

# Master's Degree Artificial Intelligence



## Master's Degree Artificial Intelligence

- » Modality: online
- » Duration: 12 months
- » Certificate: TECH Global University
- » Credits: 60 ECTS
- » Schedule: at your own pace
- » Exams: online

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

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# 01

# Introduction

Artificial Intelligence has experienced a dizzying advance, from the first steps of neural network research to the current state of *Deep Learning*. AI has proven to drive revolutionary advances, applicable in areas as diverse as health, logistics and education. In this context, the growing demand for highly trained professionals in this field has become a reality for most companies. For this reason, TECH has created this exclusive academic program, which offers graduates a unique opportunity to delve into the most current advances in Artificial Intelligence. In a world where innovation is key, this academic program will prepare specialists for future challenges.



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*With this Master's Degree you will discover how artificial intelligence is transforming industries and you will prepare yourself to lead the change"*

AI is transforming numerous industries, from healthcare to logistics to automotive to e-commerce. Its ability to automate repetitive tasks and improve efficiency has generated a growing demand for professionals capable of mastering different types of machine learning algorithms. In such a new and constantly evolving sector, it is imperative to stay up-to-date in order to compete in an increasingly technology-driven job market.

For this reason, TECH has developed a program that is presented as a strategic response to improve the job prospects and promotion potential of engineers. In this way, an innovative syllabus has been developed in which students will delve into the fundamentals of AI and delve into data mining.

Throughout the development of this Master's Degree, graduates will immerse themselves in the essential foundations, tracing the historical evolution of AI and exploring its future projections. In this way, they will delve into their integration into mass-use applications, to understand how these platforms improve the user experience and optimize operational efficiency.

It is therefore an exclusive academic program, thanks to which professionals can develop optimization processes inspired by biological evolution, finding and applying efficient solutions to complex problems with the in-depth mastery of Artificial Intelligence.

To facilitate the integration of new knowledge, TECH has created this complete program based on the exclusive *Relearning* methodology. Under this approach, students will reinforce understanding through repetition of key concepts throughout the program, which will be presented in various audiovisual supports for a progressive and effective knowledge acquisition. All this from an innovative and flexible system, totally online, that allows to adapt the learning to the schedules of the participants.

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

- ♦ Development of practical cases presented by experts in Artificial Intelligence
- ♦ The graphic, schematic and practical contents with which it is conceived provide cutting- Therapeutics and practical information on those disciplines that are essential for professional practice
- ♦ Practical exercises where self-assessment can be used to improve learning
- ♦ Its special emphasis on innovative methodologies
- ♦ 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



*Boost your professional profile by developing advanced AI-, based solutions, with the most comprehensive program in the digital academic landscape"*

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*You will address from the evolution of neural networks to Deep Learning and you will acquire solid competencies in the implementation of advanced Artificial Intelligence solutions"*

The program's teaching staff includes professionals from the field who contribute their work experience to this educational program, as well as renowned specialists from leading societies and prestigious universities.

The multimedia content, developed with the latest educational technology, will provide the professional with situated and contextual learning, i.e., a simulated environment that will provide immersive education programmed to learn in real situations.

This program is designed around Problem-Based Learning, whereby the professional 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 optimize the potential of data storage in the best digital university in the world , according to Forbes.*

*You will be able to access exclusive content on the virtual campus 24 hours a day, with no geographical or time restrictions.*



# 02 Objectives

The many advances that have been made in the field of Artificial Intelligence have generated a need for constant updating on the part of professionals. For this reason, TECH has created a unique and complete program , with which graduates will master the complex algorithms that make Artificial Intelligence 'come to life'. The final goal of this degree will be to make available to students the latest information in the sector, with a training and avant-garde approach. In this way, the graduate will access a unique academic itinerary, taught 100% online.



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*You will master the keys to information  
hidden in large data sets and increase your  
job visibility in an ever-expanding market”*



## General Objectives

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- ♦ Understand the theoretical foundations of Artificial Intelligence
- ♦ Study the different types of data and understand the data lifecycle
- ♦ Evaluate the crucial role of data in the development and implementation of AI solutions
- ♦ Delve into algorithms and complexity to solve specific problems
- ♦ Explore the theoretical basis of neural networks for *Deep Learning* development
- ♦ Explore bio-inspired computing and its relevance in the development of intelligent systems
- ♦ Analyze current strategies of Artificial Intelligence in various fields, identifying opportunities and challenges





## 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
- ♦ Explore the concept of the semantic web and its influence on the organization and understanding of information in digital environments

### 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
- ♦ Analyze the regulatory aspects related to data management, complying with privacy and security regulations, as well as best practices

### 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
- ♦ Study the structure and characteristics of *datasets*, understanding their importance in the preparation and use of data for Artificial Intelligence models
- ♦ 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
- ♦ Study semantic reasoners, knowledge-based systems and expert systems, understanding their functionality and applications in intelligent decision making

### 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
- ♦ Understanding 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
- ♦ Tuning hyperparameters for *Fine Tuning* of neural networks, optimizing their performance on specific tasks

#### **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
- ♦ Understand and apply regularization techniques to improve generalization and avoid overfitting in deep neural networks

#### **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
- ♦ Implement semantic segmentation techniques to understand and classify objects in images in a detailed manner

### Module 12. Natural Language Processing (NLP) with Natural Recurrent Networks (NNN) 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 tasks
- ♦ 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**

- ♦ Introduce the fundamental concepts of 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
- ♦ Optimize human resources processes through the strategic use of artificial intelligence



*You will master the technologies of the future with this exclusive 100% online university program. Only with TECH!"*

# 03 Skills

The structure of this Master's Degree has been proposed in such a way that, at the end of the itinerary, the graduate will have acquired solid competencies to excel in the implementation and development of *Autoencoders*, *GANs*, and *Diffusion Models*. To achieve this, the professional will delve into data mining and Natural Language Processing (NLP), thanks to which machines can understand and generate human language effectively. All this in just 12 months of teaching completely online, without having to travel or adjust to a preset *timing*.



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*Don't miss this unique opportunity to increase your skills in data mining and position yourself as an AI expert"*



## 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

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*You will improve your skills thanks to the didactic tools of TECH, among which explanatory videos and interactive summaries stand out”*





## 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

04

# Course Management

In its commitment to elite teaching, TECH has carefully selected the teachers responsible for developing the syllabus for this program. Therefore, this academic program has an experienced faculty, which has an outstanding background in the development and implementation of solutions in AI. In this way, students of this Master's Degree will access a first level educational experience. They will also obtain an exclusive combination of knowledge , presented in various audiovisual media , for a more efficient and dynamic integration of knowledge.



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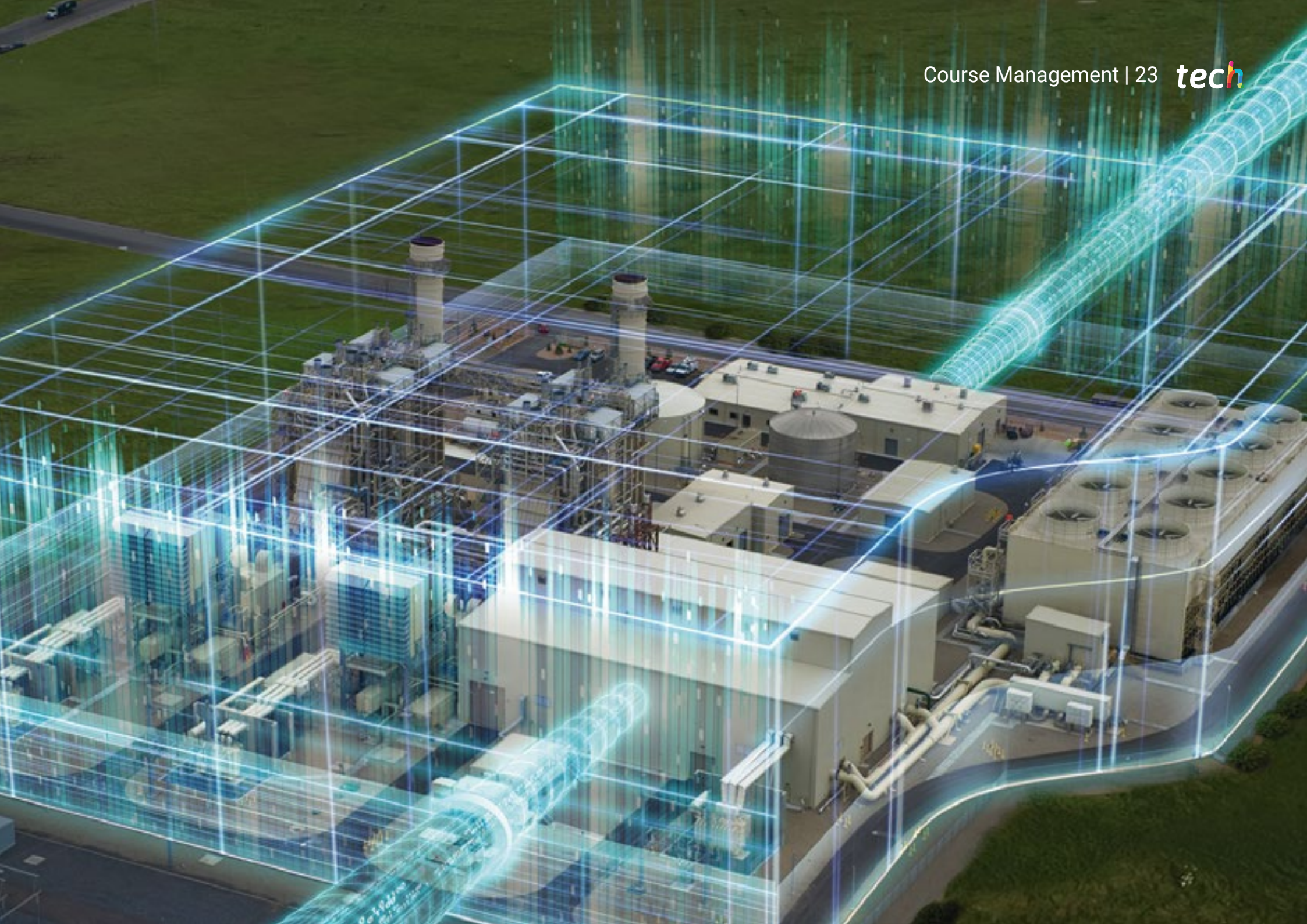
*Get up to date on the latest  
trends in Artificial Intelligence  
from the best experts in the field"*

## 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



05

# Structure and Content

This syllabus has been designed by a team of experts in the area of Artificial Intelligence, placing special emphasis on knowledge discovery processes and machine learning. Thanks to this, the students will delve into the development of algorithms and models that allow machines to learn patterns and perform tasks , without having been explicitly programmed for that task. In addition, TECH uses the pioneering *Relearning* methodology, thanks to which professionals will integrate solid knowledge in the evaluation of models in a progressive and effective way.





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*You will delve into the formulation of genetic algorithms through 12 months of the best digital teaching. Boost your professional development with TECH!"*

## 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 (*Datawarehouse*)
  - 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
- 2.10. Regulatory Aspects
  - 2.10.1. Data Protection Law
  - 2.10.2. Good Practices
  - 2.10.3. Other Normative Aspects

### 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. Discrete 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. Graph 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 Care Mechanisms in RNN
  - 12.5.2. Use of Care 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* Bookstore
  - 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. *Educational*
  - 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



*Position yourself in the labor market with a 100% online program , that adapts to your needs and allows you an immersive and solid learning"*

06

# 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.



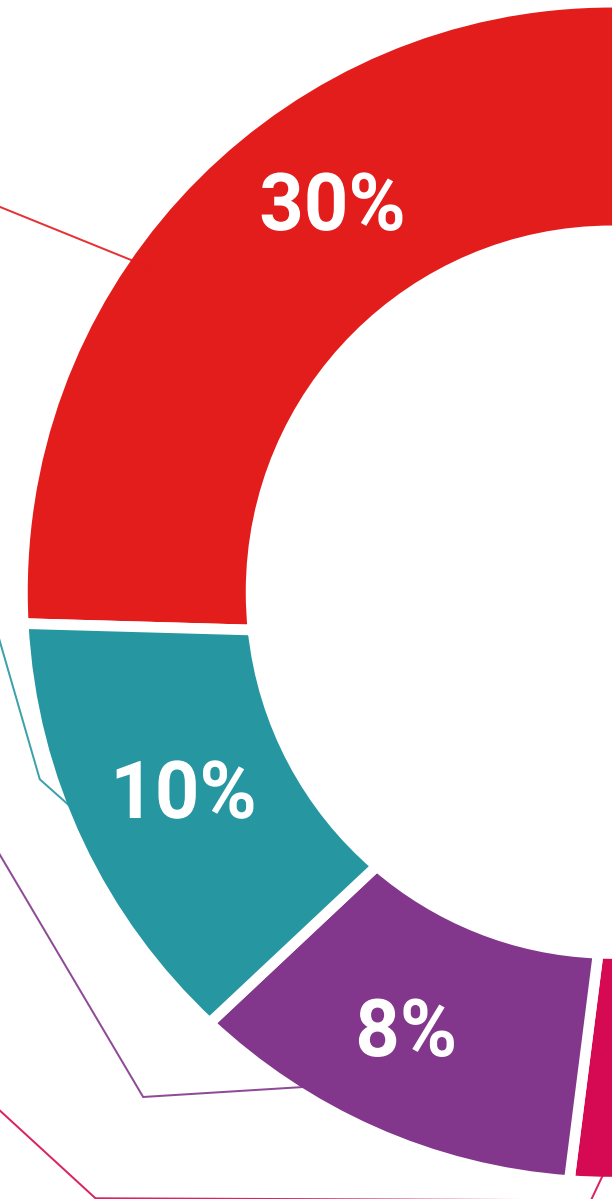
#### Practising Skills and Abilities

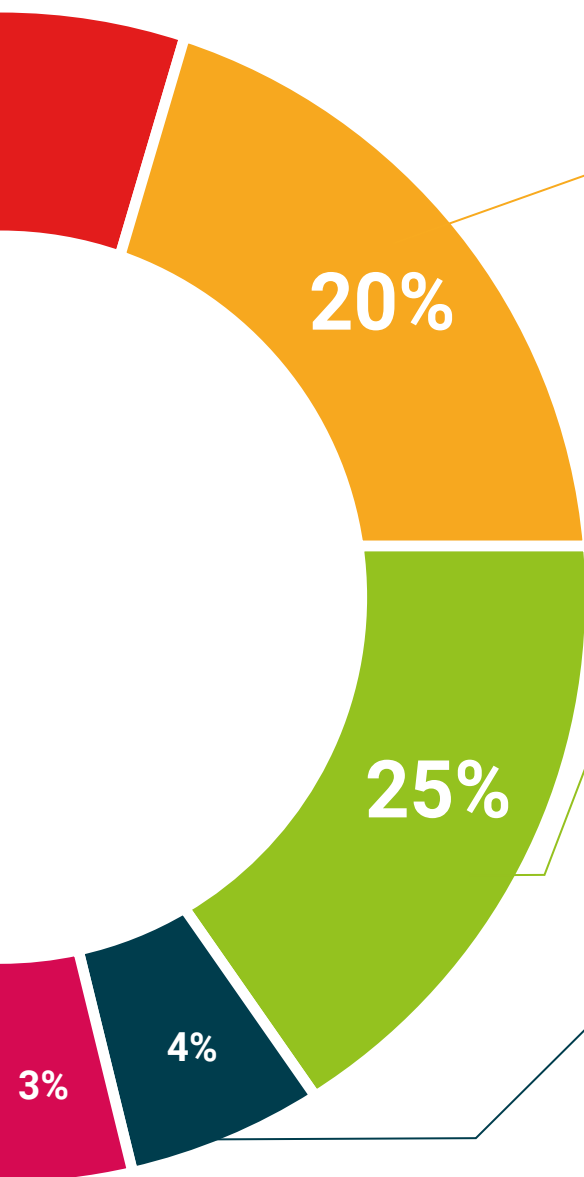
They will carry out activities to develop specific skills and abilities in each subject area. Exercises and activities to acquire and develop the skills and abilities that a specialist needs to develop in the context of the globalization that we are experiencing.



#### 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.



# 07 Certificate

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



“

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

This program will allow you to obtain your **Master's Degree diploma 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.

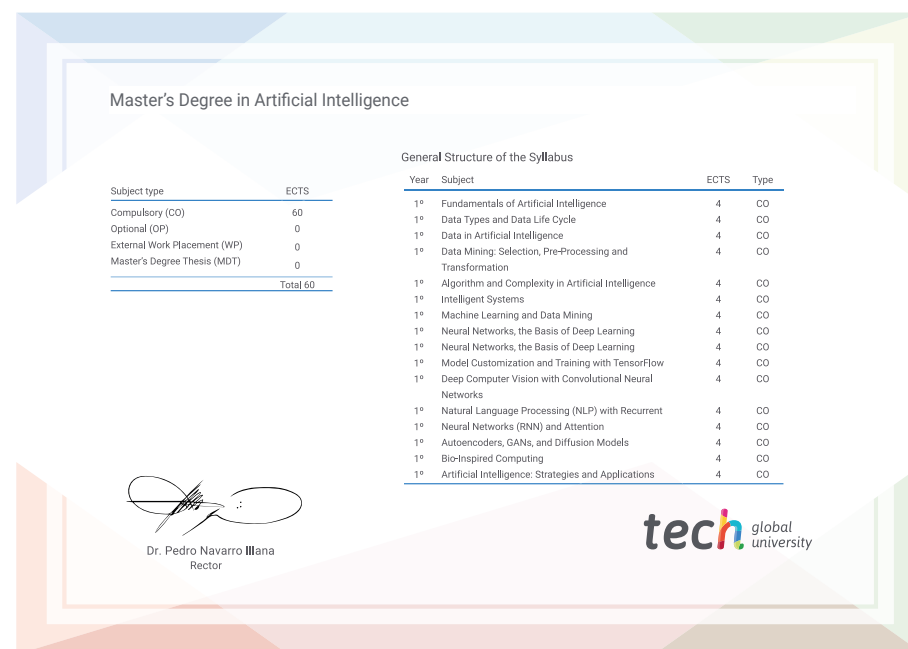
This **TECH Global University** title is a European program of continuing education and professional updating that guarantees the acquisition of competencies in its area of knowledge, providing a high curricular value to the student who completes the program.

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

Modality: **online**

Duration: **12 months**

Accreditation: **60 ECTS**





## Master's Degree Artificial Intelligence

- » Modality: online
- » Duration: 12 months
- » Certificate: TECH Global University
- » Credits: 60 ECTS
- » Schedule: at your own pace
- » Exams: online

# Master's Degree Artificial Intelligence