AthenAI

Athenai Institute of Technology

Top Quant

Advanced AI, Generative AI, and Quantum Computing Applied to Financial Markets

14th Edition

IBM Qiskit

Google Cloud Certified PROFESSIONAL MACHINE LEARNING ENGINEER

Google Cloud Certified PROFESSIONAL DATA ENGINEER

Google Cloud Certified PROFESSIONAL CLOUD ARCHITECT

AthenAI

Contents

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AthenAI Institute of Technology

A school for those who truly ***want to learn*** and are ***willing to put in the effort.***

Why study at AthenAI?

AthenAI is a School with an international presence, but it is NOT a school for everyone.

"AthenAI is the school for those who have a true desire to learn and the courage to take on real challenges."

A school for those who are not seeking degrees, but transcendence.

In a context saturated with quick formulas and superficial education, AthenAI was born with the vocation of being a knowledge and technology boutique...

- A **selective, demanding institution, fully committed** to the major challenges of the present and the future.
- A **school of technological excellence** aimed at those seeking **deep, rigorous, and authentic learning**.
- Aimed at **students willing to face real challenges** and walk a path **full of obstacles** in order to achieve transformative learning.
- Where **there is no place for those seeking shortcuts or quick solutions** empty of substance.
- Where **we train leaders who leave a lasting mark** through knowledge, effort, and a genuine commitment to their own development and the world around them.

Where failure is a real possibility

We believe that true learning involves taking risks, stepping out of one's comfort zone, and facing the real possibility of failure, which is why—**unlike other schools—failing here is possible**.

Because mediocrity is born when there are no consequences, at AthenAI we believe that those **who aspire to lead must face the challenge of failure before achieving success**.

"Enrollment means having an opportunity to surpass the program. Not the guarantee of doing so."

Our fundamental pillars: Knowledge, Reputation, and Purpose

We are committed to **high-impact training**, based on **challenging projects** and a **network of strategic contacts that generate real opportunities**. Because those who choose our school do not want to follow the traditional path—they come to us to:

- Reinvent themselves
- Launch their own start-up
- Build the next unicorn
- Become a Forbes cover story

All of this is possible thanks to the three pillars that sustain our educational model: **Knowledge, Reputation,** and **Purpose**.

Pillar 1. Knowledge

Excellence of the faculty

It is **our most valuable asset**, which is why we devote special time and attention to its rigorous selection process. Each professor has been carefully chosen based on three key criteria:

- Their deep knowledge in the area they teach.
- Their ability to transmit all that knowledge to students.
- Their real-world experience in company projects.

This approach ensures high-level training, connected to professional reality and designed to deliver transformative, high-impact learning.

Personalized Tutorial Support

Our programs are designed to provide high-performance training, in which students continually apply the knowledge acquired in practical situations. For this reason, **tutorial support is an essential part of our pedagogical approach**.

Students will have access to our exclusive platform, where they will find all relevant documentation, practical exercises, and a forum where they can raise their questions and concerns. Additionally, t**hey will be able to communicate directly with all faculty members** via email and schedule tutorials flexibly. They will also **have access to the mobile phone of the Academic Director**, allowing them to resolve any urgent matter immediately.

Practical activities are designed to represent a real challenge for students. Therefore, the teaching staff maintains **constant contact with each student, evaluating their progress**. If a decline in academic performance is observed, we meet personally with the student to identify the cause—whether it is lack of study or any other factor affecting their progress.

Each student will have an assigned tutor who will accompany and guide them throughout the entire program, ensuring continuous learning and personalized support.

Constant content updates

Unlike other business schools, **updating our programs** is not a promise—it is a **fundamental principle**.
Each new edition, we thoroughly review and adapt the entire program to incorporate the latest trends, the most relevant technological advances, and the current challenges of the sector.

We rely on the direct participation of key players from major technology companies, who **share with our students the latest published papers** (Google, Microsoft, Meta, Amazon, etc.). This ensures that the content of each edition is unique, fully updated, and aligned with the real state of the market.

Programs certified by the main technology entities

Our programs are designed so that students, in addition to acquiring cutting-edge knowledge, can **obtain the most recognized national and international certifications**.

Immersive and practical methodology

"Our training is not limited to transmitting knowledge:
Here, it is lived, practiced, and demonstrated."

Learning means evolving, which is why students immerse themselves from day one in an **engaging experience** where they "learn with their hands":

- They **attend practical, dynamic, and rigorous classes** that combine essential theory with practical exercises and challenges of increasing difficulty.
- They must **complete a practical assignment at the end of each knowledge block** (there is no theoretical exam), designed to challenge even the most advanced profiles. These assignments **simulate real professional problems and environments**, ensuring that students not only understand the concepts, but test their ability to apply what they learn in concrete situations they will face in their future careers.
- They will have **3 weeks to complete and submit these assignments**, researching and testing different approaches until they manage to solve each exercise. This type of learning stays with them for life, unlike inefficient theoretical exams.
- They must have a **passing average grade (5)** across all assignments in order to present the Final Master's Project, which will consist of **designing a financial service using AI and Big Data**, to be defended before a panel.
- They always have access to the **same tools they will use in their professional life**: notes, the internet, forums, tutors, class recordings, access to ChatGPT, etc.
- They **develop and deploy services in production**, because theory is useless if it is not put into practice. They have access to a community designed to generate high-performance teams capable of developing their ideas and bringing them to the market.
- They **certify, compare, and evolve** their knowledge and skills.
- They **collaborate and compete with other students** in a safe and stimulating environment.
- They build a **high-value network**, sharing experiences with classmates who will become strategic contacts in their career evolution... and lifelong friends.
- They make **decisions with real impact on their trajectory and reputation** within the community: grades matter during training, but reputation will matter throughout their life.

Pillar 2. Reputation

Reputation and ethics as a measure of prestige

A person may be an excellent student but lack ethics, which is why it is crucial that knowledge and reputation are properly differentiated and valued independently.

Reputation must be closely linked to the participant's behavior—toward their peers and toward the school. It is not only about what they know, but how they act and **how they contribute to the academic and professional environment**.

Where your profile speaks for you

Every action, achievement, completed assignment, and challenge overcome by the student is **100% real and accessible to all participants**, as it is recorded on their **public profile**.

This profile is **based on the student's merits, competencies, and ethics**, **previously verified by the school**, so it faithfully reflects their evolution and becomes a professional presentation card—inside and outside the community.

"You will know the strengths and weaknesses of other participants…
but they will also know yours."

In each student's profile, **you can consult their level of knowledge, their reputation, and the certifications** obtained. Additionally, **knowledge will reflect the year in which it was acquired**, so constant updating will be essential.

This approach turns the AthenAI experience into one that is:

- **Transparent** ➪ Results are visible and authentic, based on verified merits and competencies.
- **Transformative** ➪ It accelerates skill acquisition and maintains student commitment from day one until graduation.
- **Human and connected** ➪ It enables an environment of transparent and authentic interactions, creating professional and personal bonds that accompany the student throughout life.

Content updates for graduates

"An education that does not end with the last class…"

Given the accelerated pace of obsolescence in many areas of study within our master's programs, we offer our graduates ongoing access to continuous, relevant updates of the content they studied.

Our *alumni* are natural ambassadors of our programs. Their professional success and satisfaction with the training received strengthen the reputation of the master's program and attract new students.

Once **a master's is completed, grades lose importance**; what truly matters is **reputation, which must continue to be visible and evolving**. Reputation will become **a currency of value for professional growth**, allowing graduates to obtain:

- Discounts on future training and master programs.
- Attendance at international conferences.
- Free content updates.

Factors that influence reputation

- Contributing to the learning of others: responding to student questions in the school forums, helping create an environment of collaboration and mutual support.
- Publishing research or papers together with the school, sharing your knowledge with the academic and professional community.
- Actively participating in school competitions, demonstrating your ability and commitment in practical and challenging contexts.
- Sharing your personal experience on social media, posting videos and testimonials about your journey in the school, inspiring others and positioning yourself as a reference.
- Developing innovative projects and services in collaboration with the school, providing concrete solutions that benefit the community.
- Attracting new students, recommending the school to future candidates and acting as a brand ambassador.
- Collaborating in school events and activities, participating in conferences, seminars, or mentoring sessions that reinforce your role as a leader within the community.

Factors that influence ethics

- Negatively affecting the image of the school, whether through destructive attitudes, malicious comments, or actions that harm its prestige.
- Maintaining unethical or violent behaviors, such as dishonest practices, unnecessary conflicts, or attitudes that compromise personal or institutional integrity.
- Ignoring community rules, violating academic, ethical, or behavioral policies that govern the school.
- Discrediting peers or community members, generating unjustified conflicts and contributing to a toxic environment.
- Showing disinterest or abandoning commitments, leaving projects or tasks unfinished and harming collective work.

Pillar 3. Purpose

Improving employability and working conditions

The level of rigor in our programs, along with the constant updating of their content, turns our graduates into an **exceptional talent pool, highly sought after** for specific positions at high-responsibility levels (C-Level) or in technological or cybersecurity laboratories, both in the public and private sectors.

Thanks to our close collaboration with these laboratories, students **can work on real projects and participate in strategic challenges** proposed by leading institutions, significantly **increasing the job placement opportunities of our graduates**.

"Our objective is to ensure that the employability of our graduates, nationally and internationally, is close to 100% in relevant positions."

Creating AI experts

Most programs seek to create advanced AI users ➪ A user depends on third-party software.

Our objective is to create AI experts ➪ An expert is capable of creating their own AI software, from design to production deployment, and adapting it to solve any task they undertake.

"Our goal is to teach how to develop AI, not just how to use AI."

A school with a soul

AthenAI was born from the mind of Zeus, combining **knowledge, arts, justice, and strategy**. Its name not only evokes wisdom, but also determination and character.

Our school was founded with a clear, shared purpose: **to inspire our students to transcend the personal and create real impact in the world**...

"Build something you believe in."

It is not only about studying, but creating.

It is not about working, but leading.

It is not only about teaching, but transforming the student into their best version.

It is about separating leaders from those who are not.

Here begins your story

Welcome to AthenAI

AthenAI

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Our platform

Much more than a virtual classroom: a living digital ecosystem, designed to drive learning, collaboration, and continuous professional growth, beyond the classroom and throughout the entire journey of our students.

The perfect ecosystem for unlimited education

We transform the educational experience into a dynamic, demanding, deeply realistic, and future-oriented environment that **maintains the motivation and focus of our students**.

Our methodology is not only advanced, rigorous, and challenging. We ensure that **each student evolves within an ecosystem meticulously designed for success**:

"When learning becomes an immersive experience,
knowledge turns into action and results become tangible."

Our educational platform has been created as a **constantly expanding ecosystem, where** ideas come to life and where **every interaction connects you with new opportunities**: learning, sharing, collaborating, competing, innovating, growing, projecting yourself professionally…

It is not just another virtual classroom. It is a living digital environment that provides the necessary tools to **maximize learning and students' professional development, accompanying them throughout their entire journey** (as students and as active professionals), allowing them to continue growing long after they have completed their training and to belong to a global community that never stops evolving.

1. The School: The academic core of the ecosystem

Within the *School* space, students have access to all the tools necessary **to manage and enhance their learning**:

- **To consult their progress in the programs** in which they are enrolled, as well as in those already completed. They will also be able to view the percentage of credits that can be validated for programs in which they are not enrolled.
- To access live online classes, recordings of completed sessions, consult the session calendar, review their grades, submit assignments, request tutorials with their professors…
- To progress flexibly in their education, being able **to enroll in new programs** and use their accumulated reputation as a currency to obtain academic discounts and benefits.
- Graduates will be able to access subsequent updates to the materials (notes, exercises, and videos from the latest editions) through a small annual fee. In addition, they will be able to **recertify in specific areas of knowledge** to keep their professional profile up to date and to demonstrate the validity and evolution of their competencies.

2. Community: An exclusive network, unique of its kind

The *Community* **is the heart of the ecosystem**, **a selective and exclusive club** inspired by international institutions of excellence such as **Mensa** or **Forbes**, where access is restricted and standards of excellence are exceptionally high.

Students, mentors, and graduates interact within **a living, dynamic, and transparent network**, generating synergies, opportunities, and challenges. A space where learning is expanded through collaboration and collective intelligence, where members can:

- **Connect with students and graduates from any program**, share experiences, resolve questions, or propose projects.
- **Participate in debates, collaborate on projects, answer questions** from other peers, or r**equest a direct meeting** with any member of the network.

- **Consult any profile** 100% verified by the School, guaranteeing the authenticity of shared knowledge and fostering an environment of trust and prestige.
- **Access reputation and knowledge-area rankings**, identify the top profiles in each field, and discover how to improve their positioning within the community, stimulating healthy and enriching competition.
- **Increase their reputation with every valuable** contribution they make to the community, expanding their training opportunities, collaboration possibilities, and professional visibility.
- **Build solid and long-lasting relationships** that will impact their prestige and professional and personal development.

3. Competitions: Learning turned into challenge

Competitions allow students **to apply acquired knowledge in real and stimulating environments**, challenging them to overcome problems in areas as diverse as financial markets, cybersecurity, law, or climate prediction, as well as new topics proposed by students or partner companies.

Each participant **may compete individually or join a team**, lead proposals, or even **create their own competition**, under the academic supervision of the School. It is another way to demonstrate creativity, talent, and leadership ability to the community and to partner companies, gaining reputation in the process.

4. Library: Open, shared, and validated knowledge

The *Library* is a space where knowledge is democratized. A living collective repository, constantly growing, offering **access to a wide collection of academic materials**: notes, summaries, exercises, practice examples, papers, videos, and resources created by both professors and students.

Each validated resource enriches and supports the community, **contributing to the reputation of the contributor**.

Here, learning is not limited to classes: it is expanded through the ideas, curiosity, and generosity of the entire academic community.

5. SOFIA: The intelligence of talent

SofIA is the space reserved for **top-of-the-class students and program directors**.

Its mission is to identify and channel exceptional talent toward **high-impact strategic projects**.

An exclusive environment where the brightest minds connect with the **most innovative and ambitious opportunities**.

6. LARA: Where ideas become companies

Our *start-up accelerator* allows graduates to present innovative projects and **access mentorship, regulatory sandboxes, and investment opportunities (Business Angels)**.

Through our network of **Business Archangels**, in addition to investment, projects receive expert guidance, real involvement, and hands-on support to launch their initiatives into the market

7. SFINGE: Collaboration without borders

Sfinge was the first electronic financial services company in Spain and the technological origin of our School, representing one of the most innovative spaces within the ecosystem.

It enables the **creation of multidisciplinary and international teams** capable of developing projects and Master's Final Projects collaboratively, without geographical barriers.

Thanks to advanced search tools, students can identify peers with complementary profiles and form high-performance international teams operating 24 hours a day.

They will be able to build projects that, once consolidated, **can be submitted to the LARA acceleration program to take them to the next level**.

8. Job Board: Connecting talent with opportunity

The *Job Board* is designed to **enhance employability and boost professional projection**. It represents the meeting point between the talent trained at the School and companies seeking to incorporate highly qualified profiles.

Graduates of a Top program **may apply for exclusive job offers** or even **create their own positions** if their company is looking to recruit talent trained at the School.

Partner companies **may request knowledge assessments or certifications verified by the School**.

9. Strategy Games: Learning by playing

Our ecosystem incorporates a recreational section of *Strategy Games*, **inspired by ancient civilizations** (Egyptians, Vikings, Romans, Celts…), fostering decision-making, strategic thinking, and global tactical vision.

Students **may compete against AI or challenge other peers**, striving to climb the **School ranking** while developing key skills for leadership and management.

10. An ecosystem that evolves with its students

Our ecosystem is a network that grows and transforms alongside its students, accompanying them throughout their entire academic and professional lives.

A digital environment that **connects knowledge, innovation, opportunities, and a global community** to drive talent, collaboration, and success.

"Here, learning does not end when a master's degree finishes:
it becomes a way of life."

AthenAI

A UNIQUE Program

Lead the financial markets through ***Artificial Intelligence, Big Data, Blockchain***, and ***Quantum Computing***, training with a truly UNIQUE program.

Top Quant: Two master's programs that make up the most complete and demanding program in the world

Top Quant: The Elite in Finance, Artificial Intelligence, and Quantum Computing

Top Quant is not merely an educational program; it is an intellectually demanding challenge designed for those who aspire to lead the future of the financial and technology industries. With a unique structure worldwide, it combines academic excellence, rigorous training, and international recognition, establishing itself as the highest standard in advanced education.

By enrolling in this program, students can earn two master's degrees:

- **Quant Essential**: 450 instructional hours, equivalent to 54 ECTS (first academic year).
- **Top Quant**: 705 instructional hours, equivalent to 85 ECTS (second academic year).

Additionally, the program includes **five top-level official certifications**, awarded by leading entities in each discipline:

Quant Essential Certifications:

- Professional Cloud Architect (PCA), issued by Google

Top Quant Certifications:

- Quantum Computing Developer Qiskit 2, issued by IBM
- Professional Data Engineer (PDE), issued by Google
- Professional Machine Learning Engineer (PMLE), issued by Google

Students may choose to pursue only the Quant Essential program, one of the most comprehensive and demanding master's programs available, capable of transforming them into highly competitive and distinctive professionals.

Only those who aim to transcend and become true global leaders will take on the Top Quant challenge. This full program requires prior completion of the Essential level and represents the pinnacle of training in finance and applied artificial intelligence.

Top Quant is not studied: IT IS CONQUERED.

Nature of the master's degree

This master's degree was created as a direct response to **an urgent need within the business sector**: the lack of professionals with comprehensive and in-depth training in programming, finance, crypto-assets, investment algorithms, financial and technological law, cloud services and big data, artificial intelligence, blockchain, and quantum computing.

In an environment where companies struggle to recruit hybrid profiles capable of combining quantitative analysis and artificial intelligence, this master's degree positions itself as **a strategic pathway to train the new AI Quants, one of the scarcest, most valued, and best-paid profiles in the financial ecosystem**.

The orientation of this program is not academic, but entirely professional. This is not about completing a syllabus to obtain a degree, but about equipping students with the most advanced tools, skills, and knowledge available on the market. The program works with real data, professional development environments, and practical cases drawn directly from the industry.

Objective

The profiles that access this program usually have clear and ambitious motivations. In most cases, their objectives fall into three main categories:

- **To boost their professional career**, making a qualitative and quantitative leap, especially in terms of responsibility, projection, and salary.
- **To avoid technological obsolescence** by updating and expanding key competencies in a highly dynamic environment, even when starting from well-paid senior positions.
- **To access the labor market with a real competitive advantage**, through rigorous, multidisciplinary, and clearly differentiating training.

This master's degree is not just another line on a résumé. It is a turning point.

Admission profiles

Access to the master's degree is open to various profiles:

a) If you come from **a technical background** such as physics, mathematics, telecommunications engineering, computer engineering, etc., you will have solid knowledge in programming and mathematics, but limited knowledge in advanced Artificial Intelligence and Quantum Computing techniques, as well as limited training in finance—especially in the real application of your knowledge to the stock market (development and deployment of investment algorithms). This master's degree is for you if you want to become an AI-powered Quant.

b) If you come from a **finance-related background** such as Business Administration, statistics, actuarial science, auditing, or if you are an investment fund manager, trader, broker, investment director, innovation director, compliance officer, auditor, etc., you will have strong financial knowledge but limited expertise in programming and Artificial Intelligence techniques. This master's degree is for you if you want to stand out in the financial world and aspire to work in the top investment and innovation laboratories of leading brokerage firms.

c) If you come from a **critical infrastructure** background, you will have solid knowledge in statistics and probably in programming, but limited knowledge in finance and Artificial Intelligence. This master's degree will allow you to strengthen both areas, enabling you to develop advanced Artificial Intelligence services and apply them to the financial world.

The first modules of the program are designed to balance the knowledge base and working methodologies of these profiles.

Required prior knowledge

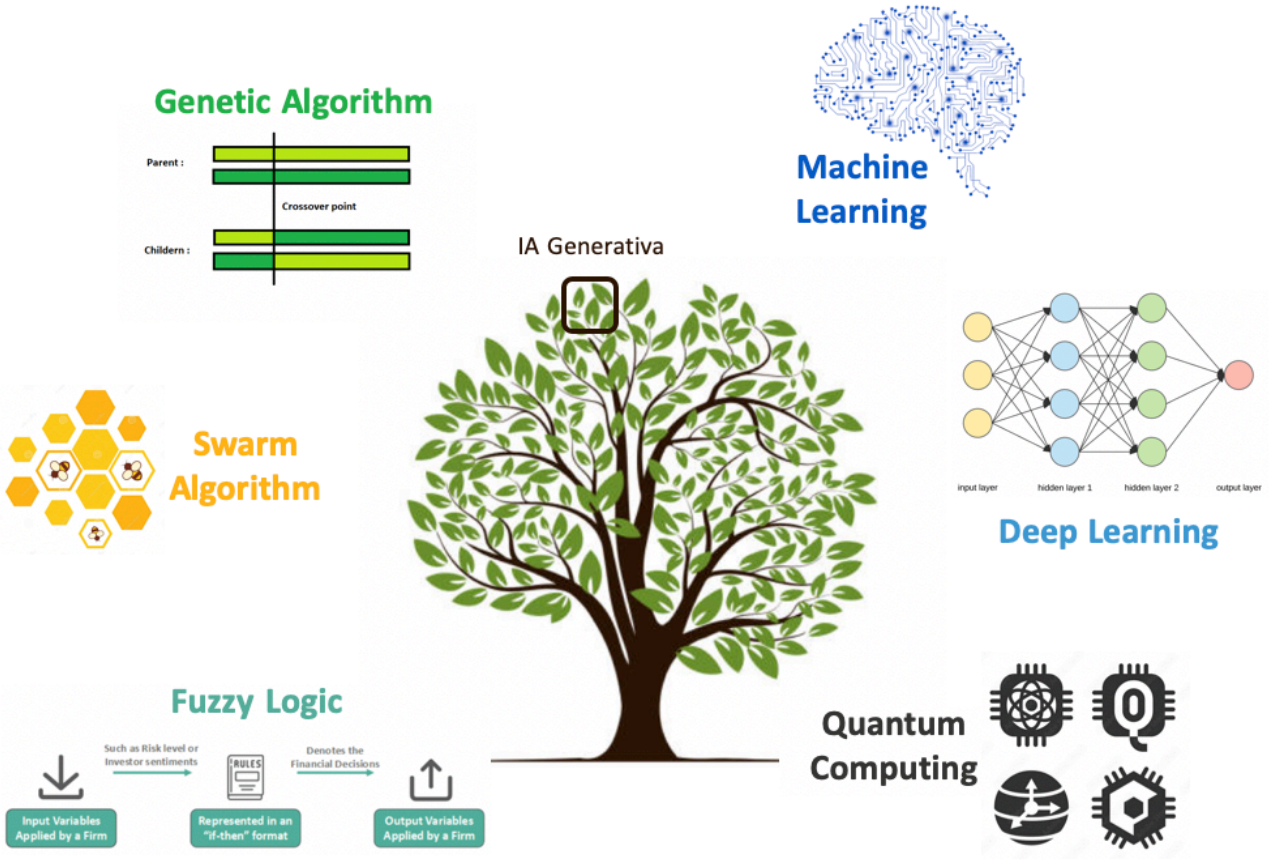
Enrollment in this master's degree **does not require** participants to have a prior **technical or conceptual background**; however, a commitment and **a minimum dedication of 4 hours of daily study will be essential**.

Throughout the program, the student **will develop skills and acquire knowledge** in Programming, Finance, Advanced Artificial Intelligence, Blockchain, Quantum Computing, Big Data, and Cloud Services.

In this master's degree, Deep Learning is not the only focus

There are 5 branches of Artificial Intelligence:

- Genetic Algorithms
- Swarm Algorithms
- Fuzzy Logic
- Machine Learning and Deep Learning
- Hybrid Quantum Models



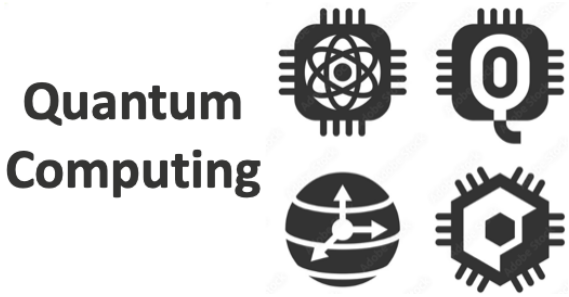
This master's program is the only one in existence where all five branches of Artificial Intelligence are studied in depth, exploring each concept and explaining **what is currently being used in the industry**.

AI is not only Generative

The future undoubtedly lies in hybrid quantum AI models and their application to financial markets. In this master's degree, we delve deeply into these models and their application to finance.

Quantum Hybrid AI Models

- Quantum Support Vector Machine
- Quantum Convolutional Neural Networks
- Quantum Recurrent Neural Networks
- Quantum Generative Adversarial Network
- Quantum Reinforcement Learning
- Quantum Bayesian Networks
- Quantum Autoencoder
- Quantum Transfer Learning
- Quantum Transformer
- Quantum Genetic Algorithms
- Quantum Blockchain
- Quantum Swarms



Applications to Financial Markets

- Value at Risk (Quantum Monte Carlo)
- Quantum Risk Analysis (Quantum Bayesian Networks)
- Option Pricing (Quantum Monte Carlo, QAE, QAOA)
- Scenario Simulation (Iterative Quantum Amplitude Estimation, Quantum Monte Carlo)
- Portfolio Optimization (VQE, QAOA, Grover Optimization, Quantum PSO)
- Fraud Detection (Classical–Quantum Classifier Ensemble)
- Best Execution (Quantum Reinforcement Learning)

Faculty

The faculty of this program is composed of engineers from **Google, IBM, Stock Exchanges and Financial Markets, JP Morgan, CNMV, the Bank of Spain**, among others.

Program certified by Google and IBM

Within this program, students may **obtain the most recognized certifications at national and international levels**:

- A large portion of the Artificial Intelligence module faculty consists of Google engineers. During this module, students will receive the training required to obtain the **Cloud Architect, Big Data Engineer, and Machine Learning Engineer certifications**. These exams will be taken directly through Google's own platform, the entity responsible for certifying students' knowledge.
- Among the faculty of the Quantum Computing module, we include IBM's Head of Quantum Computing Applied to Finance. During this module, students will receive the official training required to obtain the **Qiskit 2 certification**. This exam will be taken directly through IBM's own platform, the entity responsible for certifying students' knowledge.

Access to real quantum computers

Globally, the vast majority of master's programs that teach quantum content rely on quantum simulators in Python. Thanks to our close collaboration with IBM's quantum laboratory, our students will have **access to real quantum computers with 154 qubits**.

Employability and AI lab talent pipeline

In today's corporate landscape, the **AI Quant** role is considered **one of the hardest positions to fill**, making it one of the **best-paid profiles in the financial sector**.

The level of rigor of the program, together with the constant updating of its contents, turns our graduates into a **pipeline of exceptional talent, highly sought after** to fill specialized positions in **any brokerage firm, broker, or investment fund**.

The program maintains a **direct connection with the AI laboratories of leading brokerage firms**. Thanks to this close collaboration, students **will be able to work on real projects (Master's Final Projects) and participate in strategic challenges** proposed by reference institutions, significantly i**ncreasing the employability opportunities of our graduates**.

Startup accelerator and Business Angels

The program also aims to help students fulfill their dream of **launching their own startup**. During the program, students will have the opportunity to present their projects to various accelerators and Business Angel associations.

Academic Direction

Guillermo Meléndez Alonso

Four-time top graduate of his class. Holds a degree in Business Administration and Management from the University of Alcalá. Completed a Master's in Auditing at CEF, a Master's in Quantitative Finance at CIFF, a Master's in Financial Markets and Alternative Investments at Instituto BME, a Master's in Data Science & Big Data at AFI, and a Master's in Deep Learning at MBIT.

Founder and CEO of AtheAI Business School (2025)
Chief of Artificial Intelligence & Quantum Computing Officer (2025)
Founder of the AI and Quantum Computing Laboratory at Bolsas y Mercados Españoles (2008–2024)

- Developed AI-driven investment algorithms (2016–2024) capable of consistently outperforming the market. These algorithms generated fees solely based on alpha relative to the benchmark (total return).
- Developed Spain's first AI-powered robo-advisor (2018) and has developed the most advanced robo-advisors on the market (2018–2025), utilizing genetic algorithms, reinforcement learning, swarm intelligence (ACO, ABC), and quantum swarms (PSO).
- Created Spain's first AI-driven best execution algorithm in 2018, consistently outperforming other market execution algorithms (VWAP, TWAP, POV).

Founder and Director of the Master's in Artificial Intelligence and Quantum Computing at Bolsas y Mercados Españoles (MIAX, editions 1–13).

Recognized as one of the leading voices in the financial sector, frequently consulted by market participants and regulators (CNMV, Bank of Spain, Ministry of Economy), and has participated in numerous conferences as a Keynote Speaker:

- FIAB (2018, Asunción): Presentation of the first dynamic configuration algorithm, capable of self-modifying without human intervention.
- Ministry of Economy (2018): Future impact of AI on financial markets, presenting benefits and risks to regulators (CNMV, Bank of Spain, SEPBLAC, Ministry of Economy, Directorate General of Insurance).
- Morningstar (2019, Museo Nacional de Arte Reina Sofía): Presentation of Spain's first AI-integrated robo-advisor.
- CEOE – CNMV (2022, CEOE Headquarters): AI applied to investment management.
- BME (2022, Madrid Stock Exchange Palace): Presentation of the world's first quantum swarm-based robo-advisor.
- CNMV (2024, Palacio de la Magdalena, Santander): Artificial Intelligence applied to financial markets: risks and opportunities.

Academic Direction

Marcos Aza

Industrial Engineer from the Polytechnic University of Madrid and PhD ("cum laude") in Finance from Rey Juan Carlos University. Holds a Master's in Banking and Finance from AFI and an Executive Development Program from IESE. Ranked among the top 5% of his class at UPM and awarded Best Engineering Student in Spain by IBM in 2001.

Senior Investment Manager at Santander Asset Management (2020 – Present)
Responsible for managing investment fund portfolios with a focus on emerging markets and equity products. Designs and executes investment strategies, risk analysis, and global asset management, integrating Artificial Intelligence and Quantum Computing into portfolio analysis and management.

Investment Analyst & Senior Portfolio Manager at BBVA Asset Management (2016 – 2020)
Conducted asset analysis and management in both fixed income and equity markets, with an international focus. Implemented portfolio optimization models and analyzed the economic impact of monetary policies. Supervised a team of analysts in developing investment strategies.

Projects and Contributions:

- Designed and executed investment strategies in emerging markets, achieving returns above benchmark indices for three consecutive years.
- Developed quantitative risk management models for investment funds, leveraging machine learning to predict market trends and optimize asset allocation.
- Led teams in developing innovative financial products at Santander Asset Management, including thematic funds focused on technology, sustainability, and energy transition.

Conferences, Presentations, and Publications:

- *"Innovation and Sustainability in Investment Management"* (2022, Investment Funds Conference, Madrid). Presentation on integrating Environmental, Social, and Governance (ESG) factors into global investment strategies.
- *"Impact of New Technologies on Asset Management"* (2021, Financial Innovation Forum, Barcelona). Analysis of how AI and Big Data are transforming asset management and investment strategies in the financial sector.
- *"Emerging Markets: Opportunities and Risks on the 2025 Horizon"* (2020, Global Investment Congress, London). Presentation on emerging market landscapes and effective investment strategies, including political and macroeconomic impact analysis.
- *"The Evolution of Investment Strategies in the 21st Century: From Theory to Practice"* (2023, Journal of Global Finance).
- *"Machine Learning in Asset Management: New Opportunities for Institutional Investors"* (2021, Journal of Financial Innovation).

Awards and Recognitions:

- Excellence in Investment Management Award (2022, Santander Asset Management)
- Best Portfolio Manager in Emerging Markets (2020, BBVA Asset Management)
- Innovation in Quantitative Finance Award (2019, European Quantitative Finance Conference)

AthenAI

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Program Structure

Every six months, we update the master's program content, ALWAYS offering truly cutting-edge material.

Full Program Structure

Modules	Teaching hours	Wt	Study hours	Total hours	ECTS
0. Introduction and TFM Sessions	30	3 %	60	90	**3,6**
1. Programming Fundamentals	55	5 %	110	165	**6,6**
2. Finance, Stock Markets, and Financial Advisory	100	9 %	200	300	**12**
3. Crypto-assets and Exotic Assets	60	5 %	120	180	**7,2**
4. Investment Algorithms, Modern Portfolio Theory, and Beyond	115	10 %	230	345	**13,8**
5. Financial and Technology Law	90	8 %	180	270	**10,8**
6. Machine Learning and Deep Learning	115	10 %	230	345	**13,8**
7. Cloud Services and Big Data	205	18 %	410	615	**24,6**
8. Advanced and Generative Deep Learning	205	18 %	410	615	**24,6**
9. Blockchain and Decentralized Ledger Market Infrastructures	60	5 %	120	180	**7,2**
10. Quantum Computing and Quantum Artificial Intelligence	90	8 %	180	270	**10,8**
11. Launching Your Own Startup	30	3 %	60	90	**3,6**
Total	**1.155**	**100 %**	**2.310**	**3.465**	**139**

Structure of the ESSENTIAL Master's Program

Modules	Teaching hours	Wt	Study hours	Total hours	ECTS
0. Introduction and TFM Sessions	15	3 %	30	45	**1,8**
1. Programming Fundamentals	55	12 %	110	165	**6,6**
2. Machine Learning and Deep Learning	105	23 %	210	315	**12,6**
3. Finance, Stock Markets, and Financial Advisory	30	7 %	60	90	**3,6**
4. Investment Algorithms, Modern Portfolio Theory, and Beyond	65	14 %	130	195	**7,8**
5. Advanced and Generative Deep Learning	110	24 %	220	330	**13,2**
6. Cloud Services and Big Data	70	16 %	140	210	**8,4**
Total	**450**	**100 %**	**900**	**1.350**	**54**

Structure of the TOP Master's Program

Modules	Teaching hours	Wt	Study hours	Total hours	ECTS
0. Introduction and TFM Sessions	15	2 %	30	45	**1,8**
1. Finance, Stock Markets, and Financial Advisory	70	10 %	140	210	**8,4**
2. Crypto-assets and Exotic Assets	60	9 %	120	180	**7,2**
3. Investment Algorithms, Modern Portfolio Theory, and Beyond	50	7 %	100	150	**6**
4. Financial and Technology Law	90	13 %	180	270	**10,8**
5. Cloud Services and Big Data	135	19 %	270	405	**16,2**
6. Advanced and Generative Deep Learning	105	15 %	210	315	**12,6**
7. Blockchain and Decentralized Ledger Market Infrastructures	60	9 %	120	180	**7,2**
8. Quantum Computing and Quantum Artificial Intelligence	90	13 %	180	270	**10,8**
9. Launching Your Own Startup	30	4 %	60	90	**3,6**
Total	**705**	**100 %**	**1.410**	**2.115**	**85**

ESSENTIAL Program

Module 1 | Programming Fundamentals
55 Teaching hours

Program Overview
- Presentation and Alignment of Objectives
- Emerging Technologies in Financial Markets
- Business Case (Ensuring Consistency in Technology Application)

Python Programming Fundamentals I
- Installation
- Jupyter Notebooks
- Basic syntax, operations, and primitive data types
- Strings
- Data structures: Lists, Tuples, Sets, and Dictionaries

Python Programming Fundamentals II
- Control Flow
- Dictionary and List Comprehensions
- Exceptions
- Functions
- Modules and Scripts
- Writing text files and saving variables

Python Programming Fundamentals III
- NumPy Library

Python Programming Fundamentals IV
- Pandas Library

Python Programming Fundamentals V
- Time Series Processing
- Risk Measurement Simulation (VaR)
- Portfolio Optimization

Python Programming Fundamentals VI
- Data Visualization with Matplotlib
- Data Visualization with Pandas
- Data Visualization with Seaborn
- Financial Data Visualization
- Interactive Visualization with ipywidgets
- Data Acquisition and Storage

Python Programming Fundamentals VII
- Object-Oriented Programming
- Inheritance
- Decorators

Python Programming Fundamentals VIII
- Introduction to HTML
- Web Scraping

Python Programming Fundamentals IX
- Fundamentals of Relational Databases
  - Creating and Manipulating Your Own Databases
  - Importing Relational Data into Python
  - Filters, Sorting, and Grouping in Queries
- Advanced Queries with SQLAlchemy
- Introduction to MongoDB in Python

Python Programming Fundamentals X
- Efficiency Analysis
- Error Management, Testing, and Debugging
  - Types of Testing (Unit, Integration, Functional, and Acceptance Testing)
  - Testing Tools (pytest and unittest)
  - Debugging (Stack Traces, Breakpoints, and Variable Inspection)
- IDEs Beyond JupyterLab

Advanced Visualization Techniques
- Introduction to HTML
- Introduction to CSS
- Introduction to Flask
- Interactive Interfaces with Dash

Module 2 | Machine Learning and Deep Learning
105 Teaching hours

Genetic Algorithms
- Objective Function
- Selection Strategies
- Crossover
- Mutation
- Generational Replacement

Swarm Algorithms
- Ant Colony Optimization (ACO)
  - Environment Construction
  - Path Selection
  - Pheromone Quantity
  - Evaporation
  - Pruning toward the Optimal Solution

Fuzzy Logic
- Fuzzy Sets and Degrees of Membership
- Fuzzy Operators
- Rule Creation
- Fuzzification
- Defuzzification

Machine Learning I
- Introduction to Machine Learning
  - AI vs. ML
  - Supervised vs. Unsupervised Learning
  - Classification vs. Regression
  - Parametric vs. Non-Parametric Models
  - Linear vs. Nonlinear Models

- Examples of Financial Applications Using ML
- K-Nearest Neighbors (KNN)
- Decision Trees
  - Simple Decision Tree Example
  - Explainable AI (XAI) for Trees

Machine Learning II

- Preprocessing and Evaluation Metrics
  - Normalization and Standardization
  - Encoding, Labeling, and Discretization (Dummies)
  - Missing Values, Outliers, and NaNs
  - Approaching Time Series as Sequence Blocks
  - Evaluation Metrics: Confusion Matrix, Precision, Recall
  - Simple and Cross Validation
- Dimensionality Reduction
  - The Curse of Dimensionality
  - Feature Selection and Principal Component Analysis (PCA) and Linear Discriminant Analysis (LDA)

Machine Learning III

- More Complex Classification Models
- Bayesian Theory: Naive Bayes
- Ensemble Classifiers: Bagging, Boosting, Random Forest, and Gradient Boosting
- Support Vector Machines (SVMs)

Machine Learning IV

- Agglomerative Hierarchical Clustering
  - Definition (Linkage Types)
  - Manual Implementation
  - Simple Example
- Centroid-Based Clustering: K-Means and K-Medoids
  - Definition and Manual Implementation
  - Simple Example with K-Means
  - Interpreting Centroids as Representatives
- Gaussian-Based Clustering: Expectation-Maximization (EM)
  - Definition (Generalization of K-Means)
- Density-Based Clustering: DBSCAN
  - Definition and Simple Example
- Comparison of Clustering Algorithms
  - Comparison Metrics
  - Selection of Appropriate Clustering Algorithm
  - Comparison Examples
- Asset Clustering Using Correlations and Momentum

Machine Learning V – Practical Case

- Feature Generation
- Extraction of Relevant Attributes
- Dimensionality Reduction Incorporating XAI
- Clustering
- Graphext (No-Code Data Analysis)
- XAI for Obtained Results

Dense Neural Networks I

- Introduction
- Working Environment
- Basic Concepts
- Linear Regression
- Gradient Descent
- Logistic Regression
- Nonlinear Models

Dense Neural Networks II

- Introduction to Neural Networks
- Feedforward Neural Networks
- Implementing a Neural Network (Forward Pass)
- Chain Rule for Derivatives
- Backpropagation

Dense Neural Networks III

- Implementing a Neural Network (Backward Pass)
- Introduction to Keras and PyTorch
- Automatic Differentiation

Dense Neural Networks IV

- Implementing a Neural Network with Keras and PyTorch
- Training a Neural Network
- Stochastic Gradient Descent
- Cost Function
- Activation Function

Dense Neural Networks V

- Regularization
- Weight Initialization
- Batch Normalization
- Other Optimization Techniques
- Second-Order Methods

Dense Neural Networks VI

- Hyperparameter Optimization
- Evaluation Metrics
- Cross-Validation
- Grid Search
- Keras Tuner
- HParams Dashboard

Convolutional Neural Networks I

- Kernel Size
- Stride and Padding
- Max Pooling
- Number of Filters and Features
- Dropout

Convolutional Neural Networks II

- Building in Keras
- Kernel Optimization
- Stride and Padding Optimization
- Max Pooling
- Optimization of Filters and Features
- Dropout
- 1D, 2D, 3D Networks

Convolutional Neural Networks III

- Distance Measures Between Images
- Siamese Networks and Content-Based Image Retrieval (CBIR)
- Learning Representations with CNNs
- Applications in Image Search
- Network Robustness
- Adversarial Examples

Convolutional Neural Networks IV

- Input Perturbation Attacks: One-Pixel Attack
- Adversarial Training Methods: Differential Evolution (DE)
- Applications in Generating Robust Models
- YOLO Networks
- RAM (Recognize Anything)

Recurrent Neural Networks I

- Memory-Based Networks
- Long-Term Dependency Problem
- LSTM Networks in TensorFlow and Keras
- LSTM Variants

Recurrent Neural Networks II

- Truncated Backpropagation
- Accumulating LSTM
- Bidirectional LSTM
- Forecasting with LSTM: Time Series, Sequences, and Predictions

State of the Art in Artificial Intelligence

- Inspiration and Research Directions for Master's Thesis Projects

Module 3 | Finance, Stock Markets, and Financial Advisory

30 Teaching hours

Financial Mathematics, Statistics, and Quantitative Analysis

- Interest Rates: Nominal, Effective, and Annual Percentage Rate (APR)
- Capitalization: Simple, Compound, and Continuous
- Discount Factors
- Measures of Central Tendency, Dispersion, Skewness, and Kurtosis
- Volatility and Correlation
- Hypothesis Testing
- Price-Based Indicators: RSI, Stochastic, and Momentum Indicator
- Volatility-Based Indicators: Bollinger Bands, ATR
- Volume-Based Indicators: OVB, ACD, Chaikin Oscillator
- Market Breadth Indicators: McClellan Oscillator

Equity Markets

- Functions of the Stock Exchange
- Distinction Between Primary and Secondary Markets
- Types of Transactions: Takeovers (OPA) and Public Offerings (OPV), Capital Increases, Splits and Reverse Splits
- Operation of the Spanish Continuous Market (SIBE)
  - Market Phases
  - Blocks and Special Transactions
  - Auctions vs. Open Market
  - Trading Rules
  - Types of Orders
  - Volatility Auctions: Static and Dynamic Ranges
- Organized Markets vs. OTC
- Clearinghouse

Futures on Indices and Stocks

- Forward Price of an Asset
- Concept of Basis and Open Position
- Futures in Contango and Backwardation
- Futures Price and Its Implied Rate
- Index Futures and Dividend Adjustment to Index Points
- Speculation and Leverage
- Hedging with Stock Futures: Full and Partial
- Hedging with Index Futures
- Hedging Risk
- Arbitrage: Cash & Carry and Reverse Cash & Carry
- Time Spreads: Effect of Roll-Over in Contango and Backwardation

Equity Options

- Types: American and European
- Intrinsic and Time Value
- Classification: In-the-Money, At-the-Money, Out-of-the-Money
- Parameters Affecting Valuation: Underlying Asset, Strike Price, Dividends, Time to Maturity, and Interest Rates
- Replication of Assets
- Options Arbitrage
- Conversion and Reversal
- Risks
- Call-Put Parity Theory: Formulations and Option Types
- The Greeks and Sensitivity Management: Delta, Gamma, Vega, Theta, and Rho
- Static Hedging
- Call, Put, Spreads, and Tunnels
- Selection of Strike Price and Maturity
- Scenario Analysis and Synthetic Adjustments of Risk Profile
- Combined Strategies: Trend, Volatility, and Mixed
- Volatility Trading, Delta Neutral, and Gamma Scalping

Foreign Exchange Market

- Factors Affecting Exchange Rates
- Spot FX and Cross Rates
- Market Conventions
- Forward Price of a Currency (Implied Rates)
- Currency Futures
- Forward Price: Swap Points
- Currency Hedging
- Currency Options
- Delta Hedging
- Volatility Surface
  - Risk Reversal
  - Volatility Skew
  - Contracts and Characteristics

Fixed Income Market

- Bond Pricing
- Mathematical Fundamentals: Capitalization and Discount, Time Value of Money
- Interest Rates: Euribor / Eonia / EuroSTR
- Zero-Coupon Curve: Rates and Construction Conditions

- Bonds and Floating Rate Notes
- Valuation: Duration, Sensitivity, and Convexity
- Trading Fixed Income Instruments
- Fixed Income Derivatives: Bond Futures and Euribor Futures

Module 4 | Investment Algorithms, Modern Portfolio Theory, and Beyond
65 Teaching hours

Investment Algorithm Design I
- Acquisition of historical data for equities, currencies, and fixed income
- Acquisition of investment fund data
- Retrieval of index history and composition: Yahoo Finance
- Data cleaning, standardization, and adjustment (splits and reverse splits)

Investment Algorithm Design II
- How to evaluate an investment algorithm

Investment Algorithm Design III
- Selection of the investment universe

Investment Algorithm Design IV
- Calculation of the Markowitz frontier, Minimum Variance Portfolio, Security Market Line (SML)
- Critiques of the Markowitz model

Investment Algorithm Design V
- Steps for designing an investment algorithm

Investment Algorithm Design VI
- Design of an investment algorithm

Investment Algorithm Design VII
- Parameter selection, stress testing, model stability, scenario analysis

Advanced Backtesting I
- Look-Ahead Bias
- Survivorship Bias
- Selection Bias
- Execution Assumptions
- Signal Analysis
- Evaluation of signals using rolling windows and bootstrapping
- Relative performance, drawdown, and time under water
- Application of trading rules and comparison with benchmark

Advanced Backtesting II
- Implementation of a historical portfolio
- Portfolio performance with cash inflows and outflows
- Generation of synthetic data
- Implications for limit orders

Advanced Backtesting III
- Event estimation
- Trading order outcomes
- Dividend considerations
- Evaluation using tick-by-tick execution data

Modern Portfolio Theory and Beyond I
- Fama and French: Three-Factor Model
- Impact of covariance matrix structure
- Weight allocation
- Industry benchmark to beat: 60/40
- Adjustments to the covariance matrix

Modern Portfolio Theory and Beyond II
- Risk Parity
- Hierarchical Risk Parity
- Inverse Volatility
- Kalman Filter
- Kelly Criterion

Modern Portfolio Theory and Beyond III – Workshop
- Minimization of covariance matrix condition number
- High-dimensional spaces
- Generation of robust portfolios using genetic algorithms

Module 5 | Advanced and Generative Deep Learning
110 Teaching hours

Natural Language Processing I
- Corpus and Stopwords
- Word-to-Vector Models: Language Representation
- NLP Models and Sequence-to-Sequence Models
- Bucketing & Padding

Natural Language Processing II
- Supervised Learning in NLP: Defining the Language Domain
- Named Entity Recognition: Entity Detection and Applications in Finance
- Text Classification: Headlines, Reports, News
- Sentiment Analysis: News and Social Media

Natural Language Processing III
- Transfer Learning in NLP: TensorFlow Hub
- Pre-trained Models: BERT, ELMO
- Re-training Pre-trained Models for Specific Tasks

Natural Language Processing IV
- Attention Layers
- Attention-based Models
- Introduction to Transformer Models

Natural Language Processing V
- Advanced Transformer Models
- Generative Pre-Training: GPT Models
- PaLM, Chinchilla, Flamingo, Minerva, Gato

Generative Models I
- Dimensionality Reduction and Factors: PCA
- Autoencoders: Non-linear Models
- Maximum Likelihood and Gaussian Mixture Models (GMM)
- Stock Quote Generation using PCA + GMM
- GANs, Diffusion Models, and Conditional Models

Generative Models II
- Deep Generative Models
- Variational Autoencoders (VAE)
- Memory-Augmented Autoencoders (MAAE)
- Sparse Autoencoders
- Generative Adversarial Networks (GANs)
- Recurrent Generative Models

- Normalizing Flows

Generative Models III

- Pretraining Large Language Models (LLMs)
- Fine-Tuning and Parameter-Efficient Fine-Tuning (PEFT)
- Knowledge Distillation
- Frameworks: T5X, PAX, Others
- TPU Architectures

Generative Models IV

- Introduction to LangChain
- Components I: Memory, Models, and Prompting
- Components II: Retrievals, Chains, and Agents
- Retrieval-Augmented Generation (RAG) Techniques

Aprendizaje por transferencia y modelos avanzados

- Inception V3, VGG16, Resnet, Bert
- Reutilización de modelos
- Concatenación de modelos
- Solventando el problema de rotaciones
- Solventando el problema de escalado
- Mejora de redes convolucionales y generativas
- Solventando el desvanecimiento del gradiente
- Resnet
- Redes de capsula

Anomaly Detection and Analysis

- Types of Anomalies: Point, Contextual, Collective
- Linear Methods: PCA, MCD, LMDD, One-class SVM
- Proximity-based Methods: Local Outlier Factor, Histogram-based Outlier Score
- Probabilistic Methods: Angle-Based Outlier Detection, Stochastic Outlier Selection
- Ensemble Methods: Isolation Forest, Feature Bagging, LSCP, LODA
- AI-based Methods: XGBOD (Extreme Boosting Based Outlier Detection), Deep Autoencoders

Graph Neural Networks (GNNs)

- Concept of Independence
- Conditional Independence
- Geometric Neural Networks
- Fair Learning
- Model Adjustment Methods through Fair Learning
- Information Theory
- Dependence using Kernel Methods
- Dependence using Multivariate Gaussianization

Uncertainty in Neural Networks and Its Application in Financial Markets

- Measures of Uncertainty
- Propagation of Uncertainty Through Networks
- Uncertainty Prediction Using Neural Networks
- Bayesian Networks
- Network Summary: Network Topologies and Model Zoo

Explainable Artificial Intelligence (XAI) I

- Reverse Engineering Methods
- Explainability in Machine Learning
- XAI in Deep Learning
- XAI Tools

Explainable Artificial Intelligence (XAI) II

- Nature of XAI Algorithms
  - Interpretability vs Explainability vs Transparency
  - Local vs Global Explainability
  - Model-specific vs Model-agnostic Explainability
  - Transparency in Models
- Challenges in Explainable Deep Learning (XDL)
- Data Visualization and Explainability
- Global Explainability
  - Components of Models (Neural Networks, Trees, SVMs)
  - Local Explainability: Permutation, LIME (Local Interpretable Model-Agnostic Explanations)
- Measuring Explainability

Explainable Artificial Intelligence (XAI) III

- Deep Learning Explainability Strategies
  - Perturbation-based Explainability
  - Gradient-based Local Explainability
  - Relevance-based Local Explainability (LRP)
- Explainability in Recurrent Neural Networks (RNNs)
  - Vanishing Gradient and Solutions

Explainable Artificial Intelligence (XAI) IV

- Transparency in RNNs
  - RNNs as State Machines and Oracles
- Workshops:
  - Adversarial Image Attacks via Explainability
  - Audio Signal Filtering via Explainability
  - Spatio-temporal Analysis of Biological Signal Processing (P300-ERPs)

Explainable Artificial Intelligence (XAI) V

- Fundamentals of Causal Inference
- Causal Estimation Techniques
- Causal Reasoning and Structural Models
- Advanced Causality and Real Applications

Reinforcement Learning I

- Markov Decision Processes
- Learning Algorithms
- Function Approximation
- Q-learning
- Double Q-learning
- SARSA
- Search Methods

Reinforcement Learning II

- Automated Machine Learning (AutoML)
- Model Selection
- Architecture Search
- Full Pipeline Optimization
- Policy-based Algorithms
- Actor-Critic Methods (A2C, A3C)

Reinforcement Learning III

- Practical Review of the Components of an RL System
- Introduction to Environment Design
- Factors to Consider in Designing Your Algorithms

Module 6 | Cloud Services and Big Data
70 Teaching hours

Google Cloud I. Cloud Basics
- IAM, Console
- Cloud shell
- Authentication, permissions

Google Cloud II. Compute
- Compute Engine
- App Engine
- Cloud GPU
- Spot VMs
- Bare Metal
- Disks

Google Cloud III. Storage. Databases
- AlloyDB for PostgreSQL
- Cloud SQL
- Firestore
- Spanner
- Memorystore

Google Cloud IV. Kubernetes I
- Google Kubernetes Engine
- Artifact Registry
- Cloud Build

Google Cloud V. Kubernetes II
- Migrate to Containers
- Knative
- Deep learning Containers

Google Cloud VI. Security and Identity
- Sensitive Data protection
- Google Threat Intelligence
- Security Conmmand Center
- Assured workloads

Google Cloud VII. Networking
- Cloud CDN
- Load balancing
- Cloud NAT
- Virtual Private Cloud
- Private Service Connect

Google Cloud VIII. Developer Tools
- Cloud Workstations
- Cloud SDK
- Cloud Code
- Cloud Deploy

Google Cloud IX. Serverless
- Cloud Run
- Cloud Functions
- Workflows
- API Gateway

Google Cloud X. Operations
- Cloud Logging
- Cloud monitoring
- Error reporting
- Cloud Trace
- Cloud Profiler

Preparation for the Professional Cloud Architect Certification

CI/CD I
- Introduction and Advanced Git Configuration
- Advanced Branch Management, Merges, and Conflict Resolution
- Collaboration on GitHub: Pull Requests, Code Review, Actions
- Collaborative Project Using Git and GitHub (Full Workflow)
- Feedback and Evaluation of Collaborative Project

CI/CD – Session II
- Introduction to Docker, images, and containers
- Supervised practical exercise: creating custom Docker images
- Docker Compose: basic container orchestration
- Practical deployment of a multi-container web application

Professional Cloud Architect Certification Exam

Master's Thesis Defense I
Master's Thesis Defense II

TOP Program

Module 1 | Finance, Stock Markets, and Financial Advisory
70 Teaching hours

Program Overview
- Presentation and Alignment of Objectives
- Emerging Technologies in Financial Markets
- Business Case (Ensuring Consistency in Technology Application)

Macroeconomic Analysis
- Introduction to Macroeconomic Analysis
- Objectives and Key Indicators
- Economic Growth and the Business Cycle
- Inflation and Monetary Policy
- Labor Market and Fiscal Policy
- Exchange Rates and Balance of Payments
- Leading Indicators
- Models for Financial Analysts (IS-LM, Mundell-Fleming)
- Relationship Between Macroeconomics and Financial Markets

Fundamental Analysis and Company Valuation
- Fundamental Analysis
  - Top-Down and Bottom-Up Techniques
  - Sector Analysis: Concept, Sector Groups, and Characteristics
  - Solvency vs. Liquidity, Book Value, Profitability Ratios, Market Ratios, and Turnover
- Company Valuation
  - Relative Valuation: Market and Trading Multiples
  - Absolute Valuation: Discounted Cash Flow (DCF)
  - Advantages and Disadvantages
  - Cost of Equity
  - Risk-Free Rate
  - Risk Premium
  - Leveraged Beta
  - Weighted Average Cost of Capital (WACC)

Volatility Management
- Interpretation and Characteristics
- Volatility Instability and Calculation in Time Windows (SMA)
- Volatility Cones
- Historical Volatility Models (HL)
- Conditional Volatility Models
- Implied Volatility
- Forward Volatility Calculation
- Volatility Indices: Calculation, Characteristics, and Investment Strategies
- Option Strategies: Directional, Hedging, Skew, Calendar Spread

Advanced Trading
- Spread Trading
  - Cointegration and Statistical Methods
  - Pairs Trading
  - Spread Construction
  - Equity Spreads
  - Index and Equity Spreads
  - Futures Spreads
- Options Trading
  - Hedging vs. Investment
  - Strike Price and Maturity Selection
  - Trade Horizons: Delta and Speed of Movement
  - Position Management
  - Risk Reversal, Cones, Straddles, Out-of-the-Money Options
- Currency Trading
  - Carry Trade
  - Risk Reversal and Delta Hedging
  - Tunnels, Seagull, and Condor Strategies

Intraday Trading
- Types of Trading
  - Strategies and Instruments
  - Liquidity and Trading Frequency
  - Transaction Costs
  - Leverage Levels
- Intraday Timing
- Stop-Loss and Stop-Profit

Wealth Management I
- MiFID Regulations
- ESG Investing
- Wealth Management: The Beginning
- Art as an Investment Asset
- Review of Key Wealth Management Concepts
- Financial Assets: Definition and Behavior
- Equities Compared to Other Asset Classes
- Determinants of Fair Value

Wealth Management II
- The Business Cycle
- Key Macroeconomic Indicators
- Monetary Policy
- True Risk Profile of an Investor
- Fixed Income
- Convertibles

- Inflation-Linked Bonds
- Equity Valuation and Current Market Conditions

Collective Investment Schemes (IICs and UCITS)

- Typologies, Open Architecture Origins, and Fee Structures
- Fixed Income / High-Yield Funds
- Emerging Market Local Currency Fixed Income Funds
- Inflation-Linked Bond Funds, Securitization Funds, Convertible Bond Funds
- Equity Funds: Growth, Value, Emerging Market, Sectoral, Thematic, and Safety-Oriented Funds
- Absolute Return: Origins and Quantitative Funds
- Financial Boutiques, Fixed-Income Pseudo-Hedge Funds, Alpha and Beta Generation and Management
- Implicit Assets, Volatility Funds, Hedge Fund Indices

Macroeconomic Models

- Investment Clock (Monetary Assets, Fixed Income, Equities, Commodities)
- Portfolio Management Models (Markowitz, Black-Litterman, Value at Risk)
- Portfolio Construction Combining Macro and Management Models

Money Management, Behavioral Finance, and Trading Psychology

- Importance of Money Management
- Stages of Money Management
- Strategy Evaluation
- Probability of Ruin
- Strategy Classifications: Fixed Risk, Alexander Elder, Kelly Formula, Optimal F, Secure F
- Diversification
- Portfolio Management
  - Information Requirements: Investment Profile
  - Discretionary Portfolio Management
  - Non-Discretionary Management
  - Advisory and Transaction Services
- Behavioral Finance
- Trading Psychology

Banking Systems Analysis

- Business Models
- Central Banks and Monetary Policy Tools
- Yield Curve and Key Spreads to Monitor
- Economic Cycle Indicators
- Credit Cycle Indicators

Bank Valuation

- Financial Statement Analysis
- Ratio Analysis
- CAMELS Methodology
- Valuation Approaches

Insurance and Financial Planning

- The Insurance Sector
- Types of Insurance
- Importance of Financial Planning in Wealth Management
- Objectives and Priorities
- Time Horizon, Risk, and Return
- Taxes and Inflation

Taxation

- Economy, Tax Collection, and Tax Burden
- Overview of the Tax Perimeter
- Taxation of Trading in Personal Income Tax (IRPF)
- Structure of the Tax
- Capital Gains and Losses in IRPF
- Anti-Avoidance Rules
- Investment Income
- Dividend Taxation
- Taxation of Financial Products in IRPF
- Taxation of Financial Products in Corporate Tax

Module 2 | Crypto-assets and Exotic Assets

60 Teaching hours

Cryptoassets I

- Foundations of Cryptoassets
- Main Cryptoassets
  - Bitcoin: usage and adoption
  - Ethereum: smart contracts and ERC-20/721 tokens
  - Other relevant assets: Litecoin, Ripple, Cardano, Solana, TON, Avalanche
  - Memecoins (community-driven concept)
- Stablecoins
  - Concept, types (backed, algorithmic), and use cases
  - USDC, USDT, DAI
- Platforms and Basic Tools
  - CoinMarketCap, CoinGecko, Messari
  - Centralized exchanges (Binance, Kraken) vs. decentralized exchanges (Uniswap, PancakeSwap)
  - Security: custodial vs. non-custodial wallets (Argent, Criptan)
- Market Landscape
  - Institutional players
  - Fintechs

Cryptoassets II

- Cryptoasset Markets
  - Spot trading: basic operation
  - Margin trading: leverage and risks
  - Derivatives: futures, options, and perpetual contracts
- Financial Instruments in Crypto
  - CFDs on cryptocurrencies
  - ETFs and cryptoasset-based funds
- Principles of Risk Management
  - Cryptoasset volatility
  - Stop-loss, take-profit, and hedging strategies

Cryptoassets III

- Introduction to DeFi (Decentralized Finance)
  - Definition and operation
  - Main protocols: Aave, Compound, MakerDAO
- DeFi Products and Strategies
  - Staking: PoS and Lido
  - Lending and borrowing: decentralized platforms
  - Institutional lending

- Yield farming: liquidity pools and rewards
- Interoperability and Bridges
  - How blockchain network bridges work
  - Key projects: Polkadot, Cosmos
- Risks and Opportunities in DeFi
  - Smart contract security
  - Rug pulls and flash loan attacks

Cryptoassets IV

- Cryptomining
  - Mining models: PoW vs PoS
  - Cloud mining and mining pools: how they work
- Staking as an alternative
  - Emerging Business Models
- Trends and Regulation
  - Impact of CBDCs (Central Bank Digital Currencies)
  - International regulations / market impact
- DefAI, RWA
- Practical adoption examples: El Salvador, global companies
- Market analysis and future outlook

Cryptoassets V

- FinTech and Open Banking
- Digital Assets and Token Economy
- DeFi and tokenization
- Building a digital asset platform: Renta 4 (success case)

Commodities

- Classification, markets, and instruments
- Price formation, volatility, and correlation
- Contango and backwardation
- Base metals: Aluminum, Copper, Zinc, Nickel, Lead, Tin
- Oil, CO_2, precious metals (Gold, Silver, Platinum, Palladium)
- Others: plastics, coal, agricultural products, paper

Exotic Options

- Path Dependent
  - Asian (APO/ARO, ASRO), lookback, cliquet/rachet, ladder, shout, barrier (knock-out/knock-in)
- Non-Path Dependent
  - Bermuda, binary, OPC, compound, chooser, whale, rainbow (best-of/worst-of), mountain (Atlas, Everest, etc.), basket, quanto, spread

Energy and Natural Gas Derivatives

- Spot market
- Forward market (traded products, OTC, official markets, clearinghouses)
- Price volatility in electricity and natural gas
- Market participants
- Forward curve
- EMIR and REMIT regulations
- Procurement management
- Types of market risk
- Portfolio construction
- Hedging strategy design

Catastrophe Bonds (CAT Bonds)

- Types: climate, life, cyberattack & pandemic
- Parametric and non-parametric triggers
- Structure and design of catastrophe bonds
- Modeling, valuation, and contracting

Climate Derivatives I

- Data acquisition with Google Earth Engine
  - Wind, floods, temperature, wildfires, droughts
  - Forest mass detection
  - Climate prediction
- Temporal and spatial data delimitation
- Data homogenization

Climate Derivatives II

- Google Earth Engine beyond surface data
- Global Forest Cover Change
- Collect Earth
- Global Surface Water
- AlphaEarth

Climate Derivatives III

- Types and characteristics
- Markets and evolution
- Market participants
- Temperature indices: CDD, HDD, CAT
- Practical applications
- Challenges in climate derivatives
- Economic impact calculation
- Climate risk score calculation
- Portfolio Value at Risk and investment strategies

Module 3 | Investment Algorithms, Modern Portfolio Theory, and Beyond

50 Teaching hours

Optimization I

- Linear: problem modeling with constraints
- Quadratic: problem modeling, alternatives, and transformations
- Arbitrage identification

Optimization II

- Mixed-integer programming
- Modeling of logical conditions
- Algorithms and solution techniques
- Global constraint programming

Optimization III

- Heuristic search: state space modeling, uninformed search
- Stochastic local search: solution space modeling
- Genetic algorithms II
- Portfolio optimization
- Client profiling: risk profile
- UCITS constraints
- Preference vector
- Mandates
- Portfolio rebalancing
- Genetic robo-advisor and backtesting

Swarm algorithms II

- Advanced ACO algorithm
- Artificial Bee Colony (ABC) algorithm
- Bacterial foraging algorithm

- Herd algorithm
- Construction of financial environments

Swarm Algorithms III

- Particle Swarm Optimization (PSO) family of algorithms
- Uncertainty analysis in decision-making
- Application of PSO to portfolio optimization

Swarm Algorithms IV

- Optimal distribution of axes
- Hypercube
- ACO + ABC swarm-based robo-advisor
- ABC + PSO swarm-based robo-advisor
- Profiling and constraints
- Preference vector and mandates

Fuzzy Logic II

- Fuzzy investment clock
- Application to strategy rebalancing
- Application to swarms

HFT and Best Execution Algorithms

- High-Frequency Trading
  - Statistical arbitrage
  - Latency arbitrage
  - Momentum trading
  - Delta hedging
  - Proximity vs. colocation
- Best execution
  - Market impact vs. market risk
  - Advanced order types: OCO, OSO, Bracket, Ghost, Pegged, Trailing Stop
  - Development with microsecond time series
  - Order book simulation: order book depth, price-time priority
  - VWAP, TWAP, POV, Smart Order Routing

Darwinex

- Productization of investment algorithms
- Risk management in third-party algorithms
- Algorithm selection: Darwin Index
- Investment algorithm competition

Module 4 | Financial and Technology Law
90 Teaching hours

Law Applied to Financial Markets I

- Regulatory framework of financial markets
  - Regulatory authorities and supervision at the European level
  - MiFID (Markets in Financial Instruments Directive)
  - Market Abuse (Financial Instruments Directive)
  - Anti-money laundering and counter-terrorism financing
  - EMIR, REMIT, FATCA, CRS
  - Corporate criminal liability
  - RDR (Retail Distribution Review)
  - Volcker Rule (separation of investment banking and commercial banking activities)
  - SFT (Securities Financing Transactions)
  - PRIPs, PRIIPs, KIDs and KIIDs

Law Applied to Financial Markets II

- Regulation of collective investment schemes
  - UCITS Directive
  - AIFMD (Alternative Investment Fund Managers Directive)
  - EUSEF (European Social Entrepreneurship Funds) and EUVECA (European Venture Capital Funds)
  - ELTIF (European Long-Term Investment Funds)
  - Law 35/2003 on Collective Investment Institutions
  - Law 22/2014 on Venture Capital, Collective Investment Entities, and Management Companies

Regulation of credit institutions

- Justification for the regulation of financial institutions
- Capital requirements
  - Basel I
  - Basel II
  - Basel III
- Liquidity requirements
- Banking crisis management framework
- Banking crises 2023

Law Applied to Artificial Intelligence I

- Legal frameworks for Artificial Intelligence in Europe, the United States, Asia, and the Middle East
- Liability associated with artificial intelligence systems (I)
- The roles of operator/producer and their legal implications
- The case of autonomous learning systems: online vs. offline learning

Law Applied to Artificial Intelligence II

- Liability associated with artificial intelligence systems (II)
- The New Artificial Intelligence Regulation
  - Legal framework for advisory services / investment algorithms / MiFID II
  - Requirements for high- and low-frequency trading algorithms
  - Traceability and associated liabilities
- Data protection
- Case studies on liability in the use of AI

Law Applied to Artificial Intelligence III

- The importance of ethics in AI regulation
- Data protection regulations applicable to AI systems
- The Artificial Intelligence Sandbox
- The Spanish Agency for AI Supervision
- Malfunction vs. past performance does not guarantee future returns

Law Applied to Crypto-assets and Decentralized Technologies I

- An introduction to MiCA
- Legal aspects of smart contracts: essential elements of the contract, formal requirements
- Signature, identification of parties, applicable law
- Interpretation of smart contracts
- Governance models
- Onboarding in DLT systems: obligations of the parties
- Sanctioning regimes

- European Regulation on DLT-based market infrastructures

Law Applied to Crypto-assets and Decentralized Technologies II

- Legal aspects of smart contracts
- Sandbox and positioning of the CNMV / Bank of Spain / Comparative Law
- Legality of exchanges
- Compliance
- Regulatory challenges and traceability
- Tax regulation
- Cointracking

Law Applied to Digital Transformation and Sustainability I

- Relationship between FinTech and sustainability, and areas of collaboration
- Sustainable finance, theoretical perspective and practical examples
- EU Action Plan on Sustainable Finance: background and context
- Regulatory initiatives derived from the Action Plan
- The banking sector's commitment beyond regulation
- Crowdfunding and participatory financing platforms
- The digital euro

Law Applied to Digital Transformation and Sustainability II

- Blockchain technology in the financial sector and its relation to ESG aspects
  - Green finance, risk management, and reporting
  - CO_2 credits
  - Accounting and reporting of greenhouse gas (GHG) emissions impact
  - Ecological certification of non-fungible tokens (NFTs)
  - Tokenized incentives and rewards

Law Applied to Platform and Distributed Services I

- Cloud services and data security
- Types of cloud computing services
  - Building services from the cloud: trusted service providers (eIDAS2 Regulation)
- Regulatory and contractual aspects of cloud storage
  - Terms and conditions: applicable versioning
  - Standards and verification
  - Multi-jurisdictional issues and data protection: virtualization
  - Data protection in the cloud

Law Applied to Platform and Distributed Services II

- DSA: scope of application
  - Liability exemption for service providers regarding content: "Good Samaritan" clause
  - Due diligence obligations
    - Universal
    - For all hosting services, including online platforms
    - Additional for online platform providers
    - Special and additional for very large online platforms and search engines
  - Application of the regulation, competent authorities, and sanctions

Law Applied to Cryptography and Trust Service Providers

- Electronic signature: definition and properties. Types (advanced, probabilistic, blind, multiple, delegated, etc.)
- Document signing: creation and verification of an electronic signature
- Standard signature algorithms: RSA, DSA, ECDSA
- Electronic certificates (with/without private key). Certification Authorities and relational structures
- Certificate revocation
- Timestamps and Time Stamping Authorities: requirements
- Trust Service Providers
- Vulnerabilities and risk assessment

Law Applied to Cybersecurity

- Security vs. security management: ISO/IEC 27001 model
- Cybersecurity regulations and competent authorities
  - Critical infrastructures
  - NIS1 and NIS2
  - Cybersecurity Act
  - Connections with criminal codes

Law Applied to Digital Identity I

- Identity and identification methods under the eIDAS Regulation
  - The concept of identity
  - Presumed identity and risk analysis: Zero Trust vs. Friction
  - Differences between identity, identification, identity verification, and authentication
    - PSD2, EBA, and authentication factors
  - Identity model under the eIDAS1 Regulation
    - National identity documents: analog and digital
    - Signature certificates: types and evidentiary value for identity

Law Applied to Digital Identity II

- The verification process and its five phases: in-person and online processes
  - Applicable regulations: Spain and the EU
  - Applicable standards: Spain and the EU
- Identity model under the eIDAS Regulation
  - The EDIW (European Digital Identity Wallet)
    - Regulation, functioning
    - Interoperability with trusted third parties
    - Wallet security
  - Attribute attestations:
    - Trusted attribute attestation providers
    - Regulation and functioning
    - Similarities and differences with qualified certificate issuers and SSI/DID-based models
    - Interactions with other providers/operators
  - Trust services and their providers after the reform: what changes and what remains
  - Changes in cybersecurity requirements: new framework and obligations

Legal Aspects (Open AI)
- Open AI
- Types of licenses for AI components
- Model Cards
- Role of intellectual property rights
- Impact of regulation on models
- Case studies

Certification Exam for Financial Advisory: CNMV – MiFID II

Module 5 | Cloud Services and Big Data
135 Teaching hours

Big Data and Data Processing I
- Analítica de datos: visión end-to-end de todos los servicios
  - Collect: Pub/sub, VerneMQ
  - Process: dataflow, Dataproc (spark)
  - Store: GCS, BigQuery, BigQuery ML, BigTable
  - Analyze: BigQuery SQL, Dataproc (spark)

Big Data and Data Processing II. Collect I
- Google Cloud Pub/sub
- Messages, Topics
- Best practices
- VerneMQ
- Apache Kafka

Big Data and Data Processing III. Process I
- Dataflow
- Templates
- I/O connectors best practices
- Dataflow runner

Big Data and Data Processing IV. Process II
- Dataproc (spark)
- Dataproce serverless
- Clusters
- Toubleshooting

BBig Data and Data Processing V. Store I
- Google Cloud Storage
- BigQuery
- BigTable

Big Data and Data Processing VI. Analyze I
- BigQuery SQL
- Storage/compute separation
- Dataform

Big Data and Data Processing VII. Analyze II
- Looker
- Looker Studio
- Visualization

Big Data and Data ProcessingVIII
- Data lakes
- Linage, automatizations
- Dataplex

Preparation for the Professional Big Data Engineer Certification

Google Vertex AI – Session I
- Introduction to Vertex AI
- MLOps
- Methodology and Technical Components
- Customer References

Google Vertex AI – Session II
- Training a Custom Model in Vertex AI
- Distributed Training in Vertex AI
- Hyperparameter Tuning in Vertex AI
- Hardware Accelerators for Training

Google Vertex AI – Session III
- Vertex AI Prediction
- Batch Predictions
- Model Monitoring
- Explainable AI

Google Vertex AI – Session IV
- Vertex AI Model Registry
- Vertex AI Experiments
- Model Cards

Google Vertex AI – Session V
- Vertex AI Pipelines
- Kubeflow Pipelines
- Components
- Pipelines
- I/O v2

Google Vertex AI – Session VI
- Tabular Workflows
- Hands-On Pipelines I
- Hands-On Pipelines II

Google Vertex AI – Session VII
- ML Metadata
- Low-Code/No-Code
- AutoML
- BQML

Google Vertex AI – Session VIII
- Model Garden: LLMs/LRMs in Vertex AI
- LLMOps in Vertex AI
- Vertex AI Workbench
- Colab Enterprise

Preparation for Professional ML Engineer Certification

CI/CD – Session III
- Core concepts of Kubernetes
- Installation and configuration of Minikube or local environment
- Deployment, scaling, and updating applications in Kubernetes
- Introduction to monitoring (Prometheus + Grafana)
- Basic implementation of monitoring in Kubernetes

CI/CD – Session IV
- Jenkins and GitHub Actions
- Practical configuration of automated pipelines
- CI/CD integration with Docker/Kubernetes
- Final project: complete pipeline with Git, Docker, Kubernetes integration, and monitoring

AWS Session I
- General introduction to AWS and key services
- Account creation and initial configuration
- Launching, configuring, and managing an EC2 instance (SSH connection)
- Basic VPC and Security Group configuration
- Integrative practice: Deployment of a web server (Apache/Nginx)

AWS Session II
- Introduction to Amazon S3
- Hands-on practice with buckets, policies, file upload, and access management
- Introduction to RDS databases
- Creation, configuration, and connection to an RDS MySQL/Postgres instance
- Practical integration: EC2 + RDS + S3

AWS Session III
- Introduction to the serverless model
- Creation and deployment of AWS Lambda functions (integration with S3)
- Automation with CloudFormation (basic templates)
- Comprehensive practice: Building a serverless architecture with CloudFormation
- Project: Automating deployment and management with CloudFormation

AWS Session IV
- Monitoring with CloudWatch: alarms, metrics, and logs
- Supervised practice with CloudWatch
- Final integrative project (EC2 + Lambda + S3 + CloudWatch)
- Project presentation and evaluation

IronIA: Investment Algorithm Competition
- Access to investment fund information
- Out-of-market behavior: a fund does not behave like a stock
- Competition rules

Professional Big Data Engineer Certification Exam

Professional ML Engineer Certification Exam

Module 6 | Advanced and Generative Deep Learning

105 Teaching hours

Workshop: Multiobjective Portfolio Optimization (MPO) via Gradient Descent
- Case Study 1: Maximizing the Sharpe Ratio
- Case Study 2: Minimizing CVaR
- Case Study 3: Minimizing CVaR + UCITS constraints
- Case Study 4: Minimizing CVaR with Tracking Error ≤ TE
- Case Study 5: Joint Optimization (Sharpe ↑, CVaR ↓, TE, UCITS, minimum weight, N assets)
- Case Study 6: Minimizing risk with subset weight constraints

Workshop: AI Applied to Stock Markets I
- Environment creation
- Case study presentation: Execution algorithms
- Problem-solving: Theoretical framework
- Team-based development of an RL algorithm applied to finance: Part I

Workshop: AI Applied to Stock Markets II
- Environment creation
- Team-based development of an RL algorithm applied to finance: Part II

Workshop: AI Applied to Stock Markets III
- Thematic portfolio generation (NLP + Generative Models + Recommender Systems)
- Workshop: LangChain
  - Chains, Links, and Connectors
  - Modular design and extensibility
  - LCEL
  - Anatomy of a chain and intermediate chains
  - Agents in LangChain
  - Structured output extraction
  - Integration of external data sources
  - Error handling and event logging
  - Performance optimization
  - LangServe and LangSmith

Workshop: AI Applied to Stock Markets IV
- Downloading price series (S&P 500)
- Downloading Fama & French factors (5 daily factors)
- Linear regression of Apple stock prices with the Small Minus Big (SMB) factor
- Calculation of excess return
- Construction of an autoencoder with TensorFlow
- Linear regression between actual and predicted excess returns
- Portfolio construction based on predicted excess returns: long winners, short losers
- Construction of a sparse autoencoder
- Neuron visualization

Workshop: AI Applied to Stock Markets V
- Synthetic data generation with generative algorithms
- Beyond generation with normal distributions
- Comparison with previous methodologies
- Application to stock markets

Kohonen networks
- Unsupervised competitive networks
- 2D self-organizing maps
- 3D self-organizing maps
- Solving the Traveling Salesman Problem with self-organizing maps

Recommender Systems
- Profile and Asset Clustering
- Recommendation Generation and Allocation Systems
- TensorFlow Recommenders
- Similarity-based Systems
- Factorization-based Systems
- Deep Learning-based Systems

Causal Inference
- Causality vs. Prediction
- Experimental vs. Observational Data

- DAGs
- D-separation, Confounders/Colliders/Mediators
- Back-door/Front-door Criteria and Do(·) Notation
- From Identification to Estimation
- Guided Practice: Constructing and Validating a Case DAG

From Inference to Applied Causal AI

- Modern Estimation and Reproducible Pipelines
- DoubleML, Doubly Robust Estimators (AIPW)
- ATE/CATE, Intervals, and Diagnostics of Balance/ Positivity
- Implementation with DoWhy
- SCM, Interventions, and Counterfactuals
- Abduction–Action–Prediction Algorithm
- Causal AI in Action: Policy/Uplift Learning, Connections with RL, and Applications with LLMs
- End-to-End Practice: Policy Design and Counterfactual Evaluation with DoWhy/DoubleML

Workshop: Structural Break Detection in Time Series

- Definition and Types of Regime Change (Level, Trend, Variance, and Dependence)
- Classical Deterministic Methods (Chow/Quandt-Andrews, CUSUM, Binary Segmentation, PELT)
- Supervised ML (XGBoost and Ensembles)
- Sequential Deep Learning (LSTM/Transformers) for Detection and Anticipation

Research with Google DeepMind I

- Federated Learning
- Gemini Model Family: Versions 1.0, 1.5, and 2.0 (Review of 4 Papers)
- Multimodality

Research with Google DeepMind II

- Gemma Model Family (Review of 11 Papers)
  - Models: Gemma-1, RecurrentGemma, CodeGemma, PaliGemma, ShieldGemma, DataGemma, ColPali
  - Innovations: SigLIP, Griffin, and Gemma Scope
  - LLaMA Model Family (Review of 4 Papers from Meta)
  - STaR: Bootstrapping Reasoning With Reasoning
  - Human-like Systematic Generalization Through a Meta-learning Neural Network
  - Towards Self-Assembling Artificial Neural Networks via Neural Developmental Programs

Agentic AI I

- Deterministic AI Agents: Dialogflow
- Generative AI Agents: Playbooks
- Agentic Architectures
- Data Stores for Agents

Agentic AI II

- ADK (Agent Development Kit)
- MCP (Model Context Protocol)
- A2A (Agent-to-Agent Protocol)
- Introduction to LangChain

Agentic AI III

- Foundational Concepts of Agents
- Building Agents in Google Cloud
- Agentic Memory
- Memory Management: LLM as Operating Systems
- Labs

Agentic AI IV

- Agent Engine and Agent Garden
- Evaluation and Improvement of Agents
- AgentOps
- Labs

LRM – Large Reasoning Models

- Architectures
- Differences Between LLMs and LRMs
- Gemini 2.5 vs. OpenAI o3, o4
- Evaluation Methodology
- Use Cases

GRC Tools for AI

- Inventory and classification of AI systems
- Risk catalog and associated AI controls
- Monitoring of projects, use cases, and dashboards
- Evaluation of systems based on regulatory requirements
- Workflows

Workshop on Agent Construction and Practical Application I

- Review: Fundamentals of Generative Agents (LangChain, AutoGPT)
- Hands-on development of a basic agent with LangChain
- Integration of agents with APIs and external tools
- Supervised practice: basic agent with memory and retrieval
- Practical evaluation of created agents

Workshop on Agent Construction and Practical Application II

- Application to Smart Due Diligence
- Cloud + MCP + graph structures
- Error detection capability and model self-adjustment of prompts to complete tasks

Module 7 | Blockchain and Decentralized Ledger Market Infrastructures

60 Teaching hours

Fundamentals of Blockchain

- Bitcoin
  - The double-spending problem
  - Bitcoin and blockchain technology
  - Economic aspects and technical keys
  - Hash functions and asymmetric cryptography
  - Keys, addresses, and wallets
  - Transactions, blockchains, and consensus
  - Lightning Network
- Ethereum
  - Technical fundamentals
  - Wallets and transactions
  - Solidity, Vyper
  - Consensus and tokens
  - DeFi, Uniswap, Compound, NFTs, DAOs

Smart Contract Programming on Ethereum I

- The Solidity language

- Structure of a Solidity source file
- Remix: development, deployment, and interaction
- Contract structure
- Data types
- Units and globally available variables

Smart Contract Programming on Ethereum II

- Control structures
- Error handling
- Inheritance
- Interfaces
- Assembly
- Advanced concepts
- Debugging and unit testing in Remix

Smart Contract Programming on Ethereum III

- ERC20 and ERC721 token standards
- Case Study 1: Bank
- Case Study 2: Room reservation
- Case Study 3: Auction
- Design patterns: withdraw and owner
- Smart contract security
  - Reentrancy
  - Overflow
  - Denial of service
  - Code and security analysis tools

Smart Contract Programming on Ethereum IV

- Design patterns in Solidity
  - Proxy pattern
  - Smart contract upgrade pattern
  - Diamond pattern
- Vyper and other programming languages for Ethereum
  - Principles and objectives
  - Vyper vs. Solidity
  - Writing a contract in Vyper
  - Compilation and deployment
  - Other alternatives: Yul, Yul+, Fe

Smart Contract Programming on Ethereum V

- Development tools:
  - Truffle
  - Ganache
  - MetaMask
- Solidity for applications: Backend
  - Java
  - JavaScript
- Solidity for applications: Frontend
  - Graphical interface integration
  - MetaMask connection

Utilities for Decentralized Applications I

- Case study: dApp with voting system for members
- Blockchain oracles
  - What they are and why they are necessary
  - Different architectures and designs
  - Provable & Chainlink
  - Practical cases
- Decentralized storage
  - IPFS, Swarm
  - Case study

Utilities for Decentralized Applications II

- Digital identity
  - Definition and non-blockchain applications
  - OpenID, electronic voting
- Digital identity on blockchain
  - Standards and implementations
  - Decentralized governance

Blockchain Network Management

- Main clients: Geth, Hyperledger Besu, Quorum, etc.
- What is Hyperledger Besu?
- Features and components: architecture, consensus algorithms, privacy, permissioning, monitoring
- Practical cases

Scalability in Blockchain Networks I

- Optimistic Rollups
- Zero-Knowledge Rollups
- State channels
- Sidechains

Scalability in Blockchain Networks II

- Plasma
- Validium
- Ethereum: The Merge
- Internet Computer Protocol

Hyperledger Fabric

- What is Hyperledger Fabric?
- Network architecture
- Consortia, channels, and permissioning with MSP
- Chaincode
- Lifecycle of a transaction in Fabric
- Privacy: Private Data and Channels
- Practical exercise: Deploy your first Chaincode

Module 8 | Quantum Computing and Quantum Artificial Intelligence

90 Teaching hours

Introduction to Quantum Computing

- Theory of Computing
- Quantum computing
- History
- Applications
- Introduction to Quantum Mechanics

Linear algebra

- Vector spaces, linear independence, bases
- Linear operators, eigenvectors, and eigenstates
- Inner product, orthonormalization
- Hilbert space (projective)
- Hermitian and unitary operators
- Operator operations (trace, commutator, anticommutator)
- Tensor product of vector spaces

Principles of quantum mechanics

- Physical state space (Dirac notation)
- Qubits

- Evolution (Schrödinger equation)
- Probabilistic interpretation
- Measurement process (state projection)
- Heisenberg uncertainty principle

Composite systems

- Pure and entangled states
- Density operator
- EPR paradox
- Bell inequalities
- No-cloning theorem

Quantum Algorithms

- Quantum logic gates
- Dense coding
- Quantum teleportation

Quantum computing software

- Frameworks and cloud platforms
- IBM Quantum Platform: superposition, entanglement, visualization, and tools
- Qiskit: Quantum Information Science Kit – Project and Qiskit Lab
- Gates
- Circuits
- Visualizations
- Execution on simulators and real quantum computers
- Quantum volume
- CLOPS
- Qiskit Runtime

Classical vs. quantum computing

- Computational complexity theory
- Comparison between classical and quantum algorithms
- Grover's and Shor's algorithms
- Physical realizations of qubits
- Decoherence and error correction

Quantum Circuits and Algorithms

- Bernstein-Vazirani algorithm
- Grover: oracle implementation
  - Binary Sudoku
- Quantum Support Vector Machines
  - Creation of classical and quantum kernels
  - Quantum classifiers
  - Classical-quantum ensemble classifiers: fraud detection

Quantum Applications

- Specific algorithms (Optimization, Linear Algebra, Machine Learning)
- Quantum Amplitude Estimation (QAE)
- Variational Quantum Eigensolver (VQE)
- Quantum Approximate Optimization Algorithm (QAOA)
- Quantum Generative Adversarial Network (qGAN)
- Applications in finance
  - Quantum risk analysis
  - Option pricing using quantum computers

Qiskit Optimization

- Optimization module
- DocPLEX models
- VQE, QAOA, Grover optimization
- Portfolio optimization

Quantum cryptography

- Introduction to Information Theory
  - Shannon entropy
  - von Neumann entropy
- Symmetric and asymmetric cryptography systems
- Quantum Key Distribution (QKD)
- Protocols: BB84, B92, EPR
- Security of quantum protocols

Quantum Machine Learning

- Quantum Neural Networks
- PyTorch-Qiskit connector
- Hybrid classical-quantum neural networks
  - Quantum Support Vector Machine
  - Quantum recurrent neural network
  - Quantum convolutional neural network

Advanced Applications

- Quantum Bayesian networks: risk analysis
- Quantum Generative Adversarial Networks
- Quantum Reinforcement Learning
- Swarm algorithms and quantum computing (Quantum PSO)
- Quantum autoencoder
- Quantum Transfer Learning
- Quantum transformers

Qiskit Finance and Advanced Applications

- Value at Risk (Quantum Monte Carlo)
- Quantum risk analysis (quantum Bayesian networks)
- Option pricing (Quantum Monte Carlo, QAE, QAOA)
- Scenario simulation (Iterative Quantum Amplitude Estimation – IQAE)
- Portfolio optimization (VQE, QAOA, Grover optimization, Quantum PSO)
- Fraud detection (classical-quantum ensemble classifiers)
- Best execution (Quantum Reinforcement Learning)

Tensor Networks I

- Mathematical introduction: what is a tensor and how to operate on it
- Notation: definition and examples
- Representations: MPS/TT, MPO, PEPS
- Understanding tensors with SVD
- Contraction schemes
- Logical tensor networks
- Simulation of quantum circuits
- Example: Deutsch-Jozsa algorithm
- Combinatorial optimization with logical tensor networks

Tensor Networks II

- Traveling Salesman Problem example
- Knapsack problem example

- Task scheduler example and integration with genetic algorithms

Tensor Networks III

- Machine Learning with tensor networks
  - Layer compression
  - Tensor network derivation
  - LLM: CompatifAI
- Anomaly detection via compression
  - Definition
  - Time series
- Differential equations with tensor networks
- DMRG
- Recommended Software Libraries

Qiskit Certification Exam: Quantum Computing Developer Certificate

Module 9 | Launching Your Own Startup

30 Teaching hours

Business Idea Definition and Validation

- Development of a Solid Value Proposition
- Analysis of Competitive Advantage: Is It Sustainable Over Time?
- Definition of Requirements and Project Coherence

Product Prototyping and Validation

- Development of a Minimum Viable Product (MVP)
- Value Chain Analysis

Market Entry and Competitive Strategy

- Development of a Go-to-Market Strategy
- Competitive Analysis
- Pricing Strategy
- Marketing Strategy

Financing and Legal Considerations

- Cash Flow Estimation
- Securing Financing
- Legal Aspects of the Project

Presentation of the Project to Startup Accelerators

Presentation of the Project to the Business Angels Association

Master's Thesis Defense I

Master's Thesis Defense II

AthenAI

Certifications

You will have the opportunity to obtain up to ***five certifications and launch your own startup***. All while studying in this master's program.

Financial Advisor Certificate

This certification validates that a professional possesses the necessary competencies to provide financial advice in accordance with the standards required by the European MiFID II Directive.

Purpose of the Certificate

- Ensure compliance with the professional suitability requirements established by the CNMV for providing financial advice to clients.
- Guarantee that advisors have adequate knowledge of financial products, markets, and current regulations.

Regulation and Legal Context

- MiFID II Directive (Markets in Financial Instruments Directive): Aims to protect investors.
- Technical Guide 4/2017 of the CNMV: Defines the knowledge and competency requirements for professionals offering financial advice and managing portfolios.

Competencies Assessed

The certification covers fundamental knowledge in:

- **Financial Products:**
  Fixed income, equities, derivatives, structured products, investment funds.
- **Financial Advisory:**
  Assessment of client risk profiles.
  Portfolio analysis and construction.
- **Regulation and Compliance:**
  Legal requirements, MiFID II compliance, and investor protection.
- **Risk Management and Taxation**

Benefits for Students

- **Legal Compliance**: Enables legal practice as a financial advisor in Spain and other European Union countries.
- **Enhanced Employability and Credibility**: Financial institutions require certified professionals to meet regulatory standards and develop new products and services.

Quantum Computing Developer Qiskit 2, IBM

This certification is designed for developers seeking to deepen their expertise in quantum computing. It focuses on the programming and conceptualization of quantum circuits and algorithms, as well as understanding the mathematical operations underlying quantum systems.

Certificate Content

Fundamental Concepts of Quantum Computing:

- Qubits and basic operations
- Quantum gates and circuit creation

Quantum Algorithms:

- Deutsch-Jozsa, Grover, and Shor algorithms

Qiskit 2:

- Using Qiskit to build and simulate quantum circuits
- Managing simulators and real quantum computers

Quantum Applications:

- Optimization and finance

Priority access through IBM to real 154-qubit quantum devices to practice the knowledge acquired in class.

Benefits for Students:

- Competitive Differentiation: Gain expertise in an advanced, high-demand field
- Access to Specialized Opportunities: Open pathways in quantum computing and finance
- Advanced Technical Skill Development: Hands-on experience with real quantum systems
- Industry-Recognized Credentials

To obtain this certification, students must pass the practical exam on the IBM platform (Pearson VUE).

An additional fee of $200 is required for the exam, payable directly to IBM by the student.

Professional Machine Learning Engineer (PMLE), Google Cloud

The **Professional Machine Learning Engineer (PMLE) certification**, issued by Google, is designed as a key credential for students, developers, and data scientists who wish to demonstrate skills in machine learning, model deployment, data governance, and AI infrastructure.

This certification is intended to validate that professionals can:

- Design scalable and maintainable ML solutions.
- Implement ML models following Google Cloud best practices.
- Assess the effectiveness and risks of deployed ML models.

Certification Content

Machine Learning Conceptual Framework:

- Selection of modeling techniques and data
- Hyperparameter tuning and evaluation

ML Model Development:

- Creation of data pipelines
- Implementation of algorithms and techniques for supervised and unsupervised problems

Production Deployment:

- Automation of ML models
- Continuous monitoring and improvement of deployed models

Google Cloud Tools:

- Use of Vertex AI, TensorFlow, and BigQuery ML

Benefits for Students

- Global Recognition by Google
- **Enhanced Employability and Credibility:** ML and Google Cloud skills are highly sought after across various industries, including finance.
- **Access to an Innovation Ecosystem:** GCP products and AI technologies are constantly evolving; this certification demonstrates that the student is prepared and officially certified by Google.

To obtain this certification, students must pass an exam of approximately **2 hours**, consisting of **50–60 multiple-choice questions**, taken remotely under supervision without access to reference materials.

The exam fee is **200 USD**, which must be paid directly to Google by the student.

Professional Cloud Architect (PCA), Google Cloud

The **Professional Cloud Architect (PCA) certification**, issued by Google, is designed to validate the skills required to design, develop, and manage secure, scalable, and highly available infrastructures on Google Cloud Platform (GCP). It is an essential credential for professionals seeking to master cloud architecture with a practical and strategic approach.

This certification demonstrates that professionals are capable of:

- Designing robust, efficient, and secure cloud architectures.
- Managing infrastructure solutions that meet technical, business, and regulatory requirements.
- Monitoring, optimizing, and securing the performance of cloud environments.

Certification Content

Cloud Architecture Design:

- Selecting appropriate services for different business needs
- Defining network, storage, compute, and database structures

Security and Regulatory Compliance:

- Implementing access control, encryption, and auditing policies
- Ensuring alignment with regulatory frameworks such as GDPR or MiFID II

Management and Optimization of GCP Solutions:

- Monitoring resources and performance
- Automating tasks using tools like Cloud Deployment Manager and Terraform

Specific Use Cases:

- Implementing financial analytics, big data, and AI solutions on GCP

Google Cloud Tools:

- Cloud Storage, Compute Engine, Kubernetes Engine, BigQuery, Cloud IAM, among others

Benefits for Students

- **International Recognition:** Official certification issued by Google Cloud.
- **High Employability:** Cloud architecture skills are essential in banking, fintech, and capital markets.
- **Preparation to Lead Digital Transformation:** Students will be equipped to design solutions that meet the highest standards in the financial sector.

To obtain this certification, students must pass an exam of approximately **2 hours**, consisting of **50–60 multiple-choice questions**, taken remotely under supervision without access to reference materials.

The exam fee is **200 USD**, which must be paid directly to Google by the student.

Professional Data Engineer (PDE), Google Cloud

The **Professional Data Engineer (PDE) certification**, issued by Google Cloud, is aimed at professionals who design, build, and optimize scalable, secure, and value-oriented data processing systems. This credential certifies key skills for turning data into actionable insights, which is essential in the financial sector.

This certification validates that professionals can:

- Design and build efficient, scalable data processing systems.
- Integrate and transform large volumes of structured and unstructured data.
- Ensure data security, integrity, and governance.
- Apply machine learning techniques to extract advanced insights.

Certification Content

Data System Design:

- Architectures for data ingestion, storage, and analysis
- Selection of technologies for streaming and batch data

Data Pipeline Construction:

- Implementation of processing workflows using tools such as Dataflow, Pub/Sub, Dataproc, and Apache Beam
- Data cleaning, transformation, and enrichment

Data Modeling and Analysis:

- Using BigQuery for real-time analytics
- Applying machine learning models to large-scale datasets

Security and Compliance:

- Access management, auditing, and regulatory compliance in regulated environments

Key Google Cloud Tools:

- BigQuery, Cloud Composer, Dataflow, Dataproc, Pub/Sub, Vertex AI

Benefits for Students

- **Globally Recognized Certification:** Endorsed by Google Cloud and acknowledged by leading companies in the financial and technology sectors.
- **High Employability:** The role of Data Engineer is highly sought after due to its critical role in digital transformation.
- **Practical Skills for the Financial Sector:** Specific preparation for working with high-frequency financial data, market history, and risk analysis.

To obtain this certification, students must pass an exam of approximately **2 hours**, consisting of **50–60 multiple-choice questions**, taken remotely under supervision without access to reference materials.

The exam fee is **200 USD**, which must be paid directly to Google by the student.

Startup Launch Program

The Startup Launch Program is designed for students and emerging entrepreneurs seeking to transform their innovative ideas into real businesses. Through a hands-on approach, participants develop the skills necessary for idea validation, creation of minimum viable products, market strategy design, and securing funding.

Program Structure and Content

Definition and Validation of the Business Idea

- Development of a solid value proposition
- Analysis of the sustainability of competitive advantage
- Identification of needs and evaluation of project coherence

Prototyping and Product Validation

- Creation of a minimum viable product (MVP)
- Value chain analysis to maximize operational efficiency

Development of a Market Entry Strategy

- Comprehensive competitor analysis
- Determination of optimal pricing for the product or service
- Design of an effective marketing strategy

Funding and Legal Aspects

- Cash flow estimation and financial analysis
- Strategies for obtaining funding (investors, loans, grants)
- Legal requirements for entrepreneurship

Project Presentation to Investors

- Presenting proposals to startup accelerators
- Presenting proposals to Business Angel associations

This program provides a comprehensive skill set for startup creation, from idea conception to funding and market entry.

Students will not only acquire theoretical knowledge but also develop practical competencies and have the opportunity to present their projects to real startup accelerators and Business Angels.

AthenAI

Career Opportunities

Upon completing this Master's program, you will become an AI Quant—***one of the most sought-after and highly compensated profiles in the financial sector***.

Two Paths, Multiple Destinations

This Master's program offers powerful and ambitious career opportunities aligned with the most sought-after profiles in the new financial-technological paradigm. There are two natural pathways upon completing the program, though they are not the only options.

1. **The Entrepreneurship Path:** If your goal is to create your own tech startup, this Master's program provides the tools, knowledge, and network you need. You will have a dedicated entrepreneurship module focused on defining and validating business ideas, developing prototypes, and product validation. Additionally, you will have the opportunity to present your project to accelerators and Business Angel networks. If you dream of founding a company that transforms the financial sector, this is where your journey begins.
2. **Joining an Innovation Team within a Financial Institution:** Thanks to our close collaboration with the financial sector, many final projects originate from real challenges posed by these organizations, seeking talent ready to join their AI laboratories. If you aspire to work from day one with real data, investment algorithms, and cutting-edge technology in demanding financial environments, this Master's program is your gateway.

Beyond these paths, there is a broader ecosystem of opportunities: specialized consulting, innovation departments, financial product development, and much more. At AthenAI, the path is yours to define.

Comparison of Technological Profiles

Modules	Data Analytics	Data Scientist	Data Engineer	Quant Essentials	Top Quant
1. Programming Fundamentals	Expert	Expert	Expert	Expert	Expert
2. Finance, Financial Markets, and Investment Advisory	–	–	–	Advanced	Expert
3. Cryptoassets and Exotic Assets	–	–	–	–	Expert
4. Investment Algorithms, Modern Portfolio Theory, and Beyond	–	–	–	Advanced	Expert
5. Financial and Technology Law	–	–	–	–	Advanced
6. Machine Learning and Deep Learning	Beginner	Advanced	Beginner	Expert	Expert
7. Cloud Services and Big Data	Advanced	Expert	Expert	Advanced	Expert
8. Advanced and Generative Deep Learning	Beginner	Beginner	Beginner	Advanced	Expert
9. Blockchain and Decentralized Market Infrastructure	–	–	Beginner	–	Expert
10. Quantum Computing and Quantum AI	–	–	–	–	Expert
11. Launching Your Own Startup	–	–	–	–	Advanced

Toolbox Upon Completion

Programming Language

Python

Finance, Cryptoassets, and Investment Algorithms

- Portfolio Optimization and Management
- Wealth Management
- Risk Management and Hedging Products:
  - Spot: Bonds, Equities, Deposits, Currencies
  - Derivatives: Repos, Forwards, Futures, Options, Warrants, and Swaps
  - Structured Products
- Investment Funds
- Volatility Management
- Sensitivity Management and Strategies
- Climate Derivatives
- CAT Bonds
- Fundamental Analysis
- Investment Algorithm Design and Backtesting
- Routing and Best Execution
- ...

Financial and Technology Law

Applied to:

- Financial Markets
- Artificial Intelligence
- Cryptoassets and Decentralized Technologies
- Digital Transformation and Sustainability
- Platform and Distributed Services
- Cryptography and Trusted Service Providers
- Cybersecurity

Inteligencia Artificial

Genetic Swarm Fuzzy Logic

ML

Machine Learning (ML)

- Frameworks: TensorFlow, PyTorch, Keras
- Model evaluation
- Data visualization
- Clustering algorithms

DL

Deep Learning (DL)

- Convolutional Neural Networks (CNN)
- Recurrent Neural Networks (RNN)
- Principal Component Analysis (PCA)
- Natural Language Processing (NLP)
- Probabilistic Graphical Models (PGM)
- Bayesian Networks (BN)
- Generative Adversarial Networks (GAN)
- Variational Autoencoders (VAE)
- Deep Autoencoders (AE)
- Reinforcement Learning (RL)
- Recommendation Systems
- Transfer Learning (TL)
- Large Language Models (LLM)
- Explainable AI (XAI)
- AI Agents

Cloud Architecture

AWS

Azure

Google Cloud

Big Data

Spark

- Hadoop
- Impala
- Cassandra
- ScyllaDB

Containers

Docker

Kubernetes

API Development

FastAPI

DevOps

CI/CD with GitLab Runners

Databases (DB)

- NoSQL
- SQL
- MongoDB

ETL Pipeline Development and Deployment

ETL

Blockchain

Quantum Computing and Quantum AI

You Will Achieve:

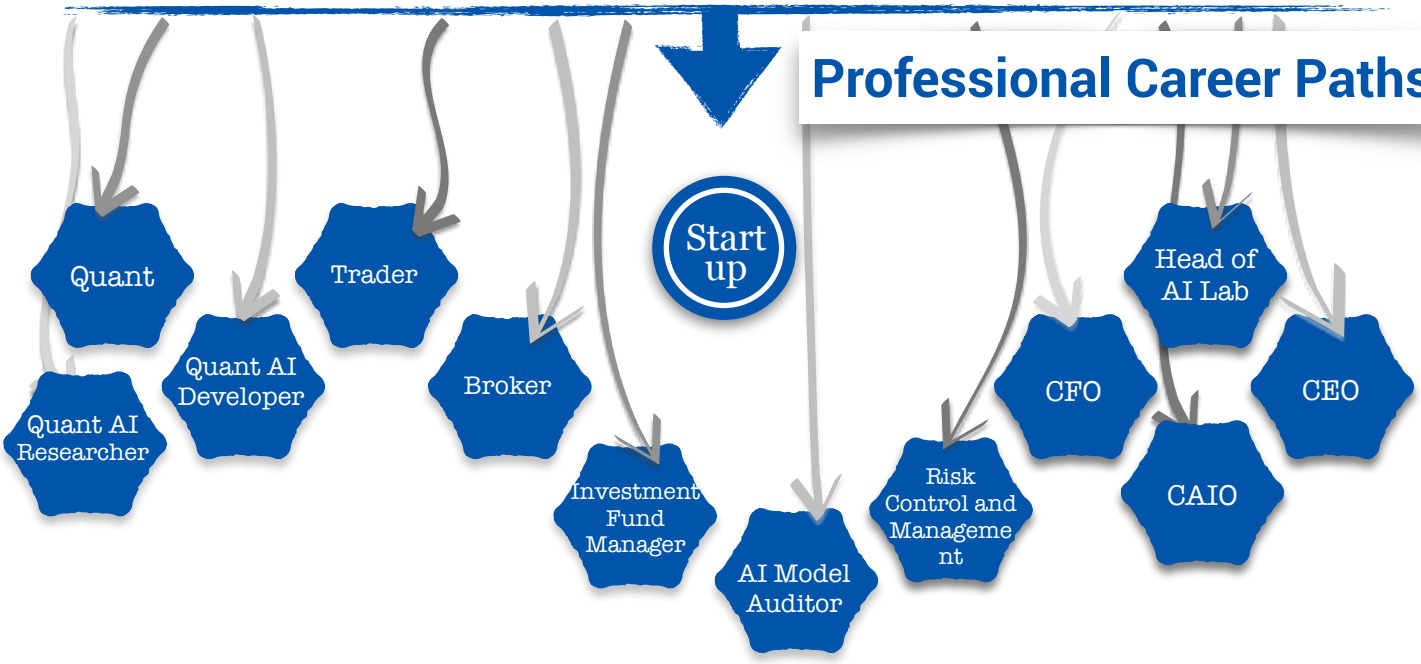
Qiskit IBM

Google Cloud Certified – Professional Machine Learning Engineer

Google Cloud Certified – Professional Cloud Architect

Google Cloud Certified – Professional Data Engineer

Professional Career Paths



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7

Faculty of Experts and Instructors

The faculty is the ***most valuable asset of the Master's program***, which is why the selection of professors is one of the aspects to which we have devoted the most time and attention.

Profesor	Especialidad	Formación	Puesto actual
 **Alejandro Mata Ali**	Quantum Computing	Degree in Physics Master's in Particle Physics	Head of Quantum Computing and Tensor Networks ITCL
 **Álvaro Galiñanes**	Finance (Investment Fund Management)	Bachelor's in Economics Master's in Banking and Finance Master's in Quantitative Finance Master's in Artificial Intelligence Applied to Financial Markets (mIAX)	Director of Investments Banco Santander
 **Álvaro Suárez Bravo**	Blockchain	Bachelor's in Computer Engineering Master's in Computer Science	Principal Software Engineer DLT Finance AG
 **Ángel Luis Quesada Nieto**	Blockchain	Bachelor's in Mathematics MBA – Master in Business Administration for Entrepreneurs	Founder & CEO Onyze, Kubide & Climbspot
 **Christian Oliva**	Artificial Intelligence	Bachelor's in Computer Engineering Master's in Research and Innovation in Computational Intelligence and Interactive Systems PhD Candidate in Computer Engineering – Biological Neurocomputation and Machine Learning	Assistant Professor & Researcher Autonomous University of Madrid (UAM)
 **Emma Izquierdo-Verdiguier**	Artificial Intelligence	Bachelor's in Physics Master's in Remote Sensing – Thesis: "Automatic Detection and Classification of Cultivated Tree Plantations in High-Resolution Spatial Images" Doctor of Philosophy	Google Developer Expert – Earth Engine University of Natural Resources and Life Sciences
 **Franco Dante Albareti**	Quantum Computing	Bachelor's in Physics (First in Class) Master's in Theoretical Physics, Cosmology and Elementary Particles PhD in Theoretical Physics and Spacetime Curves (First in Class) Master's in Artificial Intelligence Applied to Financial Markets (mIAX)	Senior Software Engineer Affirm
 **Ginés Carrascal de las Heras**	Quantum Computing	Bachelor's in Physics, Optics and Electronics Master's in Spectral Laser Microanalysis	Quantum Computational Scientist IBM Quantum

Profesor	Especialidad	Formación	Puesto actual
 **Gonzalo Navarro Ruiz**	Law	Bachelor's in Law Bachelor's in Business Administration Master's in Corporate Legal Advisory (First in Class) PhD in Corporate Law – Securities Market (Summa Cum Laude, Unanimous) Executive Master of Business Administration (EMBA)	Head of Financial Regulation ONTIER
 **Guillermo Fajardo Calvache**	Artificial Intelligence	Bachelor's in Finance and Accounting Civil Engineering Master's in Artificial Intelligence Applied to Financial Markets (mIA-X) Master's in Alternative Finance, Banking and Financial Services (MFIA)	Data Scientist Bolsas y Mercados Españoles (BME)
 **Guillermo Meléndez Alonso**	Artificial Intelligence + Finance – Academic Management	Diploma in Business Studies (First in Class) Bachelor's in Business Administration (First in Class) Master's in Auditing Master's in Quantitative Finance Master's in Stock Market and Alternative Investments Master's in Data Science and Big Data (First in Class) Master's in Deep Learning (First in Class)	CEO AthenAI
 **Javier Riaño Sierra**	Finance (Investment Fund Management)	Bachelor's in Business Administration and Management Master's in Valuation and Derivatives Management Master's in Artificial Intelligence Applied to Financial Markets (mIAX)	Founder Diaphanum Valores Founder IronIA Fintech
 **Jesús Mardomingo**	Law	Bachelor's in Law	Partner Dentons
 **Jesús Sanz del Real**	Artificial Intelligence + Finance	Bachelor's in Law Bachelor's in Business Administration and Management Master's in Artificial Intelligence Applied to Financial Markets (mIAX) CFA Level II	Associate Team Leader & Data Scientist Oliver Wyman
 **Jordi Puente**	ESG	Master's in Artificial Intelligence Applied to Financial Markets (mIAX) Postgraduate in Inbound Marketing and Branded Content MBA Bachelor's in Psychology, Human Resources and Applied Psychology in Business	Digital Director and Member of the Executive Committee Corresponsables
 **Jorge Bolívar**	Artificial Intelligence + Finance	Mining and Mineral Engineer	CEO ETS Asset Management Factory

Profesor	Especialidad	Formación	Puesto actual
 **Jorge Soriano Lázaro**	Cryptoassets	- Bachelor's in Architecture	Co-founder & CEO Criptan
 **Jose Antonio Esteban Sánchez**	Big Data	Technical Systems Engineer	Chief Executive Officer (CEO) IronIA Investment Fund Manager Specialized in AI
 **Juan Luis Fernández-Martínez**	Artificial Intelligence	PhD in Philosophy PhD in Petroleum Engineering Mining Engineer Diploma in Applied Geophysics Master's in Petroleum Engineering	Co-founder StockFink
 **Luis Fernando Lago Fernández**	Artificial Intelligence and Mathematics	Bachelor's in Physics Bachelor's in Mathematics PhD in Computer Science	Department of Biological Neurocomputation Polytechnic University of Madrid
 **Manuel Sánchez Montañés Isla**	Artificial Intelligence	Bachelor's in Physics PhD in Computer Engineering	Researcher Autonomous University of Madrid
 **Miguel García Cordo**	Artificial Intelligence + Finance	Master's in Artificial Intelligence Applied to Financial Markets (mIAX) Master's in Artificial Intelligence (Artificial Intelligence Institute) ISO 42001 AI Management Leader Certification ISO 38507 AI Governance Leader Certification	Chief Risk Officer (CRO) Inversis
 **Miguel Jaureguízar**	Finance + Blockchain	Telecommunications Engineer – Summa Cum Laude Diploma of Advanced Studies (DEA), Applied Economics Postgraduate Studies, Applied Economics	Director of Digital Development and Digital Assets Renta4 Banco
 **Minerva Rodríguez Cabrera**	Artificial Intelligence + Finance	Master's in Artificial Intelligence Applied to Financial Markets (mIAX)	Operations Analyst Darwinex Broker

Profesor	Especialidad	Formación	Puesto actual
 **Pedro Ventura Gómez**	Artificial Intelligence + Finance	Master's in Artificial Intelligence Applied to Financial Markets (mIAX) (First in Class) Expert in Back Office Management, Financial Services, and Financial Management Technical Telecommunications Engineer	Project Director March Asset Management
 **Rafael Sánchez**	Artificial Intelligence + Big Data	Bachelor's in Telecommunications PhD in Engineering and Telecommunications	Manager, Generative AI / ML, Southern Europe and Middle East Google
 **Raquel Hernández Falcón**	Artificial Intelligence + Finance	Bachelor's in Mathematics, Statistics, and Research Master's in Artificial Intelligence Applied to Financial Markets (mIAX) Master's in Quantitative Finance	Risk and Compliance Control March Asset Management
 **Tomás de la Rosa Turbides**	Artificial Intelligence + Finance	Bachelor's in Systems and Computing PhD in Telecommunications CFA Level I	Vice President, AI Research Lead JP Morgan

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General Information

General Information

Duration

Full program equivalent 139 ECTS

Quant Essential

- Equivalent to 54 ECTS
- 450 teaching hours
- 1.350 teaching + study hours
- 12 months

Start Date	*End Date*
April 10th, 2026	March 16th, 2027

Top Quant

- Equivalent to 85 ECTS
- 705 teaching hours
- 2.115 teaching + study hours
- 15 months

Start Date	*End Date*
April 2nd, 2027	June 27th, 2028

Schedule

Wednesday and Thursday from 7:00 PM to 9:30 PM

Friday from 4:00 PM to 9:00 PM

Saturday from 9:00 AM to 2:00 PM

* Wednesday, Thursday, and Friday classes will be conducted exclusively online.
* Saturday classes will be delivered both in-person and online.

Location

Essential master's programs are delivered entirely online.

Top master's programs combine online training with in-person sessions, although they may also be completed fully online. All in-person sessions take place in Madrid.

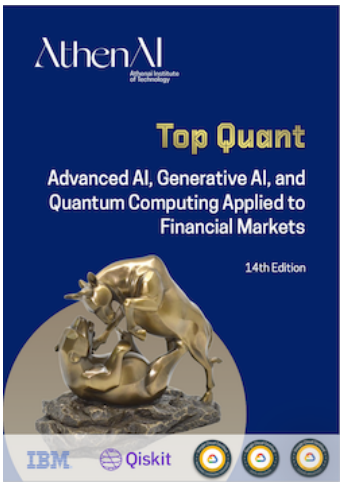
Price

The price of the **Quant Essential** program is 11.000 €

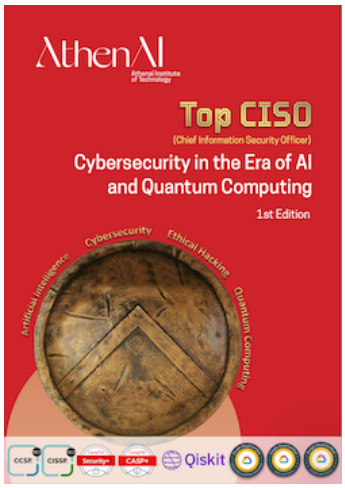
The price of the **Top Quant** program is 16.500 €

The price of the **Full program** is 27.500 €

Content recognition between master's programs: a unique advantage

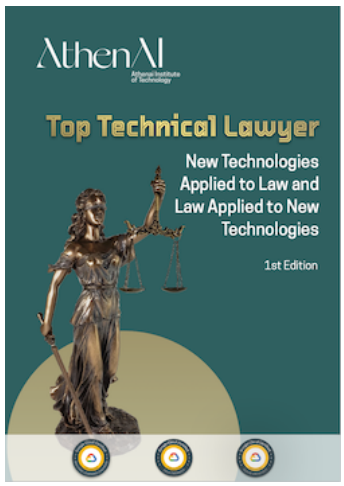


Focused on Financial Markets, AI, and Quantum Computing



Focused on Cybersecurity, AI, and Quantum Computing

Focused on the role of Chief Artificial Intelligence Officer (CAIO)



Focused on Law and Emerging Technologies

At our school, each master's program specializes in a different area, yet all share a common knowledge base in the new technologies modules: Python, AI, Cloud Services, Cybersecurity, Quantum Computing...

This structure allows students to take the common subjects only once, benefiting from automatic **content recognition in any other master's program** they choose.

For example, if you first complete the ***Top Quant*** Master's program, priced at **€27,500**, you will have covered much of the common content of other master's programs, so:

- You can access the other master's programs with automatic recognition of the previously completed content modules*.
- The price of the subsequent master's programs will be significantly reduced**.
- You could **complete all four master's programs for only €50,000*****, instead of paying €108,000 (€27,000 × 4 master's programs).

This creates a powerful leverage effect on your education: more knowledge, greater specialization, lower cost.

* If you access a master's program with more than 50% of its content recognized, it will be offered exclusively online.

** The price of each master's program will be at least 20% of its original value.

*** This price is an approximate example, as it may vary depending on each master's program.

**** Recognitions can only be applied if the original master's program has been successfully completed.

AthenAI

In 2025, AthenAI established a program to train the world's top Quants. Its purpose was to teach how to combine advanced technologies and investment strategies to lead the financial markets.

The official name of the Master's program was:

"Advanced, Generative Artificial Intelligence and Quantum Computing Applied to Financial Markets."

The students referred to it as…

Top Quant