

# Hybrid Master's Degree Artificial Intelligence



## Hybrid Master's Degree Artificial Intelligence

Modality: Hybrid (Online + Internship)

Duration: 12 months

Certificate: TECH Global University

Accreditation: 60 + 4 ECTS

Website: [www.techtute.com/us/engineering/hybrid-master-degree/hybrid-master-degree-artificial-intelligence](http://www.techtute.com/us/engineering/hybrid-master-degree/hybrid-master-degree-artificial-intelligence)

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# 01

# Introduction

In today's technology landscape, Artificial Intelligence (AI) has proven to be a key catalyst for innovation in various industries. According to recent reports, companies implementing AI have seen a 20% improvement in operational efficiency. For engineers, this translates into the opportunity to develop smarter, more adaptive systems and optimize manufacturing processes through the use of deep learning algorithms. For this reason, TECH has developed this comprehensive program, which is divided into two fundamental sections. The first, completely theoretical and 100% online, is based on the innovative Relearning methodology. The second consists of a 3-week internship in a company specialized in Artificial Intelligence services.



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*Thanks to this Hybrid Master's Degree, you will develop specialized technical skills in machine learning, data mining, neural networks and natural language processing”*

Artificial Intelligence (AI) has experienced significant advances in recent years, transforming various industries thanks to emerging technologies such as large language models and deep neural networks. Engineers are implementing these technologies to optimize processes.

This is how this Hybrid Professional Master's Degree was created, which will address the historical evolution of AI, the principles of neural networks and genetic algorithms, as well as the importance of data structuring through thesauri and taxonomies. In addition, it will focus on the fundamental concepts of statistics, data classification and its life cycle, including planning, collection and storage in data warehouses.

Furthermore, the agenda will focus on data science and data mining, providing engineers with tools and techniques for information extraction, transformation and visualization, as well as data preparation and cleansing. Algorithm design strategies, algorithm efficiency analysis and agent theory will also be introduced, as well as knowledge representation and the semantic web.

Finally, from supervised and unsupervised learning to advanced Deep Learning techniques will be covered. Likewise, professionals will be able to personalize models with TensorFlow and apply Deep Learning in natural language processing. The degree will culminate with the study of Autoencoders, GANs and diffusion models, as well as in bio-inspired computing and AI implementation strategies in various sectors.

In this context, TECH has designed a university program that combines 100% online theory with a practical stay of 3 weeks in the most recognized companies in the sector. In this way, the first half of the program will be adapted to the graduate's work and personal schedule, who will only need an electronic device with an Internet connection. Additionally, it will be based on the revolutionary Relearning methodology, consisting of the repetition of key concepts for an optimal and organic assimilation of the contents.

This **Hybrid Master's Degree in Artificial Intelligence** contains the most complete and up-to-date scientific program on the market. The most important features include:

- ♦ Development of more than 100 case studies presented by experts in Artificial Intelligence
- ♦ Its graphic, schematic and practical contents provide essential information on those disciplines that are indispensable for professional practice
- ♦ Its special emphasis on innovative methodologies
- ♦ All of this will be complemented by theoretical lessons, questions to the expert, debate forums on controversial topics, and individual reflection assignments
- ♦ Content that is accessible from any fixed or portable device with an Internet connection
- ♦ Furthermore, you will be able to carry out an internship in one of the best companies



*You will expand your professional opportunities, positioning yourself at the forefront of technological innovation and being highly competitive in a constantly evolving labor market"*

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*You will spend an intensive 3-week stay in a prestigious institution specialized in Artificial Intelligence, where you will obtain the skills you need to boost your career as an engineer”*

In this Hybrid Master's Degree proposal, of professionalizing character and blended learning modality, the program is aimed at updating Computer Science professionals. The contents are based on the latest scientific evidence, and oriented in a didactic way to integrate theoretical knowledge into practice.

Thanks to its multimedia content elaborated with the latest educational technology, it will allow the IT professional a situated and contextual learning, that is to say, a simulated environment that will provide an immersive learning programmed to specialize in real situations. This program is designed around Problem-Based Learning, whereby the physician must try to solve the different professional practice situations that arise during the course. For this purpose, the students will be assisted by an innovative interactive video system created by renowned and experienced experts.

*You will delve into data science, mining and visualization techniques, and data preparation and cleaning for data mining, thanks to an extensive library of multimedia resources.*

*You will delve into advanced supervised and unsupervised learning techniques, as well as the application of Deep Learning, through the best didactic materials, at the forefront of education.*



# 02

## Why Study this Hybrid Master's Degree?

This Hybrid Master's Degree in Artificial Intelligence combines the flexibility of online learning with the richness of hands-on experience, allowing engineers to acquire advanced knowledge in critical areas such as machine learning, data mining and neural networks, and then apply this knowledge in real projects. In fact, the degree's hands-on training will enhance professionals' ability to solve complex problems and optimize processes in various sectors, expanding their job opportunities and growth potential in a market that demands more AI experts.





A close-up, blue-tinted image of a precision manufacturing process. A metal drill bit is positioned over a grid of small, conical metal parts. A bright light source is directed at the point where the drill bit meets the parts, creating a glowing yellow and orange effect. The background is dark and out of focus, showing more of the same parts.

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*The blended learning structure will encourage the development of practical and collaborative projects, enhancing the application of knowledge in real environments. With all the TECH quality guarantees!"*

### **1. Updating from the latest technology available**

New technologies are having a great impact on the field of Artificial Intelligence, providing engineers with advanced tools to optimize their work in a significant way, such as generative AI, large language models (LLMs) and deep neural networks. These technologies make it possible to optimize industrial processes, improve real-time decision making and develop intelligent systems capable of continuous learning and adaptation.

### **2. Gaining in-depth knowledge from the experience of top specialists**

During the Internship Program, a team of Artificial Intelligence professionals will accompany students to help them get the most out of this academic experience. At the same time, they will transmit the most innovative techniques for analyzing large volumes of data.

### **3. Entering first-class professional environments**

TECH's main premise is to make top-quality university programs available to everyone. For this reason, it carefully selects all the centers available for students to carry out their practical training. Thanks to this, engineers are guaranteed access to leading institutions in the field of Artificial Intelligence. In this way, you will be able to experience the day-to-day work of a demanding, rigorous and exhaustive work area, always applying the latest techniques in its work methodology.





#### **4. Combining the best theory with state-of-the-art practice**

In today's academic market it is common to find university degrees that are limited to providing theoretical content, forgetting that practice is a fundamental aspect for students to apply their knowledge to real work situations. Far from this, TECH offers a 100% practical learning model, which will allow IT professionals to acquire practical experience and face the real challenges they may encounter in their professional career.

#### **5. Expanding the boundaries of knowledge**

TECH offers graduates the opportunity to carry out this Hybrid Professional Master's Degree Program in international organizations. Thanks to this, computer scientists will be able to expand their frontiers and catch up with the best professionals who work in top-level companies. A unique opportunity that only TECH, the largest digital university in the world could offer.



*You will have full practical immersion  
at the center of your choice"*

# 03

## Objectives

The objective of the program will be to specialize engineers in basic areas of Artificial Intelligence, such as machine learning, natural language processing, computer vision and intelligent systems, to solve complex problems and design innovative solutions. In addition, critical skills, such as data analysis, data-informed decision making and implementation of advanced models, will be promoted, focused on practical application and development of real projects, enabling professionals to effectively integrate AI in industrial sectors.



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*The objectives of the Hybrid Master's Degree are to provide engineers with in-depth theoretical and practical knowledge in the latest AI technologies and methodologies"*



### General Objective

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- ♦ This Hybrid Professional Master's Degree aims to provide graduates with comprehensive and advanced training in the main areas of Artificial Intelligence. Therefore, solid technical skills will be developed in fields such as machine learning, neural networks, natural language processing and computer vision, preparing engineers to face complex challenges in various industrial sectors



*You will cultivate practical skills through the application of AI techniques in real projects, fostering the ability to innovate, lead teams and contribute to their advancement and ethical application"*





## Specific Objectives

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### Module 1. Fundamentals of Artificial Intelligence

- ♦ Analyze the historical evolution of Artificial Intelligence, from its beginnings to its current state, identifying key milestones and developments
- ♦ Understand the functioning of neural networks and their application in learning models in Artificial Intelligence
- ♦ Study the principles and applications of genetic algorithms, analyzing their usefulness in solving complex problems
- ♦ Analyze the importance of thesauri, vocabularies and taxonomies in the structuring and processing of data for AI systems

### Module 2. Data Types and Data Life Cycle

- ♦ Understand the fundamental concepts of statistics and their application in data analysis
- ♦ Identify and classify the different types of statistical data, from quantitative to qualitative data
- ♦ Analyze the life cycle of data, from generation to disposal, identifying key stages
- ♦ Explore the initial stages of the data life cycle, highlighting the importance of data planning and structure
- ♦ Study data collection processes, including methodology, tools and collection channels
- ♦ Explore the Datawarehouse concept, with emphasis on the elements that comprise it and its design

### Module 3. Data in Artificial Intelligence

- ♦ Master the fundamentals of data science, covering tools, types and sources for information analysis
- ♦ Explore the process of transforming data into information using data mining and visualization techniques
- ♦ Analyze supervised and unsupervised models, including methods and classification
- ♦ Use specific tools and best practices in data handling and processing, ensuring efficiency and quality in the implementation of Artificial Intelligence

### Module 4. Data Mining: Selection, Pre-Processing and Transformation

- ♦ Master the techniques of statistical inference to understand and apply statistical methods in data mining
- ♦ Perform detailed exploratory analysis of data sets to identify relevant patterns, anomalies, and trends
- ♦ Develop skills for data preparation, including data cleaning, integration, and formatting for use in data mining
- ♦ Implement effective strategies for handling missing values in datasets, applying imputation or elimination methods according to context
- ♦ Identify and mitigate noise present in data, using filtering and smoothing techniques to improve the quality of the data set
- ♦ Address data preprocessing in Big Data environments

### Module 5. Algorithm and Complexity in Artificial Intelligence

- ♦ Introduce algorithm design strategies, providing a solid understanding of fundamental approaches to problem solving
- ♦ Analyze the efficiency and complexity of algorithms, applying analysis techniques to evaluate performance in terms of time and space
- ♦ Study and apply sorting algorithms, understanding their performance and comparing their efficiency in different contexts
- ♦ Explore tree-based algorithms, understanding their structure and applications
- ♦ Investigate algorithms with Heaps, analyzing their implementation and usefulness in efficient data manipulation
- ♦ Analyze graph-based algorithms, exploring their application in the representation and solution of problems involving complex relationships
- ♦ Study Greedy algorithms, understanding their logic and applications in solving optimization problems
- ♦ Investigate and apply the backtracking technique for systematic problem solving, analyzing its effectiveness in various scenarios

### Module 6. Intelligent Systems

- ♦ Explore agent theory, understanding the fundamental concepts of its operation and its application in Artificial Intelligence and software engineering
- ♦ Study the representation of knowledge, including the analysis of ontologies and their application in the organization of structured information
- ♦ Analyze the concept of the semantic web and its impact on the organization and retrieval of information in digital environments
- ♦ Evaluate and compare different knowledge representations, integrating these to improve the efficiency and accuracy of intelligent systems



## Module 7. Machine Learning and Data Mining

- ♦ Introduce the processes of knowledge discovery and the fundamental concepts of machine learning
- ♦ Study decision trees as supervised learning models, understanding their structure and applications
- ♦ Evaluate classifiers using specific techniques to measure their performance and accuracy in data classification
- ♦ Study neural networks, understanding their operation and architecture to solve complex machine learning problems
- ♦ Explore Bayesian methods and their application in machine learning, including Bayesian networks and Bayesian classifiers
- ♦ Analyze regression and continuous response models for predicting numerical values from data
- ♦ Study clustering techniques to identify patterns and structures in unlabeled data sets
- ♦ Explore text mining and natural language processing (NLP), understanding how machine learning techniques are applied to analyze and understand text

## Module 8. Neural Networks, the Basis of Deep Learning

- ♦ Master the fundamentals of Deep Learning, understanding its essential role in Deep Learning
- ♦ Explore the fundamental operations in neural networks and understand their application in model building
- ♦ Analyze the different layers used in neural networks and learn how to select them appropriately
- ♦ Understand the effective linking of layers and operations to design complex and efficient neural network architectures
- ♦ Use trainers and optimizers to tune and improve the performance of neural networks
- ♦ Explore the connection between biological and artificial neurons for a deeper understanding of model design

## Module 9. Deep Neural Networks Training

- ♦ Solve gradient-related problems in deep neural network training
- ♦ Explore and apply different optimizers to improve the efficiency and convergence of models
- ♦ Program the learning rate to dynamically adjust the convergence speed of the model
- ♦ Understand and address overfitting through specific strategies during training
- ♦ Apply practical guidelines to ensure efficient and effective training of deep neural networks
- ♦ Implement Transfer Learning as an advanced technique to improve model performance on specific tasks
- ♦ Explore and apply Data Augmentation techniques to enrich datasets and improve model generalization
- ♦ Develop practical applications using Transfer Learning to solve real-world problems

### Module 10. Model Customization and Training with TensorFlow

- ♦ Master the fundamentals of TensorFlow and its integration with NumPy for efficient data management and calculations
- ♦ Customize models and training algorithms using the advanced capabilities of TensorFlow
- ♦ Explore the tfdata API to efficiently manage and manipulate datasets
- ♦ Implement the TFRecord format for storing and accessing large datasets in TensorFlow
- ♦ Use Keras preprocessing layers to facilitate the construction of custom models
- ♦ Explore the TensorFlow Datasets project to access predefined datasets and improve development efficiency
- ♦ Develop a Deep Learning application with TensorFlow, integrating the knowledge acquired in the module
- ♦ Apply in a practical way all the concepts learned in building and training custom models with TensorFlow in real-world situations

### Module 11. Deep Computer Vision with Convolutional Neural Networks

- ♦ Understand the architecture of the visual cortex and its relevance in Deep Computer Vision
- ♦ Explore and apply convolutional layers to extract key features from images
- ♦ Implement clustering layers and their use in Deep Computer Vision models with Keras
- ♦ Analyze various Convolutional Neural Network (CNN) architectures and their applicability in different contexts
- ♦ Develop and implement a CNN ResNet using the Keras library to improve model efficiency and performance
- ♦ Use pre-trained Keras models to leverage transfer learning for specific tasks
- ♦ Apply classification and localization techniques in Deep Computer Vision environments
- ♦ Explore object detection and object tracking strategies using Convolutional Neural Networks

### Module 12. Natural Language Processing (NLP) with Recurrent Neural Networks (RNN) and Attention

- ♦ Developing skills in text generation using Recurrent Neural Networks (RNN)
- ♦ Apply RNNs in opinion classification for sentiment analysis in texts
- ♦ Understand and apply attentional mechanisms in natural language processing models
- ♦ Analyze and use Transformers models in specific NLP tasks
- ♦ Explore the application of Transformers models in the context of image processing and computer vision
- ♦ Become familiar with the Hugging Face Transformers library for efficient implementation of advanced models
- ♦ Compare different Transformers libraries to evaluate their suitability for specific task
- ♦ Develop a practical application of NLP that integrates RNN and attention mechanisms to solve real-world problems

### Module 13. Autoencoders, GANs and Diffusion Models

- ♦ Develop efficient representations of data using Autoencoders, GANs and Diffusion Models.
- ♦ Perform PCA using an incomplete linear autoencoder to optimize data representation
- ♦ Implement and understand the operation of stacked autoencoders
- ♦ Explore and apply convolutional autoencoders for efficient visual data representations
- ♦ Analyze and apply the effectiveness of sparse automatic encoders in data representation
- ♦ Generate fashion images from the MNIST dataset using Autoencoders
- ♦ Understand the concept of Generative Adversarial Networks (GANs) and Diffusion Models
- ♦ Implement and compare the performance of Diffusion Models and GANs in data generation

**Module 14. Bio-Inspired Computing**

- ♦ Explore social adaptation algorithms as a key approach in bio-inspired computing
- ♦ Analyze space exploration-exploitation strategies in genetic algorithms
- ♦ Examine models of evolutionary computation in the context of optimization
- ♦ Continue detailed analysis of evolutionary computation models
- ♦ Apply evolutionary programming to specific learning problems
- ♦ Address the complexity of multi-objective problems in the framework of bio-inspired computing
- ♦ Explore the application of neural networks in the field of bio-inspired computing
- ♦ Delve into the implementation and usefulness of neural networks in bio-inspired computing

**Module 15. Artificial Intelligence: Strategies and Applications**

- ♦ Develop strategies for the implementation of artificial intelligence in financial services.
- ♦ Analyze the implications of artificial intelligence in the delivery of healthcare services
- ♦ Identify and assess the risks associated with the use of AI in the healthcare field
- ♦ Assess the potential risks associated with the use of AI in industry
- ♦ Apply artificial intelligence techniques in industry to improve productivity
- ♦ Design artificial intelligence solutions to optimize processes in public administration
- ♦ Evaluate the implementation of AI technologies in the education sector
- ♦ Apply artificial intelligence techniques in forestry and agriculture to improve productivity



*Enroll now and advance in your field of work with a comprehensive program that will allow you to put into practice everything you have learned"*

# 04 Skills

The academic degree will develop key competencies for engineers, equipping them with advanced technical skills and specialized knowledge in areas such as machine learning, data mining and neural network design. As such, professionals will be able to apply innovative methods to solve complex problems, using cutting-edge tools and techniques, such as TensorFlow, and Deep Learning models. In addition, skills in data management, predictive analysis and optimization of algorithms will be strengthened, preparing professionals to lead AI projects and address emerging challenges.





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*You will acquire a deep understanding of several key concepts, such as machine learning, data mining and neural networks, with the support of the Relearning learning methodology”*



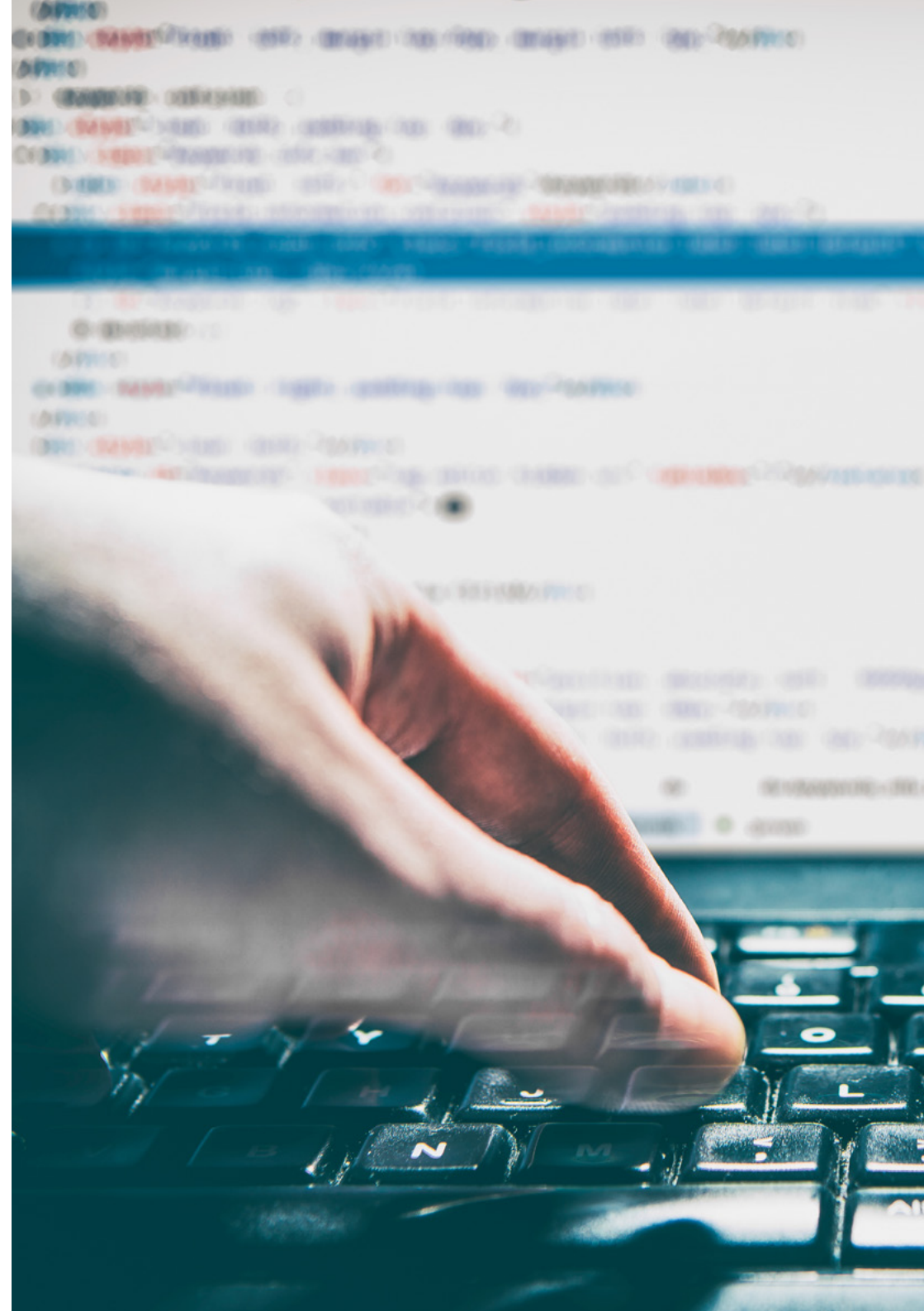
## General Skills

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- Master data mining techniques, including complex data selection, preprocessing and transformation
- Design and develop intelligent systems capable of learning and adapting to changing environments
- Control machine learning tools and their application in data mining for decision making
- Employ Autoencoders, GANs and Diffusion Models to solve specific challenges in Artificial Intelligence
- Implement an encoder-decoder network for neural machine translation
- Apply the fundamental principles of neural networks in solving specific problems



*You will strengthen your analytical and problem-solving skills, as well as your ability to design, implement and optimize intelligent systems and AI models. What are you waiting for to enroll?"*





## Specific Skills

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- ◆ Apply AI techniques and strategies to improve efficiency in the retail sector
- ◆ Delve into understanding and application of genetic algorithms
- ◆ Implement noise removal techniques using automatic encoders
- ◆ Effectively create training data sets for natural language processing (NLP) tasks
- ◆ Run grouping layers and their use in Deep Computer Vision models with Keras
- ◆ Use TensorFlow features and graphics to optimize the performance of custom models
- ◆ Optimize the development and application of chatbots and virtual assistants, understanding their operation and potential applications
- ◆ Master reuse of pre-workout layers to optimize and accelerate the training process
- ◆ Build the first neural network, applying the concepts learned in practice
- ◆ Activate Multilayer Perceptron (MLP) using the Keras library
- ◆ Apply data scanning and preprocessing techniques, identifying and preparing data for effective use in machine learning models
- ◆ Implement effective strategies for handling missing values in datasets, applying imputation or elimination methods according to context
- ◆ Investigate languages and software for the creation of ontologies, using specific tools for the development of semantic models
- ◆ Develop data cleaning techniques to ensure the quality and accuracy of the information used in subsequent analyses

05

# Course Management

The teachers are highly qualified professionals and experts in their respective fields of study. In fact, they come from diverse academic and research backgrounds, with practical and theoretical experience in Artificial Intelligence and Data Science. Moreover, these mentors are committed to innovative teaching and practical application of AI in real-world environments. As such, their expertise will not only provide graduates with a deep understanding of the latest trends and developments in AI, but will also guide them in developing critical skills to address contemporary technological challenges.







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*The professors that make up the faculty of this Hybrid Master's Degree have been selected by TECH based on their deep knowledge and practical experience in various areas of Artificial Intelligence”*

## Management



### Dr. Peralta Martín-Palomino, Arturo

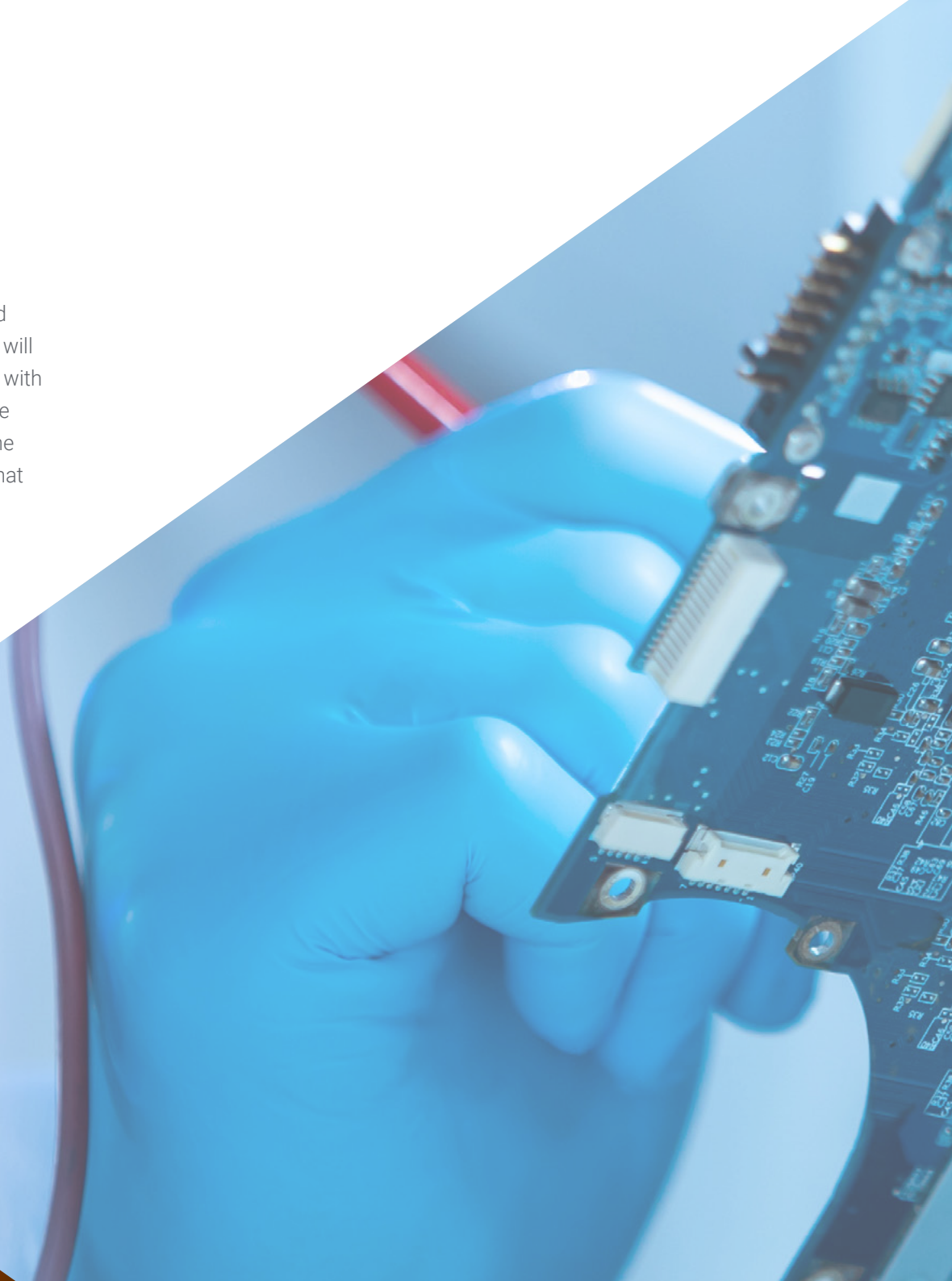
- ♦ CEO and CTO at Prometheus Global Solutions
- ♦ CTO at Korporate Technologies
- ♦ CTO at AI Shephers GmbH
- ♦ Consultant and Strategic Business Advisor at Alliance Medical
- ♦ Director of Design and Development at DocPath
- ♦ PhD. in Psychology from the University of Castilla La Mancha
- ♦ PhD in Economics, Business and Finance from the Camilo José Cela University
- ♦ PhD in Psychology from University of Castilla La Mancha
- ♦ Máster in Executive MBA por la Universidad Isabel I
- ♦ Master's Degree in Sales and Marketing Management, Isabel I University
- ♦ Expert Master's Degree in Big Data by Hadoop Training
- ♦ Master's Degree in Advanced Information Technologies from the University of Castilla La Mancha
- ♦ Member of: SMILE Research Group



# 06

## Educational Plan

The teaching materials that make up this Hybrid Master's Degree have been designed by a group of experts highly specialized in Artificial Intelligence. Therefore, graduates will have access to a syllabus that stands out for its excellent quality and for being in line with the requirements of the current labor market. Composed of 15 complete modules, the academic itinerary will emphasize the processes of knowledge discovery and Machine Learning. In this way, you will delve into the development of algorithms and models that allow machines to learn patterns and perform tasks.



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*Bet on TECH! This university program includes specialized modules in emerging areas, such as autoencoders, diffusion models and bio-inspired computing"*

## Module 1. Fundamentals of Artificial Intelligence

- 1.1. History of Artificial Intelligence
  - 1.1.1. When Do We Start Talking About Artificial Intelligence?
  - 1.1.2. References in Film
  - 1.1.3. Importance of Artificial Intelligence
  - 1.1.4. Technologies that Enable and Support Artificial Intelligence
- 1.2. Artificial Intelligence in Games
  - 1.2.1. Game Theory
  - 1.2.2. Minimax and Alpha-Beta Pruning
  - 1.2.3. Simulation: Monte Carlo
- 1.3. Neural Networks
  - 1.3.1. Biological Fundamentals
  - 1.3.2. Computational Model
  - 1.3.3. Supervised and Unsupervised Neural Networks
  - 1.3.4. Simple Perceptron
  - 1.3.5. Multilayer Perceptron
- 1.4. Genetic Algorithms
  - 1.4.1. History
  - 1.4.2. Biological Basis
  - 1.4.3. Problem Coding
  - 1.4.4. Generation of the Initial Population
  - 1.4.5. Main Algorithm and Genetic Operators
  - 1.4.6. Evaluation of Individuals: Fitness
- 1.5. Thesauri, Vocabularies, Taxonomies
  - 1.5.1. Vocabulary
  - 1.5.2. Taxonomy
  - 1.5.3. Thesauri
  - 1.5.4. Ontologies
  - 1.5.5. Knowledge Representation: Semantic Web
- 1.6. Semantic Web
  - 1.6.1. Specifications RDF, RDFS and OWL
  - 1.6.2. Inference/ Reasoning
  - 1.6.3. Linked Data

- 1.7. Expert systems and DSS
  - 1.7.1. Expert Systems
  - 1.7.2. Decision Support Systems
- 1.8. Chatbots and Virtual Assistants
  - 1.8.1. Types of Assistants: Voice and Text Assistants
  - 1.8.2. Fundamental Parts for the Development of an Assistant: Intents, Entities and Dialog Flow
  - 1.8.3. Integrations: Web, Slack, Whatsapp, Facebook
  - 1.8.4. Assistant Development Tools: Dialog Flow, Watson Assistant
- 1.9. AI Implementation Strategy
- 1.10. Future of Artificial Intelligence
  - 1.10.1. Understand How to Detect Emotions Using Algorithms
  - 1.10.2. Creating a Personality: Language, Expressions and Content
  - 1.10.3. Trends of Artificial Intelligence
  - 1.10.4. Reflections

## Module 2. Data Types and Data Life Cycle

- 2.1. Statistics
  - 2.1.1. Statistics: Descriptive Statistics, Statistical Inferences
  - 2.1.2. Population, Sample, Individual
  - 2.1.3. Variables: Definition, Measurement Scales
- 2.2. Types of Data Statistics
  - 2.2.1. According to Type
    - 2.2.1.1. Quantitative: Continuous Data and Discrete Data
    - 2.2.1.2. Qualitative: Binomial Data, Nominal Data and Ordinal Data
  - 2.2.2. According to their Shape
    - 2.2.2.1. Numeric
    - 2.2.2.2. Text:
    - 2.2.2.3. Logical
  - 2.2.3. According to its Source
    - 2.2.3.1. Primary
    - 2.2.3.2. Secondary

- 2.3. Life Cycle of Data
  - 2.3.1. Stages of the Cycle
  - 2.3.2. Milestones of the Cycle
  - 2.3.3. FAIR Principles
- 2.4. Initial Stages of the Cycle
  - 2.4.1. Definition of Goals
  - 2.4.2. Determination of Resource Requirements
  - 2.4.3. Gantt Chart
  - 2.4.4. Data Structure
- 2.5. Data Collection
  - 2.5.1. Methodology of Data Collection
  - 2.5.2. Data Collection Tools
  - 2.5.3. Data Collection Channels
- 2.6. Data Cleaning
  - 2.6.1. Phases of Data Cleansing
  - 2.6.2. Data Quality
  - 2.6.3. Data Manipulation (with R)
- 2.7. Data Analysis, Interpretation and Evaluation of Results
  - 2.7.1. Statistical Measures
  - 2.7.2. Relationship Indexes
  - 2.7.3. Data Mining
- 2.8. Data Warehouse
  - 2.8.1. Elements that Comprise it
  - 2.8.2. Design
  - 2.8.3. Aspects to Consider
- 2.9. Data Availability
  - 2.9.1. Access
  - 2.9.2. Uses
  - 2.9.3. Security/Safety

### Module 3. Data in Artificial Intelligence

- 3.1. Data Science
  - 3.1.1. Data Science
  - 3.1.2. Advanced Tools for Data Scientists
- 3.2. Data, Information and Knowledge
  - 3.2.1. Data, Information and Knowledge
  - 3.2.2. Types of Data
  - 3.2.3. Data Sources
- 3.3. From Data to Information
  - 3.3.1. Data Analysis
  - 3.3.2. Types of Analysis
  - 3.3.3. Extraction of Information from a Dataset
- 3.4. Extraction of Information Through Visualization
  - 3.4.1. Visualization as an Analysis Tool
  - 3.4.2. Visualization Methods
  - 3.4.3. Visualization of a Data Set
- 3.5. Data Quality
  - 3.5.1. Quality Data
  - 3.5.2. Data Cleaning
  - 3.5.3. Basic Data Pre-Processing
- 3.6. Dataset
  - 3.6.1. Dataset Enrichment
  - 3.6.2. The Curse of Dimensionality
  - 3.6.3. Modification of Our Data Set
- 3.7. Unbalance
  - 3.7.1. Classes of Unbalance
  - 3.7.2. Unbalance Mitigation Techniques
  - 3.7.3. Balancing a Dataset
- 3.8. Unsupervised Models
  - 3.8.1. Unsupervised Model
  - 3.8.2. Methods
  - 3.8.3. Classification with Unsupervised Models

- 3.9. Supervised Models
  - 3.9.1. Supervised Model
  - 3.9.2. Methods
  - 3.9.3. Classification with Supervised Models
- 3.10. Tools and Good Practices
  - 3.10.1. Good Practices for Data Scientists
  - 3.10.2. The Best Model
  - 3.10.3. Useful Tools

#### Module 4. Data Mining: Selection, Pre-Processing and Transformation

- 4.1. Statistical Inference
  - 4.1.1. Descriptive Statistics vs. Statistical Inference
  - 4.1.2. Parametric Procedures
  - 4.1.3. Non-Parametric Procedures
- 4.2. Exploratory Analysis
  - 4.2.1. Descriptive Analysis
  - 4.2.2. Visualization
  - 4.2.3. Data Preparation
- 4.3. Data Preparation
  - 4.3.1. Integration and Data Cleaning
  - 4.3.2. Normalization of Data
  - 4.3.3. Transforming Attributes
- 4.4. Missing Values
  - 4.4.1. Treatment of Missing Values
  - 4.4.2. Maximum Likelihood Imputation Methods
  - 4.4.3. Missing Value Imputation Using Machine Learning
- 4.5. Noise in the Data
  - 4.5.1. Noise Classes and Attributes
  - 4.5.2. Noise Filtering
  - 4.5.3. The Effect of Noise
- 4.6. The Curse of Dimensionality
  - 4.6.1. Oversampling
  - 4.6.2. Undersampling
  - 4.6.3. Multidimensional Data Reduction

- 4.7. From Continuous to Discrete Attributes
  - 4.7.1. Continuous Data Vs. Discret Data
  - 4.7.2. Discretization Process
- 4.8. The Data
  - 4.8.1. Data Selection
  - 4.8.2. Prospects and Selection Criteria
  - 4.8.3. Selection Methods
- 4.9. Instance Selection
  - 4.9.1. Methods for Instance Selection
  - 4.9.2. Prototype Selection
  - 4.9.3. Advanced Methods for Instance Selection
- 4.10. Data Pre-Processing in Big Data Environments

#### Module 5. Algorithm and Complexity in Artificial Intelligence

- 5.1. Introduction to Algorithm Design Strategies
  - 5.1.1. Recursion
  - 5.1.2. Divide and Conquer
  - 5.1.3. Other Strategies
- 5.2. Efficiency and Analysis of Algorithms
  - 5.2.1. Efficiency Measures
  - 5.2.2. Measuring the Size of the Input
  - 5.2.3. Measuring Execution Time
  - 5.2.4. Worst, Best and Average Case
  - 5.2.5. Asymptotic Notation
  - 5.2.6. Mathematical Analysis Criteria for Non-Recursive Algorithms
  - 5.2.7. Mathematical Analysis of Recursive Algorithms
  - 5.2.8. Empirical Analysis of Algorithms
- 5.3. Sorting Algorithms
  - 5.3.1. Concept of Sorting
  - 5.3.2. Bubble Sorting
  - 5.3.3. Sorting by Selection
  - 5.3.4. Sorting by Insertion
  - 5.3.5. Merge Sort
  - 5.3.6. Quick Sort



- 5.4. Algorithms with Trees
  - 5.4.1. Tree Concept
  - 5.4.2. Binary Trees
  - 5.4.3. Tree Paths
  - 5.4.4. Representing Expressions
  - 5.4.5. Ordered Binary Trees
  - 5.4.6. Balanced Binary Trees
- 5.5. Algorithms Using Heaps
  - 5.5.1. Heaps
  - 5.5.2. The Heapsort Algorithm
  - 5.5.3. Priority Queues
- 5.6. Graph Algorithms
  - 5.6.1. Representation
  - 5.6.2. Traversal in Width
  - 5.6.3. Depth Travel
  - 5.6.4. Topological Sorting
- 5.7. Greedy Algorithms
  - 5.7.1. Greedy Strategy
  - 5.7.2. Elements of the Greedy Strategy
  - 5.7.3. Currency Exchange
  - 5.7.4. Traveler's Problem
  - 5.7.5. Backpack Problem
- 5.8. Minimal Path Finding
  - 5.8.1. The Minimum Path Problem
  - 5.8.2. Negative Arcs and Cycles
  - 5.8.3. Dijkstra's Algorithm
- 5.9. Greedy Algorithms on Graphs
  - 5.9.1. The Minimum Covering Tree
  - 5.9.2. Prim's Algorithm
  - 5.9.3. Kruskal's Algorithm
  - 5.9.4. Complexity Analysis
- 5.10. Backtracking
  - 5.10.1. Backtracking
  - 5.10.2. Alternative Techniques

## Module 6. Intelligent Systems

- 6.1. Agent Theory
  - 6.1.1. Concept History
  - 6.1.2. Agent Definition
  - 6.1.3. Agents in Artificial Intelligence
  - 6.1.4. Agents in Software Engineering
- 6.2. Agent Architectures
  - 6.2.1. The Reasoning Process of an Agent
  - 6.2.2. Reactive Agents
  - 6.2.3. Deductive Agents
  - 6.2.4. Hybrid Agents
  - 6.2.5. Comparison
- 6.3. Information and Knowledge
  - 6.3.1. Difference between Data, Information and Knowledge
  - 6.3.2. Data Quality Assessment
  - 6.3.3. Data Collection Methods
  - 6.3.4. Information Acquisition Methods
  - 6.3.5. Knowledge Acquisition Methods
- 6.4. Knowledge Representation
  - 6.4.1. The Importance of Knowledge Representation
  - 6.4.2. Definition of Knowledge Representation According to Roles
  - 6.4.3. Knowledge Representation Features
- 6.5. Ontologies
  - 6.5.1. Introduction to Metadata
  - 6.5.2. Philosophical Concept of Ontology
  - 6.5.3. Computing Concept of Ontology
  - 6.5.4. Domain Ontologies and Higher-Level Ontologies
  - 6.5.5. How to Build an Ontology?

- 6.6. Ontology Languages and Ontology Creation Software
  - 6.6.1. Triple RDF, Turtle and N
  - 6.6.2. RDF Schema
  - 6.6.3. OWL
  - 6.6.4. SPARQL
  - 6.6.5. Introduction to Ontology Creation Tools
  - 6.6.6. Installing and Using Protégé
- 6.7. Semantic Web
  - 6.7.1. Current and Future Status of the Semantic Web
  - 6.7.2. Semantic Web Applications
- 6.8. Other Knowledge Representation Models
  - 6.8.1. Vocabulary
  - 6.8.2. Global Vision
  - 6.8.3. Taxonomy
  - 6.8.4. Thesauri
  - 6.8.5. Folksonomy
  - 6.8.6. Comparison
  - 6.8.7. Mind Maps
- 6.9. Knowledge Representation Assessment and Integration
  - 6.9.1. Zero-Order Logic
  - 6.9.2. First-Order Logic
  - 6.9.3. Descriptive Logic
  - 6.9.4. Relationship between Different Types of Logic
  - 6.9.5. Prolog: Programming Based on First-Order Logic
- 6.10. Semantic Reasoners, Knowledge-Based Systems and Expert Systems
  - 6.10.1. Concept of Reasoner
  - 6.10.2. Reasoner Applications
  - 6.10.3. Knowledge-Based Systems
  - 6.10.4. MYCIN: History of Expert Systems
  - 6.10.5. Expert Systems Elements and Architecture
  - 6.10.6. Creating Expert Systems



**Module 7. Machine Learning and Data Mining**

- 7.1. Introduction to Knowledge Discovery Processes and Basic Concepts of Machine Learning
  - 7.1.1. Key Concepts of Knowledge Discovery Processes
  - 7.1.2. Historical Perspective of Knowledge Discovery Processes
  - 7.1.3. Stages of the Knowledge Discovery Processes
  - 7.1.4. Techniques Used in Knowledge Discovery Processes
  - 7.1.5. Characteristics of Good Machine Learning Models
  - 7.1.6. Types of Machine Learning Information
  - 7.1.7. Basic Learning Concepts
  - 7.1.8. Basic Concepts of Unsupervised Learning
- 7.2. Data Exploration and Pre-processing
  - 7.2.1. Data Processing
  - 7.2.2. Data Processing in the Data Analysis Flow
  - 7.2.3. Types of Data
  - 7.2.4. Data Transformations
  - 7.2.5. Visualization and Exploration of Continuous Variables
  - 7.2.6. Visualization and Exploration of Categorical Variables
  - 7.2.7. Correlation Measures
  - 7.2.8. Most Common Graphic Representations
  - 7.2.9. Introduction to Multivariate Analysis and Dimensionality Reduction
- 7.3. Decision Trees
  - 7.3.1. ID Algorithm
  - 7.3.2. Algorithm C
  - 7.3.3. Overtraining and Pruning
  - 7.3.4. Analysis of Results
- 7.4. Evaluation of Classifiers
  - 7.4.1. Confusion Matrixes
  - 7.4.2. Numerical Evaluation Matrixes
  - 7.4.3. Kappa Statistic
  - 7.4.4. ROC Curves

- 7.5. Classification Rules
  - 7.5.1. Rule Evaluation Measures
  - 7.5.2. Introduction to Graphic Representation
  - 7.5.3. Sequential Overlay Algorithm
- 7.6. Neural Networks
  - 7.6.1. Basic Concepts
  - 7.6.2. Simple Neural Networks
  - 7.6.3. Backpropagation Algorithm
  - 7.6.4. Introduction to Recurrent Neural Networks
- 7.7. Bayesian Methods
  - 7.7.1. Basic Probability Concepts
  - 7.7.2. Bayes' Theorem
  - 7.7.3. Naive Bayes
  - 7.7.4. Introduction to Bayesian Networks
- 7.8. Regression and Continuous Response Models
  - 7.8.1. Simple Linear Regression
  - 7.8.2. Multiple Linear Regression
  - 7.8.3. Logistic Regression
  - 7.8.4. Regression Trees
  - 7.8.5. Introduction to Support Vector Machines (SVM)
  - 7.8.6. Goodness-of-Fit Measures
- 7.9. Clustering
  - 7.9.1. Basic Concepts
  - 7.9.2. Hierarchical Clustering
  - 7.9.3. Probabilistic Methods
  - 7.9.4. EM Algorithm
  - 7.9.5. B-Cubed Method
  - 7.9.6. Implicit Methods
- 7.10. Text Mining and Natural Language Processing (NLP)
  - 7.10.1. Basic Concepts
  - 7.10.2. Corpus Creation
  - 7.10.3. Descriptive Analysis
  - 7.10.4. Introduction to Feelings Analysis

## Module 8. Neural Networks, the Basis of Deep Learning

- 8.1. Deep Learning
  - 8.1.1. Types of Deep Learning
  - 8.1.2. Applications of Deep Learning
  - 8.1.3. Advantages and Disadvantages of Deep Learning
- 8.2. Surgery
  - 8.2.1. Sum
  - 8.2.2. Product
  - 8.2.3. Transfer
- 8.3. Layers
  - 8.3.1. Input Layer
  - 8.3.2. Cloak
  - 8.3.3. Output Layer
- 8.4. Union of Layers and Operations
  - 8.4.1. Architecture Design
  - 8.4.2. Connection between layers
  - 8.4.3. Forward propagation
- 8.5. Construction of the first neural network
  - 8.5.1. Network Design
  - 8.5.2. Establish the Weights
  - 8.5.3. Network Training
- 8.6. Trainer and Optimizer
  - 8.6.1. Optimizer Selection
  - 8.6.2. Establishment of a Loss Function
  - 8.6.3. Establishing a Metric
- 8.7. Application of the Principles of Neural Networks
  - 8.7.1. Activation Functions
  - 8.7.2. Backward Propagation
  - 8.7.3. Parameter Adjustment
- 8.8. From Biological to Artificial Neurons
  - 8.8.1. Functioning of a Biological Neuron
  - 8.8.2. Transfer of Knowledge to Artificial Neurons
  - 8.8.3. Establish Relations Between the Two

- 8.9. Implementation of MLP (Multilayer Perceptron) with Keras
  - 8.9.1. Definition of the Network Structure
  - 8.9.2. Model Compilation
  - 8.9.3. Model Training
- 8.10. Fine Tuning Hyperparameters of Neural Networks
  - 8.10.1. Selection of the Activation Function
  - 8.10.2. Set the Learning Rate
  - 8.10.3. Adjustment of Weights

## Module 9. Deep Neural Networks Training

- 9.1. Gradient Problems
  - 9.1.1. Gradient Optimization Techniques
  - 9.1.2. Stochastic Gradients
  - 9.1.3. Weight Initialization Techniques
- 9.2. Reuse of Pre-Trained Layers
  - 9.2.1. Learning Transfer Training
  - 9.2.2. Feature Extraction
  - 9.2.3. Deep Learning
- 9.3. Optimizers
  - 9.3.1. Stochastic Gradient Descent Optimizers
  - 9.3.2. Optimizers Adam and RMSprop
  - 9.3.3. Moment Optimizers
- 9.4. Learning Rate Programming
  - 9.4.1. Automatic Learning Rate Control
  - 9.4.2. Learning Cycles
  - 9.4.3. Smoothing Terms
- 9.5. Overfitting
  - 9.5.1. Cross Validation
  - 9.5.2. Regularization
  - 9.5.3. Evaluation Metrics
- 9.6. Practical Guidelines
  - 9.6.1. Model Design
  - 9.6.2. Selection of Metrics and Evaluation Parameters
  - 9.6.3. Hypothesis Testing

- 9.7. Transfer Learning
  - 9.7.1. Learning Transfer Training
  - 9.7.2. Feature Extraction
  - 9.7.3. Deep Learning
- 9.8. Data Augmentation
  - 9.8.1. Image Transformations
  - 9.8.2. Synthetic Data Generation
  - 9.8.3. Text Transformation
- 9.9. Practical Application of Transfer Learning
  - 9.9.1. Learning Transfer Training
  - 9.9.2. Feature Extraction
  - 9.9.3. Deep Learning
- 9.10. Regularization
  - 9.10.1. L and L
  - 9.10.2. Regularization by Maximum Entropy
  - 9.10.3. Dropout

## Module 10. Model Customization and Training with TensorFlow

- 10.1. TensorFlow
  - 10.1.1. Use of the TensorFlow Library
  - 10.1.2. Model Training with TensorFlow
  - 10.1.3. Operations with Graphs in TensorFlow
- 10.2. TensorFlow and NumPy
  - 10.2.1. NumPy Computing Environment for TensorFlow
  - 10.2.2. Using NumPy Arrays with TensorFlow
  - 10.2.3. NumPy Operations for TensorFlow Graphs
- 10.3. Model Customization and Training Algorithms
  - 10.3.1. Building Custom Models with TensorFlow
  - 10.3.2. Management of Training Parameters
  - 10.3.3. Use of Optimization Techniques for Training

- 10.4. TensorFlow Features and Graphs
  - 10.4.1. Functions with TensorFlow
  - 10.4.2. Use of Graphs for Model Training
  - 10.4.3. Graphic Optimization with TensorFlow Operations
- 10.5. Loading and Preprocessing Data with TensorFlow
  - 10.5.1. Loading Data Sets with TensorFlow
  - 10.5.2. Preprocessing Data with TensorFlow
  - 10.5.3. Using TensorFlow Tools for Data Manipulation
- 10.6. The tf.data API
  - 10.6.1. Using the tf.data API for Data Processing
  - 10.6.2. Construction of Data Streams with tf.data
  - 10.6.3. Using the tf.data API for Model Training
- 10.7. The TFRecord Format
  - 10.7.1. Using the TFRecord API for Data Serialization
  - 10.7.2. TFRecord File Upload with TensorFlow
  - 10.7.3. Using TFRecord Files for Model Training
- 10.8. Keras Preprocessing Layers
  - 10.8.1. Using the Keras Preprocessing API
  - 10.8.2. Preprocessing Pipelined Construction with Keras
  - 10.8.3. Using the Keras Preprocessing API for Model Training
- 10.9. The TensorFlow Datasets Project
  - 10.9.1. Using TensorFlow Datasets for Data Loading
  - 10.9.2. Preprocessing Data with TensorFlow Datasets
  - 10.9.3. Using TensorFlow Datasets for Model Training
- 10.10. Building a Deep Learning App with TensorFlow
  - 10.10.1. Practical Application
  - 10.10.2. Building a Deep Learning App with TensorFlow
  - 10.10.3. Model Training with TensorFlow
  - 10.10.4. Use of the Application for the Prediction of Results

## Module 11. Deep Computer Vision with Convolutional Neural Networks

- 11.1. The Visual Cortex Architecture
  - 11.1.1. Functions of the Visual Cortex
  - 11.1.2. Theories of Computational Vision
  - 11.1.3. Models of Image Processing
- 11.2. Convolutional Layers
  - 11.2.1. Reuse of Weights in Convolution
  - 11.2.2. Convolution D
  - 11.2.3. Activation Functions
- 11.3. Grouping Layers and Implementation of Grouping Layers with Keras
  - 11.3.1. Pooling and Striding
  - 11.3.2. Flattening
  - 11.3.3. Types of Pooling
- 11.4. CNN Architecture
  - 11.4.1. VGG Architecture
  - 11.4.2. AlexNet Architecture
  - 11.4.3. Architecture ResNet
- 11.5. Implementing a CNN ResNet- using Keras
  - 11.5.1. Weight Initialization
  - 11.5.2. Input Layer Definition
  - 11.5.3. Output Definition
- 11.6. Use of Pre-trained Keras Models
  - 11.6.1. Characteristics of Pre-trained Models
  - 11.6.2. Uses of Pre-trained Models
  - 11.6.3. Advantages of Pre-trained Models
- 11.7. Pre-trained Models for Transfer Learning
  - 11.7.1. Transfer Learning
  - 11.7.2. Transfer Learning Process
  - 11.7.3. Advantages of Transfer Learning
- 11.8. Deep Computer Vision Classification and Localization
  - 11.8.1. Image Classification
  - 11.8.2. Localization of Objects in Images
  - 11.8.3. Object Detection

- 11.9. Object Detection and Object Tracking
  - 11.9.1. Object Detection Methods
  - 11.9.2. Object Tracking Algorithms
  - 11.9.3. Tracking and Localization Techniques
- 11.10. Semantic Segmentation
  - 11.10.1. Deep Learning for Semantic Segmentation
  - 11.10.2. Edge Detection
  - 11.10.3. Rule-based Segmentation Methods

## Module 12. Natural Language Processing (NLP) with Recurrent Neural Networks (RNN) and Attention

- 12.1. Text Generation using RNN
  - 12.1.1. Training an RNN for Text Generation
  - 12.1.2. Natural Language Generation with RNN
  - 12.1.3. Text Generation Applications with RNN
- 12.2. Training Data Set Creation
  - 12.2.1. Preparation of the Data for Training an RNN
  - 12.2.2. Storage of the Training Dataset
  - 12.2.3. Data Cleaning and Transformation
  - 12.2.4. Sentiment Analysis
- 12.3. Classification of Opinions with RNN
  - 12.3.1. Detection of Themes in Comments
  - 12.3.2. Sentiment Analysis with Deep Learning Algorithms
- 12.4. Encoder-Decoder Network for Neural Machine Translation
  - 12.4.1. Training an RNN for Machine Translation
  - 12.4.2. Use of an Encoder-Decoder Network for Machine Translation
  - 12.4.3. Improving the Accuracy of Machine Translation with RNNs
- 12.5. Attention Mechanisms
  - 12.5.1. Application of Attention Mechanisms in RNN
  - 12.5.2. Use of Attention Mechanisms to Improve the Accuracy of the Models
  - 12.5.3. Advantages of Attention Mechanisms in Neural Networks

- 12.6. Transformer Models
  - 12.6.1. Using Transformers Models for Natural Language Processing
  - 12.6.2. Application of Transformers Models for Vision
  - 12.6.3. Advantages of Transformers Models
- 12.7. Transformers for Vision
  - 12.7.1. Use of Transformers Models for Vision
  - 12.7.2. Image Data Preprocessing
  - 12.7.3. Training a Transformers Model for Vision
- 12.8. Hugging Face's Transformers Library
  - 12.8.1. Using the Hugging Face's Transformers Library
  - 12.8.2. Hugging Face's Transformers Library Application
  - 12.8.3. Advantages of Hugging Face's Transformers Library
- 12.9. Other Transformers Libraries. Comparison
  - 12.9.1. Comparison Between Different Transformers Libraries
  - 12.9.2. Use of the Other Transformers Libraries
  - 12.9.3. Advantages of the Other Transformers Libraries
- 12.10. Development of an NLP Application with RNN and Attention. Practical Application
  - 12.10.1. Development of a Natural Language Processing Application with RNN and Attention
  - 12.10.2. Use of RNN, Attention Mechanisms and Transformers Models in the Application
  - 12.10.3. Evaluation of the Practical Application

## Module 13. Autoencoders, GANs, and Diffusion Models

- 13.1. Representation of Efficient Data
  - 13.1.1. Dimensionality Reduction
  - 13.1.2. Deep Learning
  - 13.1.3. Compact Representations
- 13.2. PCA Realization with an Incomplete Linear Automatic Encoder
  - 13.2.1. Training Process
  - 13.2.2. Implementation in Python
  - 13.2.3. Use of Test Data
- 13.3. Stacked Automatic Encoders
  - 13.3.1. Deep Neural Networks
  - 13.3.2. Construction of Coding Architectures
  - 13.3.3. Use of Regularization

- 13.4. Convolutional Autoencoders
  - 13.4.1. Design of Convolutional Models
  - 13.4.2. Convolutional Model Training
  - 13.4.3. Results Evaluation
- 13.5. Automatic Encoder Denoising
  - 13.5.1. Filter Application
  - 13.5.2. Design of Coding Models
  - 13.5.3. Use of Regularization Techniques
- 13.6. Sparse Automatic Encoders
  - 13.6.1. Increasing Coding Efficiency
  - 13.6.2. Minimizing the Number of Parameters
  - 13.6.3. Using Regularization Techniques
- 13.7. Variational Automatic Encoders
  - 13.7.1. Use of Variational Optimization
  - 13.7.2. Unsupervised Deep Learning
  - 13.7.3. Deep Latent Representations
- 13.8. Generation of Fashion MNIST Images
  - 13.8.1. Pattern Recognition
  - 13.8.2. Image Generation
  - 13.8.3. Deep Neural Networks Training
- 13.9. Generative Adversarial Networks and Diffusion Models
  - 13.9.1. Content Generation from Images
  - 13.9.2. Modeling of Data Distributions
  - 13.9.3. Use of Adversarial Networks
- 13.10. Implementation of the Models
  - 13.10.1. Practical Application
  - 13.10.2. Implementation of the Models
  - 13.10.3. Use of Real Data
  - 13.10.4. Results Evaluation

## Module 14. Bio-Inspired Computing

- 14.1. Introduction to Bio-Inspired Computing
  - 14.1.1. Introduction to Bio-Inspired Computing
- 14.2. Social Adaptation Algorithms
  - 14.2.1. Bio-Inspired Computation Based on Ant Colonies
  - 14.2.2. Variants of Ant Colony Algorithms
  - 14.2.3. Particle Cloud Computing
- 14.3. Genetic Algorithms
  - 14.3.1. General Structure
  - 14.3.2. Implementations of the Major Operators
- 14.4. Space Exploration-Exploitation Strategies for Genetic Algorithms
  - 14.4.1. CHC Algorithm
  - 14.4.2. Multimodal Problems
- 14.5. Evolutionary Computing Models (I)
  - 14.5.1. Evolutionary Strategies
  - 14.5.2. Evolutionary Programming
  - 14.5.3. Algorithms Based on Differential Evolution
- 14.6. Evolutionary Computing Models (II)
  - 14.6.1. Evolutionary Models Based on Estimation of Distributions (EDA)
  - 14.6.2. Genetic Programming
- 14.7. Evolutionary Programming Applied to Learning Problems
  - 14.7.1. Rules-Based Learning
  - 14.7.2. Evolutionary Methods in Instance Selection Problems
- 14.8. Multi-Objective Problems
  - 14.8.1. Concept of Dominance
  - 14.8.2. Application of Evolutionary Algorithms to Multi-Objective Problems
- 14.9. Neural Networks (I)
  - 14.9.1. Introduction to Neural Networks
  - 14.9.2. Practical Example with Neural Networks
- 14.10. Neural Networks (II)
  - 14.10.1. Use Cases of Neural Networks in Medical Research
  - 14.10.2. Use Cases of Neural Networks in Economics
  - 14.10.3. Use Cases of Neural Networks in Artificial Vision



**Module 15. Artificial Intelligence: Strategies and Applications**

- 15.1. Financial Services
  - 15.1.1. The implications of Artificial Intelligence (AI) in financial services. Opportunities and challenges
  - 15.1.2. Case Uses
  - 15.1.3. Potential Risks Related to the Use of AI
  - 15.1.4. Potential Future Developments/Uses of AI
- 15.2. Implications of Artificial Intelligence in the Healthcare Service
  - 15.2.1. Implications of AI in the Healthcare Sector. Opportunities and Challenges
  - 15.2.2. Case Uses
- 15.3. Risks Related to the Use of AI in the Health Service
  - 15.3.1. Potential Risks Related to the Use of AI
  - 15.3.2. Potential Future Developments/Uses of AI
- 15.4. Retail
  - 15.4.1. Implications of AI in Retail. Opportunities and Challenges
  - 15.4.2. Case Uses
  - 15.4.3. Potential Risks Related to the Use of AI
  - 15.4.4. Potential Future Developments/Uses of AI
- 15.5. Industry
  - 15.5.1. Implications of AI in Industry. Opportunities and Challenges
  - 15.5.2. Case Uses
- 15.6. Potential risks related to the use of AI in industry
  - 15.6.1. Case Uses
  - 15.6.2. Potential Risks Related to the Use of AI
  - 15.6.3. Potential Future Developments/Uses of AI
- 15.7. Public Administration.
  - 15.7.1. AI implications for public administration. Opportunities and Challenges
  - 15.7.2. Case Uses
  - 15.7.3. Potential Risks Related to the Use of AI
  - 15.7.4. Potential Future Developments/Uses of AI
- 15.8. Education
  - 15.8.1. AI implications for education. Opportunities and Challenges
  - 15.8.2. Case Uses
  - 15.8.3. Potential Risks Related to the Use of AI
  - 15.8.4. Potential Future Developments/Uses of AI
- 15.9. Forestry and Agriculture
  - 15.9.1. Implications of AI in Forestry and Agriculture. Opportunities and Challenges
  - 15.9.2. Case Uses
  - 15.9.3. Potential Risks Related to the Use of AI
  - 15.9.4. Potential Future Developments/Uses of AI
- 15.10. Human Resources
  - 15.10.1. Implications of AI for Human Resources Opportunities and Challenges
  - 15.10.2. Case Uses
  - 15.10.3. Potential Risks Related to the Use of AI
  - 15.10.4. Potential Future Developments/Uses of AI

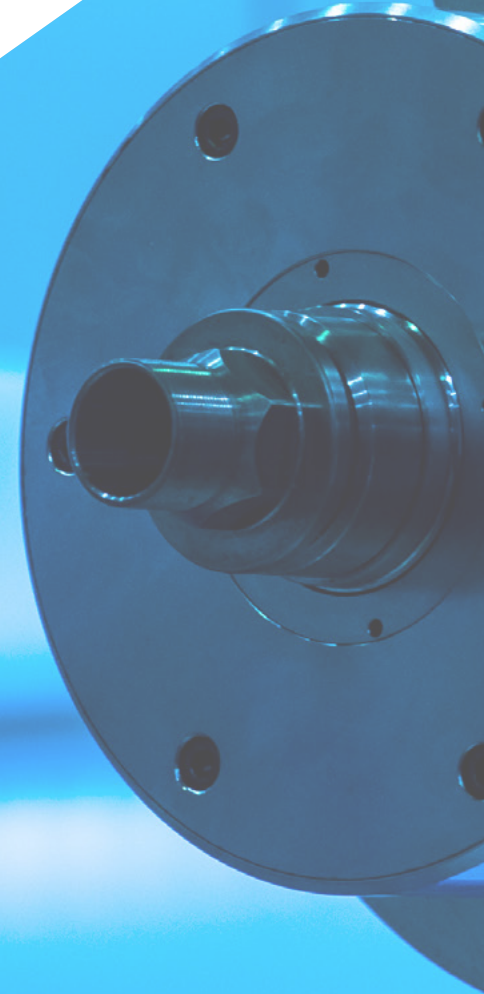


*You will delve into topics such as generative AI models, applied quantum computing, and ethics and governance strategies, hand in hand with the world's best digital university, according to Forbes"*

07

# Clinical Internship

After completing the online theoretical period, this Hybrid Master's Degree in Artificial Intelligence includes an Internship Program in a reference institution. During this period, graduates will have the support of a tutor who will help them to get the most out of this experience. Thanks to this, the engineers will acquire advanced skills to experience a remarkable leap in quality in the practice of their profession.



“

*The practical stay has been designed to offer you real experiences in AI projects, collaborating with companies in the sector to solve real problems and face current technological challenges"*

The Internship Program of this Artificial Intelligence program consists of a practical stay in a reference entity, lasting 3 weeks, from Monday to Friday, with 8 consecutive hours of practical teaching, alongside an associate specialist.

In this totally practical training proposal, the activities are aimed at developing and perfecting the necessary skills to provide Artificial Intelligence services and conditions that require a high level of qualification, oriented to the specific training to perform the activity.

Undoubtedly, engineers are facing an excellent opportunity to immerse themselves in the day-to-day of a profession full of challenges. In this way, they will collaborate in projects related to learning transfer training, model personalization or Neural Network design, among others. Thanks to this, the graduates will develop advanced competencies to optimize their praxis and raise their professional horizons.

The practical part will be carried out with the active participation of the student performing the activities and procedures of each area of competence (learning to learn and learning to do), with the accompaniment and guidance of teachers and other training partners that facilitate teamwork and multidisciplinary integration as transversal competencies for the praxis of Computer Science (learning to be and learning to relate).





The procedures described below will be the basis of the practical part of the program, and their implementation will be subject to the center's own availability and workload, the proposed activities being the following:

Module	Practical Activity
<b>Data Management Process</b>	Design and implement systems for data entry (such as web forms, mobile applications and automated capture systems)
	Manage cloud storage solutions for scalability and accessibility of data
	Execute data cleansing techniques to correct errors and assure data quality
	Create data analytics algorithms, including Machine Learning
<b>Data Mining Techniques</b>	Apply dimensionality reduction techniques in order to eliminate redundancies and reduce data size without losing relevant information
	Use visualization tools in order to explore data and detect patterns
	Generate new variables from existing ones to improve the performance of predictive models
	Use evaluation metrics to measure the performance of the models
<b>Development of Bioinspired Algorithms</b>	Build evolutionary algorithms that mimic the processes of natural selection and evolution to solve complex problems
	Model and simulate biological systems to understand their principles and apply this knowledge to computational solutions
	Apply bio-inspired algorithms to optimization problems in diverse areas such as logistics, network design, and resource planning
	Develop software frameworks that facilitate implementation and experimentation with bio-inspired algorithms
<b>Deep Computer Vision</b>	Perform preprocessing tasks such as normalization, sizing and color correction to prepare the input data
	Train Deep Neural Network models using Supervised Learning techniques
	Perform error analysis to identify and correct model prediction failures
	Monitor the performance of models in production and perform maintenance to ensure that they continue to perform well over time

## Civil Liability Insurance

This institution's main concern is to guarantee the safety of the students and other collaborating agents involved in the internship process at the company. Among the measures dedicated to achieve this is the response to any incident that may occur during the entire teaching-learning process.

To this end, this entity commits to purchasing a civil liability insurance policy to cover any eventuality that may arise during the course of the internship at the center.

This liability policy for interns will have broad coverage and will be taken out prior to the start of the practical training period. That way professionals will not have to worry in case of having to face an unexpected situation and will be covered until the end of the internship program at the center.



## General Conditions of the Internship Program

The general terms and conditions of the internship agreement for the program are as follows:

**1. TUTOR:** During the Hybrid Master's Degree, students will be assigned with two tutors who will accompany them throughout the process, answering any doubts and questions that may arise. On the one hand, there will be a professional tutor belonging to the internship center who will have the purpose of guiding and supporting the student at all times. On the other hand, they will also be assigned with an academic tutor whose mission will be to coordinate and help the students during the whole process, solving doubts and facilitating everything they may need. In this way, the student will be accompanied and will be able to discuss any doubts that may arise, both clinical and academic.

**2. DURATION:** The internship program will have a duration of three continuous weeks, in 8-hour days, 5 days a week. The days of attendance and the schedule will be the responsibility of the center and the professional will be informed well in advance so that they can make the appropriate arrangements.

**3. ABSENCE:** If the students does not show up on the start date of the Hybrid Master's Degree, they will lose the right to it, without the possibility of reimbursement or change of dates. Absence for more than two days from the internship, without justification or a medical reason, will result in the professional's withdrawal from the internship, therefore, automatic termination of the internship. Any problems that may arise during the course of the internship must be urgently reported to the academic tutor.

**4. CERTIFICATION:** Professionals who pass the Hybrid Master's Degree will receive a certificate accrediting their stay at the center.

**5. EMPLOYMENT RELATIONSHIP:** the Hybrid Master's Degree shall not constitute an employment relationship of any kind.

**6. PRIOR EDUCATION:** Some centers may require a certificate of prior education for the Hybrid Master's Degree. In these cases, it will be necessary to submit it to the TECH internship department so that the assignment of the chosen center can be confirmed.

**7. DOES NOT INCLUDE:** The Hybrid Master's Degree will not include any element not described in the present conditions. Therefore, it does not include accommodation, transportation to the city where the internship takes place, visas or any other items not listed.

However, students may consult with their academic tutor for any questions or recommendations in this regard. The academic tutor will provide the student with all the necessary information to facilitate the procedures in any case.

# 08

## Where Can I Do the Internship?

In its firm commitment to provide high quality university degrees, TECH expands the academic opportunities for students and enables the practical stay to be carried out in various prestigious international entities. Therefore, graduates have an ideal opportunity to improve their professional quality by working with the best specialists in the field of Artificial Intelligence.







“

*Take advantage of this unique opportunity that only TECH offers you! You will do your internship in a recognized institution highly specialized in Artificial Intelligence”*

## tech 50 | Where Can I Do the Internship?



The student will be able to complete the practical part of this Hybrid Professional Master's Degree at the following centers:



Engineering

### Captia Ingeniería

Country	City
Spain	Madrid

Address: Av. de las Nieves, 37, Bloque A Planta 1  
Oficina E, 28935, Móstoles, Madrid

IT company dedicated to providing advanced technological solutions to industries.

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**Related internship programs:**

- Visual Analytics and Big Data
- Software Development





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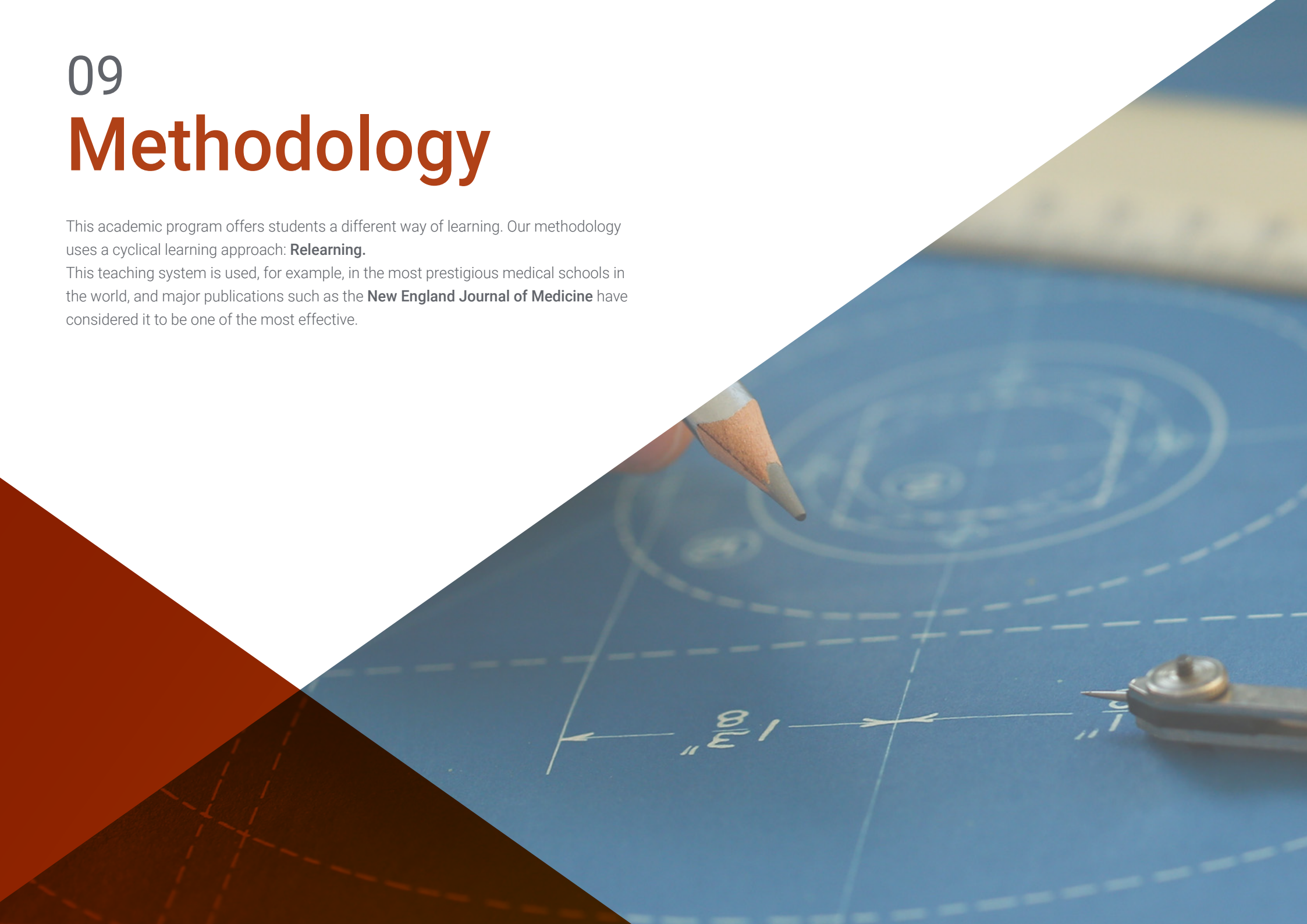
*Boost your career path with holistic teaching, allowing you to advance both theoretically and practically”*

09

# Methodology

This academic program offers students a different way of learning. Our methodology uses a cyclical learning approach: **Relearning**.

This teaching system is used, for example, in the most prestigious medical schools in the world, and major publications such as the **New England Journal of Medicine** have considered it to be one of the most effective.





“

*Discover Relearning, a system that abandons conventional linear learning, to take you through cyclical teaching systems: a way of learning that has proven to be extremely effective, especially in subjects that require memorization"*

## Case Study to contextualize all content

Our program offers a revolutionary approach to developing skills and knowledge. Our goal is to strengthen skills in a changing, competitive, and highly demanding environment.

“

*At TECH, you will experience a learning methodology that is shaking the foundations of traditional universities around the world”*



*You will have access to a learning system based on repetition, with natural and progressive teaching throughout the entire syllabus.*



*The student will learn to solve complex situations in real business environments through collaborative activities and real cases.*

### A learning method that is different and innovative

This TECH program is an intensive educational program, created from scratch, which presents the most demanding challenges and decisions in this field, both nationally and internationally. This methodology promotes personal and professional growth, representing a significant step towards success. The case method, a technique that lays the foundation for this content, ensures that the most current economic, social and professional reality is taken into account.

“*Our program prepares you to face new challenges in uncertain environments and achieve success in your career”*

The case method is the most widely used learning system in the best faculties in the world. The case method was developed in 1912 so that law students would not only learn the law based on theoretical content. It consisted of presenting students with real-life, complex situations for them to make informed decisions and value judgments on how to resolve them. In 1924, Harvard adopted it as a standard teaching method.

What should a professional do in a given situation? This is the question that you are presented with in the case method, an action-oriented learning method. Throughout the program, the studies will be presented with multiple real cases. They will have to combine all their knowledge and research, and argue and defend their ideas and decisions.

## Relearning Methodology

TECH effectively combines the Case Study methodology with a 100% online learning system based on repetition, which combines 8 different teaching elements in each lesson.

We enhance the Case Study with the best 100% online teaching method: Relearning.

*In 2019, we obtained the best learning results of all online universities in the world.*



At TECH, you will learn using a cutting-edge methodology designed to train the executives of the future. This method, at the forefront of international teaching, is called Relearning.

Our university is the only one in the world authorized to employ this successful method. In 2019, we managed to improve our students' overall satisfaction levels (teaching quality, quality of materials, course structure, objectives...) based on the best online university indicators.



In our program, learning is not a linear process, but rather a spiral (learn, unlearn, forget, and re-learn). Therefore, we combine each of these elements concentrically.

This methodology has trained more than 650,000 university graduates with unprecedented success in fields as diverse as biochemistry, genetics, surgery, international law, management skills, sports science, philosophy, law, engineering, journalism, history, and financial markets and instruments. All this in a highly demanding environment, where the students have a strong socio-economic profile and an average age of 43.5 years.

*Relearning will allow you to learn with less effort and better performance, involving you more in your training, developing a critical mindset, defending arguments, and contrasting opinions: a direct equation for success.*

From the latest scientific evidence in the field of neuroscience, not only do we know how to organize information, ideas, images and memories, but we know that the place and context where we have learned something is fundamental for us to be able to remember it and store it in the hippocampus, to retain it in our long-term memory.

In this way, and in what is called neurocognitive context-dependent e-learning, the different elements in our program are connected to the context where the individual carries out their professional activity.



This program offers the best educational material, prepared with professionals in mind:



### Study Material

All teaching material is produced by the specialists who teach the course, specifically for the course, so that the teaching content is highly specific and precise.

These contents are then applied to the audiovisual format, to create the TECH online working method. All this, with the latest techniques that offer high quality pieces in each and every one of the materials that are made available to the student.



### Classes

There is scientific evidence suggesting that observing third-party experts can be useful.

Learning from an Expert strengthens knowledge and memory, and generates confidence in future difficult decisions.



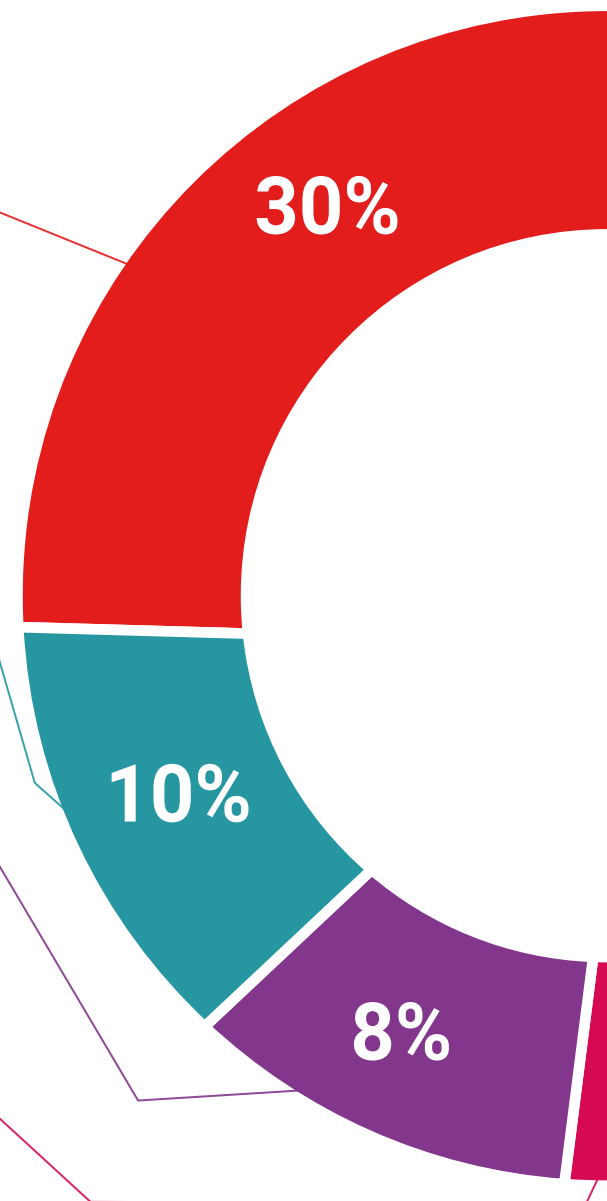
### Practising Skills and Abilities

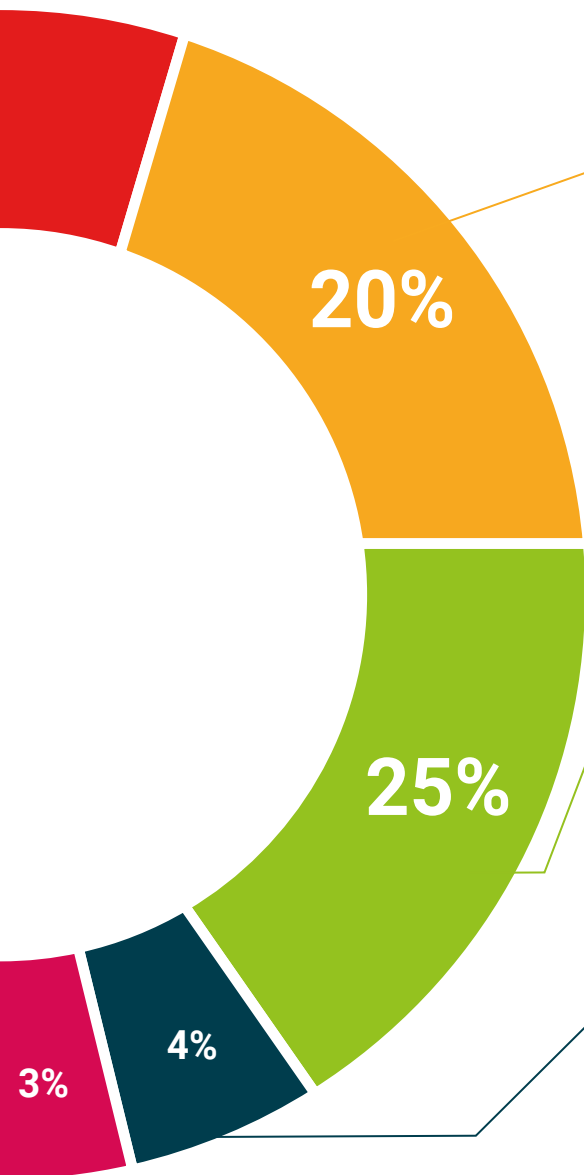
They will carry out activities to develop specific skills and abilities in each subject area. Exercises and activities to acquire and develop the skills and abilities that a specialist needs to develop in the context of the globalization that we are experiencing.



### Additional Reading

Recent articles, consensus documents and international guidelines, among others. In TECH's virtual library, students will have access to everything they need to complete their course.





#### Case Studies

Students will complete a selection of the best case studies chosen specifically for this program. Cases that are presented, analyzed, and supervised by the best specialists in the world.



#### Interactive Summaries

The TECH team presents the contents attractively and dynamically in multimedia lessons that include audio, videos, images, diagrams, and concept maps in order to reinforce knowledge.

This exclusive educational system for presenting multimedia content was awarded by Microsoft as a "European Success Story".



#### Testing & Retesting

We periodically evaluate and re-evaluate students' knowledge throughout the program, through assessment and self-assessment activities and exercises, so that they can see how they are achieving their goals.



# 10 Certificate

The Hybrid Master's Degree in Artificial Intelligence guarantees students, in addition to the most rigorous and up-to-date education, access to a Hybrid Professional Master's Degree issued by TECH Global University.





*Successfully complete this program and receive your university qualification without having to travel or fill out laborious paperwork"*

This private qualification will allow you to obtain a **Hybrid Master's Degree in Artificial Intelligence** endorsed by **TECH Global University**, the world's largest online university.

**TECH Global University** is an official European University publicly recognized by the Government of Andorra ([official bulletin](#)). Andorra is part of the European Higher Education Area (EHEA) since 2003. The EHEA is an initiative promoted by the European Union that aims to organize the international training framework and harmonize the higher education systems of the member countries of this space. The project promotes common values, the implementation of collaborative tools and strengthening its quality assurance mechanisms to enhance collaboration and mobility among students, researchers and academics.

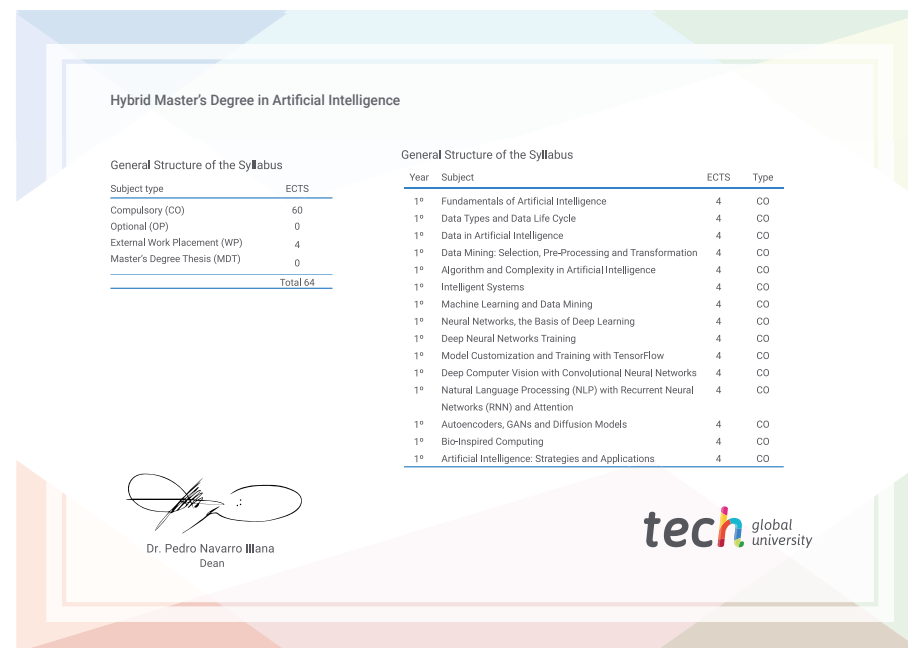
This **TECH Global University** private qualification is a European program of continuing education and professional updating that guarantees the acquisition of competencies in its area of knowledge, providing a high curricular value to the student who completes the program.

Title: **Hybrid Master's Degree in Artificial Intelligence**

Modality: **Hybrid (Online + Internship)**

Duration: **12 months**

Accreditation: **60 + 4 ECTS**



\*Apostille Convention. In the event that the student wishes to have their paper diploma issued with an apostille, TECH Global University will make the necessary arrangements to obtain it, at an additional cost.

future  
health confidence people  
education information tutors  
guarantee accreditation teaching  
institutions technology learning  
community commitment  
personalized service innovation  
knowledge present  
online training  
development language  
classroom



## Hybrid Master's Degree Artificial Intelligence

Modality: Hybrid (Online + Internship)

Duration: 12 months

Certificate: TECH Global University

Accreditation: 60 + 4 ECTS

# Hybrid Master's Degree Artificial Intelligence