainty. Second, we will consider

principles of game theory and show how such theory can model and analyze decision in situation where uncertain and strategic interactions are involved.

Industrial AI (020IAIAM2 - 4 credits)

By the end of this course, students will have acquired a comprehensive understanding of industrial AI, enabling them to effectively apply AI techniques in real-world industrial settings. They will be equipped with practical skills in MLOps, AI deployment, and XAI, making them valuable contributors to the rapidly evolving field of industrial artificial intelligence. In the final part of the course, students will explore the emerging field of Explainable AI (XAI). They will learn techniques to interpret and explain the decisions made by AI models, with an emphasis on their application in industrial scenarios.

Machine Learning and Deep Learning (020IAMLM2 - 6 credits)

Machine learning is a scientific discipline that deals with the design and development of algorithms that allow computer behaviors to evolve based on empirical data, such as databases or sensor data. A major focus of machine learning research is to make the machine able to recognize and learn complex patterns and make intelligent decisions based on the captured data; the difficulty lies in the fact that the set of all the possible behaviors considering all the possible entries is too complex to describe it by using programming languages.
The course will focus on understanding important concepts in machine learning and present the main paradigms and methods that form the basis of modern machine learning. This involves the specific study of learning algorithms as well as the empirical experimentation of algorithms.

This course is also an introduction to deep learning, a branch of machine learning concerned with the development and application of modern neural networks. Deep learning algorithms extract layered high-level representations of data in a way that maximizes performance on a given task. It covers a range of topics from basic neural networks, convolutional and recurrent network structures, deep unsupervised and reinforcement learning, LSTM, and applications to problem domains like speech recognition and computer vision.

Parallel Computing (020IAPCM2 - 6 credits)

In a parallel computation, multiple processors work together to solve a given problem. These are exciting times in parallel computing. The largest parallel machine has over a hundred thousand processors, and it is believed that machines with over ten thousand processors will be commonly available by the end of the decade. Furthermore, with most chip manufacturers moving toward multicore processors, most machines will soon be parallel ones. It is, therefore, essential to learn to use parallel machines effectively.

Learning Objectives:
At the end of this course, you should be able to accomplish the objectives given below.

- Define terminology commonly used in parallel computing, such as *efficiency* and *speedup*.
- Describe different parallel architectures, inter-connect networks, programming models, and algorithms for common operations such as matrix-vector multiplication.
- Given a problem, develop an efficient parallel algorithm to solve it.
- Given a parallel algorithm, analyze its time complexity as a function of the problem size and number of processors.
- Given a parallel algorithm, an input to it, and the number of processors, show the steps

performed by that algorithm on that input.
- Given a parallel algorithm, implement it using MPI, OpenMP, pthreads, or a combination of MPI and OpenMP.
- Given a parallel code, analyze its performance, determine computational bottlenecks, and optimize the performance of the code.
- Given a parallel code, debug it and fix the errors.
- Given a problem, implement an efficient and correct code to solve it, analyze its performance, and give convincing written and oral presentations explaining your achievements.
- Understand CUDA and using GPU

Semester S3 (30 credits)

AI based Control Systems (020IARBM3 - 6 credits)

In this course, two intelligent techniques for data processing drawn from complex and imprecise environment are presented and studied. Fuzzy Logic theory is based on the empirical aspect of the human reasoning, and is used in the manipulation of imperfect, imprecise or approximate knowledge. It allows the modeling and processing of very complex systems in which, for example, human factors are present. Theory and applications concerning fuzzy logic exit for more than fifty years. They cover several fields such as artificial intelligence, identification and control of dynamic systems, automatic decision-making in complex systems, and fault diagnosis in industrial processes. On the other hand, Artificial Neural Networks are based on the biological aspect of the human brain. They are currently widely applied in various sectors such as telecommunication systems, automation, robotics, image processing and recognition, artificial intelligence, medicine and economics.

AI in Computer Vision (020IACVM3 - 6 credits)

This course will present an overview of trends, modern methods and applications of computer vision technologies in various problems of visual computing, namely visual analytics, object recognition, 3D scene modeling from multiple-views, cross training of multimodal data, etc. Also, this course will present an overview of trends, relevant to the automatic interpretation of medical imaging from computer aided solutions. The course will discuss the entire chain of problems in mid and high-level interpretation addressing the pillar problems of the field (detection, segmentation, registration) and the most AI-driven advanced technologies for computer aided diagnosis.

AI in Cybersecurity (020IACSM3 - 4 credits)

To intelligently solve today's various cybersecurity issues, popular AI techniques involving machine learning and deep learning methods, the concept of natural language processing, knowledge representation and reasoning, as well as the concept of knowledge or rule-based expert systems modeling can be used. In this course, you will learn about preparing the data for machine learning, common machine learning techniques and tools, and their applications to cybersecurity such as detecting anomalies, detecting known types of attacks like injections, clustering user activities, adversarial learning, etc. This course goes over the main disciplines of AI and explains how to apply these disciplines to solve pressing security problems, such as the challenges of data at scale and speed in threat response. Plus, you will learn how to best prepare your organization to apply AI-driven security.

AI in Financial Technology (Fintech) (020IAFIM3 - 4 credits)

Technology is playing an increasingly dominant role in the financial service industry. It is changing how existing players operate and it is creating new ways to deliver core services like saving, investing, borrowing, and transacting. The course provides an overview of the most significant technological advances that are radically changing the industry, focusing on AI and Blockchain. We will analyze how these technologies create value in the financial industry by lowering frictions — from unit processing cost, through asymmetric information and network effects. The course will integrate a high-level discussion of the competitive landscape and the market opportunities for new entrants, with an in-depth understanding of the technologies and their applications. We will do so by focusing on three areas in which these technologies are driving change: (I) Lending, (II) Clearing (III) Trading. In each of these areas, we will cover examples and developments from (1) marketplace lending, (2) blockchain and distributed ledgers, (3) quantitative trading and its use of non-standard data and analytics. In each of these areas, we start by analyzing the marketplace, the incumbents, and the strategies of the incoming technology-based new entrants. We then proceed to understand the relevant technological applications in each area using real-world data.

Course Learning Outcomes

- What is fintech?
- Market place lending, Lending Club: business model, Loan data visualization
- Credit models
- Random Forest applied to LC data and MPL from investors' perspective
- Cryptography
- Blockchain — network and incentives
- Blockchain — finance applications
- Quantitative trading
- Crowdsourced trading
- Machine Learning in trading
- Unstructured data and Natural Language Processing

AI in Natural language processing (020IANLM3 - 4 credits)

This course goes beyond the phase of gathering large amounts of data by focusing on how machine learning algorithms can be rewritten and scaled up to work on petabytes of data, at the same time. both structured and unstructured, to generate sophisticated models used to make predictions. Conceptually, the course is divided into two parts.

The first part deals with deep learning and key network architectures including: convolutional neural networks, autoencoders, recurrent neural networks, short-term long-term memory networks LSTM. This part also covers stochastic networks, conditional random fields, Boltzmann machines, stochastic and mixed deterministic models as well as deep reinforcement learning.
The second part deals with the processing of natural languages: Indeed, research in automatic natural language processing (NLP) is a field of artificial intelligence aiming at the development of automated techniques for the manipulation of linguistic data. Immediate applications of these techniques include the development of more natural textual interfaces, automatic document

translation, spam detection, search for information in a collection of documents from queries, question / answer systems, and several others. This part introduces the student to the following topics: Introduction to the problem of automatic processing of the natural language and its applications. The natural language in relation to formal languages: the problem of ambiguity. Overview of current linguistic theories. Analysis and synthesis of speech. Morphological analysis: structure of the dictionary and suffix analysis. Syntax analysis: ATN parser, unification grammars and representation of the semantics of natural languages: formal logic and frameworks. Semantic interpretation. Knowledge of the world and speech context. Applications.

AI in Robotics (020IAROM3 - 4 credits)

This course explores the integration of artificial intelligence techniques into robotics, enabling robots to perceive, reason, plan and interact with the environment intelligently. The course covers fundamental concepts, methodologies and applications in the field, with an emphasis on real-world implementation.

Legal, Policy and Ethical considerations for Data scientists and AI (020IALPM3) (020IALPM3 - 2 credits)

This course introduces ethics, politics, and the ethical implications of AI and data. The course will examine the legal, political, and ethical issues that arise throughout the entire lifecycle of the science of data collection, storage, processing, analysis, and use, including, privacy, surveillance, security, classification and discrimination. Case studies will be used to explore these issues in areas such as criminal justice, national security, health, marketing, politics, education, automotive, employment, athletics, and development.

Semestre S4 (30 crédits)

Master's Thesis (020IAINM4 - 30 credits)

During the 4th semester, students must complete a professional project in a company or research work in a laboratory for a period of 4 months on a topic related to AI.

- A student has the choice between:
  - A professional project in a company lasting 3 to 4 months, in a company on a theme related to AI, concluded by writing and defending a professional report.
  - A research topic lasting 3 to 4 months in a laboratory recognized by the scientific committee, concluded by writing and defending a research paper.

- The projects will take place in companies in Lebanon or abroad. The scientific responsibility for the project is provided jointly by the company and a teacher from USJ or a partner university. This project, for a minimum of one semester, aims to develop all the skills necessary for an AI specialist:
  - Bibliographic search.
  - Study of the state of the art.
  - Proposal and implementation of solutions.

- The research takes place in a laboratory either in Lebanon or in an external institution. Scientific responsibility for this research is provided by the research professor (s) who supervise them.
  This work, of a minimum duration of one semester, aims to develop the necessary skills to carry out a research work:
  - Bibliographic search.
  - Critical analysis of the state of the art.
  - Proposals and implementations of solutions.
  - Proposals and outlets for thesis work.

- The project or research work is the subject of a report or a written dissertation and a public defense.
  Students who have validated the theoretical modules of semesters 1, 2 and 3 are authorized to submit the project report and possibly the research paper.
  The thesis or report includes a bibliographic part and a technical part.
  The evaluation of the project or research work considers three elements:
  - Evaluation of the trainee's scientific initiative.
  - Evaluation of the written brief or report.
  - Evaluation of the oral defense.