Master's Degree
Artificial Intelligence

tech global university

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Master's Degree
Artificial Intelligence

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

Website: **www.techtitute.com/us/artificial-intelligence/master-degree/master-artificial-intelligence**

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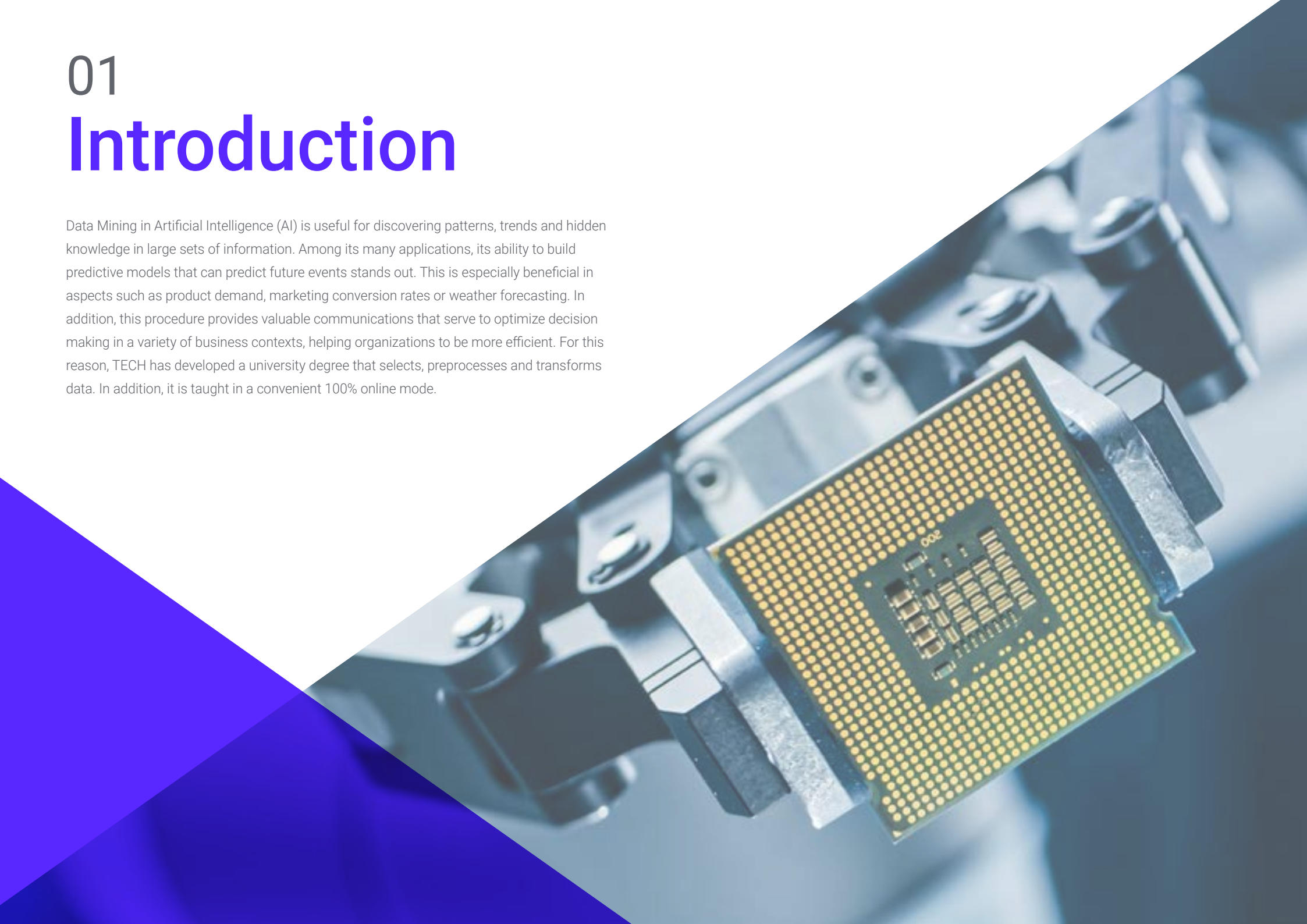
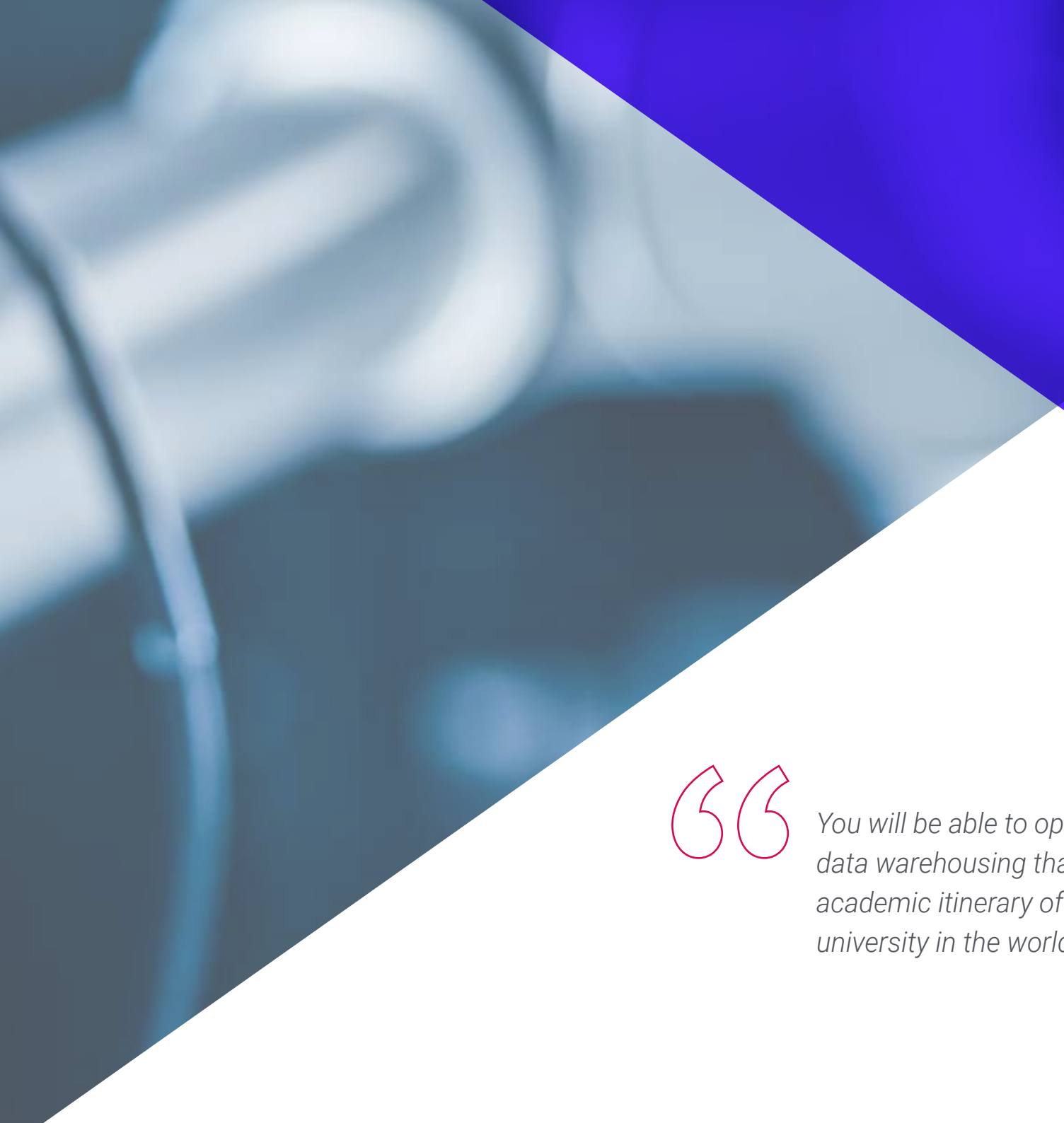
01

Introduction

Data Mining in Artificial Intelligence (AI) is useful for discovering patterns, trends and hidden knowledge in large sets of information. Among its many applications, its ability to build predictive models that can predict future events stands out. This is especially beneficial in aspects such as product demand, marketing conversion rates or weather forecasting. In addition, this procedure provides valuable communications that serve to optimize decision making in a variety of business contexts, helping organizations to be more efficient. For this reason, TECH has developed a university degree that selects, preprocesses and transforms data. In addition, it is taught in a convenient 100% online mode.





You will be able to optimize the potential of data warehousing thanks to this intensive academic itinerary of TECH, the best digital university in the world according to Forbes"

Machine Learning is in constant growth and demand in various industries, which is generating a high demand for professionals skilled in this area. To take advantage of these opportunities, specialists need to gain competitive advantages that differentiate them from other candidates. The best way to stand out is for experts to have a solid understanding of the subject matter, staying abreast of all developments in the field. In tune with this, it is vital that they acquire advanced skills that will enable them to effectively handle AI tools. Only then will they be able to open the doors to a variety of job opportunities in fields such as technology, healthcare or automotive.

Precisely to help them with this task, TECH is developing a program that will delve into the essential fundamentals of AI. Designed by experts in the field, the curriculum will delve into the integration of Cognitive Computing in mass-use applications. In this way, students will understand how these platforms serve to optimize both user experiences and operational efficiency. Likewise, the syllabus will address in detail the training of deep neural networks, applying gradient optimization and weight initialization techniques. On the other hand, students will master Autoencoders, GANs and Diffusion Models in order to perform efficient data representations.

It should be noted that this university degree has a 100% online methodology, in which the graduate only needs a device connected to the internet (such as a cell phone, tablet or computer) to access the Virtual Campus and enjoy the most dynamic teaching resources in the academic market. In addition, the innovative Relearning methodology allows students to assimilate knowledge in a natural way, reinforced with audiovisual resources to ensure that it remains in the memory and over time.

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

You will apply the B-Cube Method to your procedures and effectively evaluate the quality of classification in multi-label problems"

You will achieve your objectives thanks to TECH's teaching tools, including explanatory videos and interactive summaries"

You will handle data preprocessing with TensorFlow to improve the quality and performance of the final models.

The Relearning methodology used in this university degree will allow you to learn in an autonomous and progressive way.

The program's teaching staff includes professionals from the sector who contribute their work experience to this specializing 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, students will be assisted by an innovative interactive video system created by renowned and experienced experts.

02

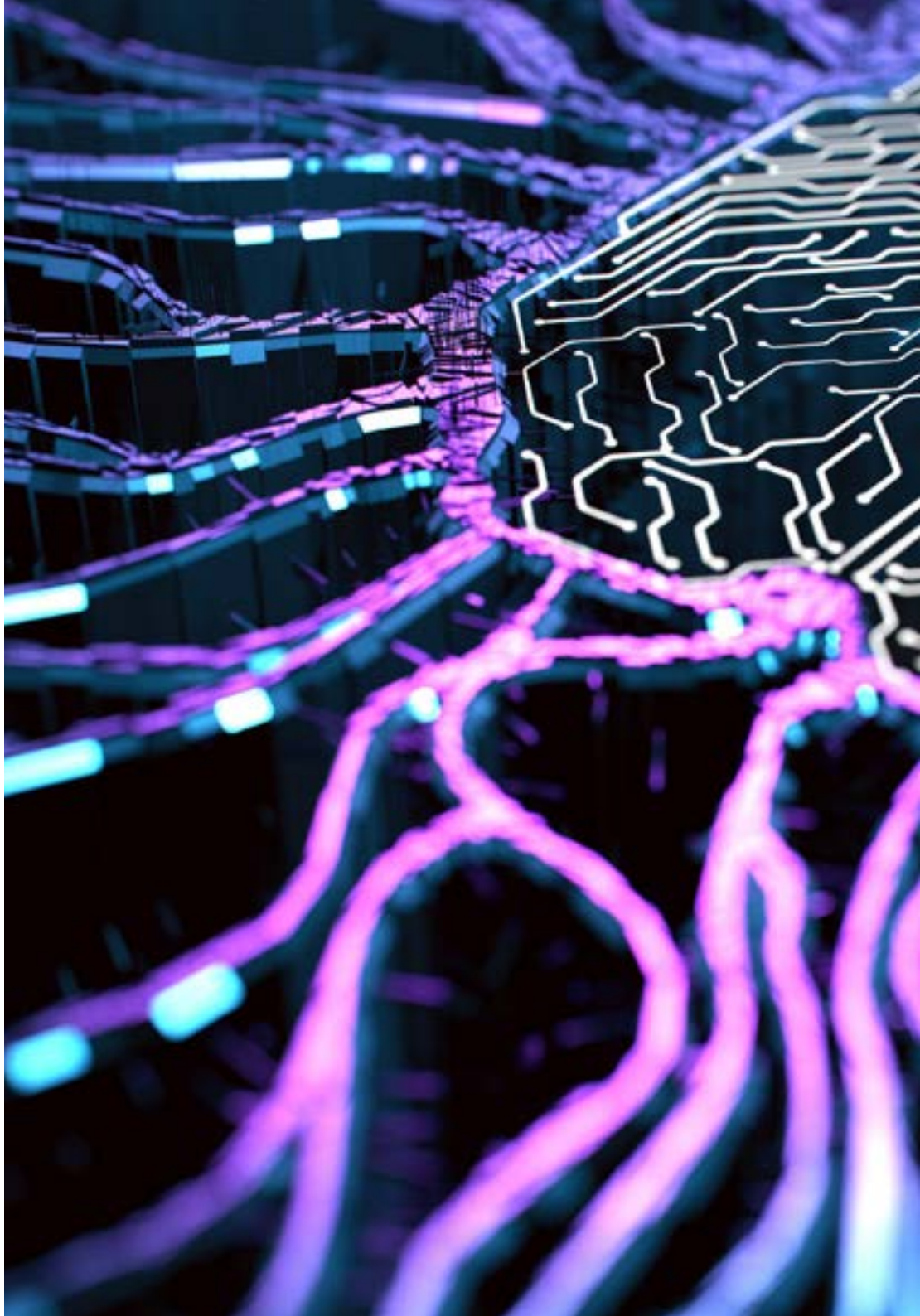
Objectives

Through this program, graduates will acquire multiple competencies that will allow them to effectively develop and implement Machine Learning systems. In this way, students will master the different AI algorithms to extract valuable information that contributes to improve decision making. At the same time, students will be able to apply AI in a variety of sectors, including health services, public administration and human resources. Experts will have at their disposal a wide range of resources to provide innovative proposals with which to excel in an ever-expanding field.

The Master's Degree allows you to practice in simulated environments, which provide you with immersive learning programmed to prepare you in real situations"

General Objectives

- 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



Specific Objectives

Module 1. Fundamentals of Artificial Intelligence

- Analyze the evolution, foundations, and application areas of artificial intelligence, relating its principles to current technological contexts
- Interpret knowledge representation models, intelligent agents, and expert systems to solve problems across different domains
- Evaluate classical AI techniques such as games, neural networks, and genetic algorithms in decision-making scenarios
- Integrate concepts of the Semantic Web, ontologies, and virtual assistants into solutions oriented toward intelligent automation

Module 2. Data in Artificial Intelligence

- Differentiate data, information, and knowledge for their strategic use in analysis processes and automated decision-making
- Apply analysis and visualization techniques to interpret datasets in diverse organizational and technological contexts
- Assess data quality by identifying biases and applying appropriate cleaning and preprocessing processes
- Implement supervised and unsupervised models while considering metrics, class balancing, and best practices

Module 3. Data Mining: Selection, Preprocessing and Transformation

- Analyze data through statistical and exploratory techniques to identify relevant patterns, biases, and relationships
- Apply data cleaning, transformation, and normalization processes to optimize data quality in AI models
- Evaluate strategies for handling missing values, noise, and high dimensionality in different analytical scenarios
- Integrate attribute and instance selection methods in traditional and Big Data environments to improve model performance

Module 4. Intelligent Systems

- Analyze intelligent agent architectures and their application in autonomous and adaptive systems
- Design knowledge representation structures through ontologies, logic, and semantic models
- Evaluate reasoning and inference mechanisms in knowledge-based systems to solve complex problems
- Integrate explainable AI approaches into the development of intelligent systems focused on transparency and reliability

Module 5. Machine Learning

- Analyze supervised, unsupervised, and reinforcement learning techniques in different application contexts
- Implement classification, regression, and clustering models using appropriate metrics for their evaluation
- Evaluate model combination strategies and probabilistic reasoning approaches to improve predictive performance
- Integrate neural networks and deep architectures into solutions focused on knowledge extraction

Module 6. Neural Networks: The Foundation of Deep Learning

- Analyze the structure and functioning of artificial neural networks in relation to their biological inspiration
- Design neural architectures considering layers, activation functions, and propagation flow
- Implement training, optimization, and evaluation processes in neural network models
- Adjust hyperparameters and loss functions to improve the performance of Deep Learning models

Module 7. Deep Neural Network Training

- Evaluate optimization and gradient control techniques in the training of deep neural networks
- Apply regularization and validation strategies to mitigate overfitting in complex models
- Implement transfer learning and model reuse across different application domains
- Integrate data augmentation and fine-tuning techniques to improve model generalization

Module 8. Customization with TensorFlow

- Implement deep learning models using TensorFlow in scalable development environments
- Design data pipelines through tf.data and preprocessing tools to optimize training
- Customize models and algorithms by adjusting parameters, functions, and optimization strategies
- Integrate Deep Learning solutions into functional applications focused on prediction and analysis

Module 9. Natural Language Processing (NLP)

- Analyze natural language processing techniques based on recurrent neural networks and Transformer models
- Implement models for text generation, classification, and translation in different contexts
- Evaluate the impact of attention mechanisms on the accuracy and efficiency of NLP models
- Integrate multiple NLP architectures into the development of intelligent language-oriented applications

Module 10. Bioinspired Computing

- Analyze bioinspired computing principles and techniques in solving complex optimization problems
- Implement evolutionary, swarm-based, and genetic algorithms in different computational contexts
- Evaluate exploration and exploitation strategies in multiobjective and highly complex problems
- Integrate hybrid neuro-evolutionary models into advanced artificial intelligence solutions

A professional growth process that will allow you to acquire the skills of an expert and compete among the best in the industry"

03

Skills

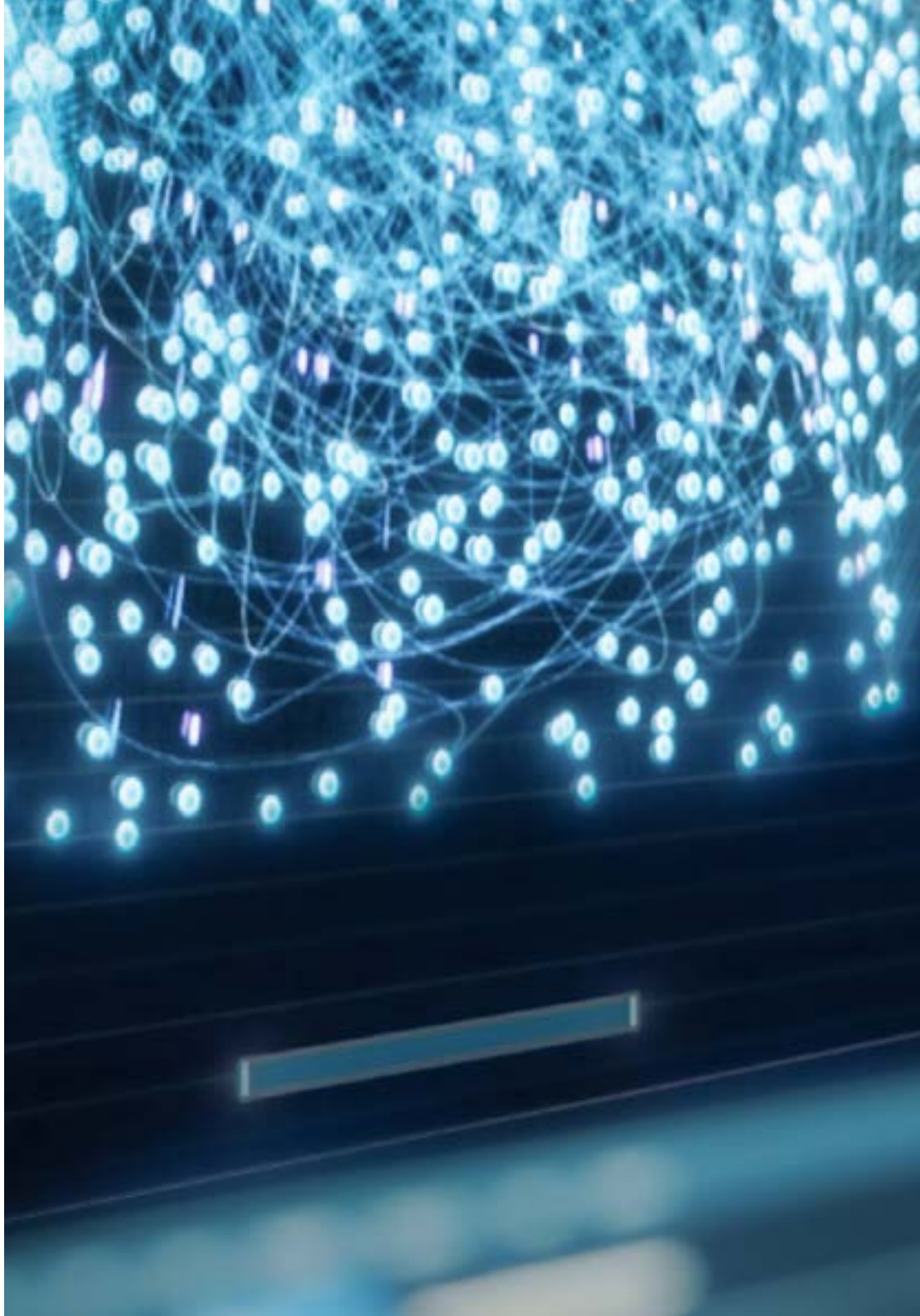
Thanks to this academic pathway, graduates will acquire solid competencies that will allow them to master Machine Learning tools and their application in Data Mining to optimize decision making. They will also be able to effectively develop Autoencoders, GANs, and Diffusion Models. It should be noted that students will be highly qualified to offer innovative proposals, while successfully overcoming the challenges they will face in the course of their work. Professionals will take advantage of the numerous opportunities offered by an industry that is advancing by leaps and bounds.

You will acquire advanced Data Mining skills to uncover valuable patterns and trends in complex information sets”

General Skills

- 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 enjoy a virtual library full of multimedia resources in different audiovisual formats to reinforce your knowledge"



Specific Skills

- 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 graphs 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 order to provide the highest education for all, TECH stands out for having an extensive renowned group of experts in Artificial Intelligence, which ensure an updated and functional learning that conforms this program. These professionals in charge of directing this program have recognized experience in this field, in which they have proposed innovative solutions to institutions of international prestige. All this is a guarantee for students who wish to obtain an advanced education from the best.

Specialize with the best! The diversity of talents and knowledge of the teaching staff will generate a dynamic learning environment"

Management

Dr. Peralta Martín-Palomino, Arturo

- CEO and CTO at Prometeus Global Solutions
- CTO at Korporate Technologies
- CTO at AI Shepherds 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 program will provide students with a solid understanding of Machine Learning. Designed by experts in the field, the curriculum will delve into both the development of algorithms and models that will allow machines to focus on patterns and perform tasks without having been specifically programmed for such work. The syllabus will also delve into Neural Networks, given their importance for training models to perform tasks such as natural language processing. On the other hand, the training will offer advanced strategies of space exploration-exploitation for genetic algorithms.

You will delve into Graph Algorithms to solve a variety of problems involving relationships and connections between elements"

Module 1. Fundamentals of Artificial Intelligence

1.1. History of Artificial Intelligence
- 1.1.1. When Did People Begin Talking About Artificial Intelligence?
- 1.1.2. References in Cinema
- 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 Terminology
  - 1.2.1.1. Player
  - 1.2.1.2. States
  - 1.2.1.3. Actions or Moves
  - 1.2.1.4. Rules
  - 1.2.1.5. Terminal States
  - 1.2.1.6. Utility or Reward Function
  - 1.2.1.7. Strategy
- 1.2.2. Classification of Games in AI
  - 1.2.2.1. According to Available Information
  - 1.2.2.2. According to the Existence of Chance
  - 1.2.2.3. According to the Number of Players
  - 1.2.2.4. According to the Outcome
  - 1.2.2.5. According to the Sequence of Moves
- 1.2.3. Game Theory
- 1.2.4. Two-Player Games
  - 1.2.4.1. Deterministic Games
  - 1.2.4.2. Perfect Information Games
  - 1.2.4.3. Turn-Based Games
  - 1.2.4.4. Two-Player Games
  - 1.2.4.5. Classic Examples
- 1.2.5. Game Trees
  - 1.2.5.1. Tree Structure
  - 1.2.5.2. Tree Depth
  - 1.2.5.3. MAX and MIN Levels
  - 1.2.5.4. Evaluation Function

1.3. Neural Networks
- 1.3.1. Biological Foundations
- 1.3.2. Computational Model
- 1.3.3. Supervised and Unsupervised Neural Networks
  - 1.3.3.1. Supervised Networks
  - 1.3.3.2. Unsupervised Networks
- 1.3.4. Single-Layer Perceptron
- 1.3.5. Multilayer Perceptron

1.4. Genetic Algorithms
- 1.4.1. History
- 1.4.2. Biological Basis
- 1.4.3. Problem Encoding
- 1.4.4. Generation of the Initial Population
- 1.4.5. Main Algorithm and Genetic Operators
  - 1.4.5.1. General Structure of the Algorithm
  - 1.4.5.2. Genetic Operators
  - 1.4.5.3. Representation of the Algorithm Pseudocode
- 1.4.6. Evaluation of Individuals (Fitness)
- 1.4.7. Applications
  - 1.4.7.1. Engineering and Optimization
  - 1.4.7.2. Computer Science and Data Science
  - 1.4.7.3. Economics, Finance, and Logistics
  - 1.4.7.4. Computational Biology

1.5. Introduction to Intelligent Agents: Types and Characteristics
- 1.5.1. Vocabularies
- 1.5.2. Taxonomies
- 1.5.3. Thesauri
- 1.5.4. Ontologies

1.6. Semantic Web and Ontological Representation
- 1.6.1. Introduction: Semantic Web
  - 1.6.1.1. Fundamental Principles
  - 1.6.1.2. Semantic Web Architecture and Layers
  - 1.6.1.3 . Advantages of the Semantic Web

1.6.2. RDF and RDFS: Resource Description
1.6.2.1. RDF Schema (RDFS)
1.6.2.2. Importance of RDF and RDFS
1.6.3. OWL: Ontology Language
1.6.3.1. OWL Levels
1.6.3.2. OWL Components
1.6.3.3. Reasoning and Inference
1.6.4. SPARQL and Semantic Queries
1.6.4.1. Basic Structure of a SPARQL Query
1.6.4.2. Query Storage and Execution
1.6.5. Applications of the Semantic Web
1.6.5.1. Government and Open Data
1.6.5.2. Health Sciences and Biology
1.6.5.3. Industry and E-Commerce
1.6.5.4. Education and Research
1.6.5.5. Linked Data Web
1.7. Expert Systems and DSS
1.7.1. Expert Systems
1.7.1.1. Extended Characteristics of Expert Systems
1.7.1.2. Main Components (Expanded)
1.7.1.3. Knowledge Representation Techniques
1.7.2. Inference Mechanisms
1.7.2.1. Forward Chaining
1.7.2.2. Backward Chaining
1.7.2.3. Expanded Reasoning Cycle
1.7.3. Decision Support Systems (DSS)
1.7.3.1. Expanded Components of a DSS
1.7.3.2. Expanded Types of DSS
1.7.4. Expanded Applications
1.8. Chatbots and Virtual Assistants
1.8.1. Types of Assistants
1.8.2. Voice Assistants
1.8.3. Text-Based Assistants
1.8.4. Fundamental Components for Assistant Development
1.8.5. *Intents*
1.8.6. Entities
1.8.7. Dialog Flow
1.8.8. Integrations: Web, Slack, WhatsApp, Facebook
1.8.9. Some Tools for Assistant Development: Dialogflow, Watson Assistant
1.8.10 Bibliography
1.9. AI Implementation Strategies
1.9.1. A Strategic Plan as a Pillar for Responsible Implementation
1.9.2. Keys to Implementing AI
1.9.3. AI Implementation Guide
1.9.4. Helpful Tips for AI Implementation
1.10. The Future of Artificial Intelligence
1.10.1. Reflections
1.10.2. Examples
1.10.3. Possibilities

Module 2. Data in Artificial Intelligence

2.1. Data Science and Automated Decision-Making
2.1.1. Data Science
2.1.1.1. Programming Languages for Data Analysis
2.1.1.2. Most Widely Used Languages
2.1.2. Advanced Tools for Data Scientists
2.1.2.1. Evolution of Python
2.1.2.2. Characteristics of Python
2.1.2.3. Python Installation
2.1.2.4. Other Tools: Anaconda

2.2. Data, Information and Knowledge
- 2.2.1. Data, Information and Knowledge
- 2.2.2. Types of Data
- 2.2.3. Basic Data Types
- 2.2.4. Complex Data Types
- 2.2.5. Operations by Type
- 2.2.6. Control Structures
- 2.2.7. Data Sources

2.3. From Data to Information
- 2.3.1. Data Analysis
- 2.3.2. Types of Analysis
- 2.3.3. Extracting Information from a Dataset
  - 2.3.3.1. Main Statistical Summaries
  - 2.3.3.2. Univariate Analysis
  - 2.3.3.3. Multivariate Analysis

2.4. Data Visualization and Explainability of AI Models
- 2.4.1. Visualization as an Analysis Tool
- 2.4.2. Visualization Methods
- 2.4.3. Visualization of a Dataset
  - 2.4.3.1. Univariate Analysis
  - 2.4.3.2. Multivariate Analysis

2.5. Data Quality and Bias Detection in AI
- 2.5.1. High-Quality Data
- 2.5.2. Data Cleaning
  - 2.5.2.1. Duplicate Value Analysis
  - 2.5.2.2. Missing Value Analysis
  - 2.5.2.3. Outlier Analysis
- 2.5.3. Basic Data Preprocessing
  - 2.5.3.1. Influence and Relationship Between Variables
  - 2.5.3.2. Conversion of Categorical Variables

2.6. Datasets and Synthetic Data Generation
- 2.6.1. Dataset Enrichment
- 2.6.2. The Curse of Dimensionality
- 2.6.3. Modification of Our Data Set

2.7. Class Imbalance and Rebalancing Techniques
- 2.7.1. Class Imbalance
- 2.7.2. Class Imbalance Mitigation Techniques
- 2.7.3. Balancing a Dataset
  - 2.7.3.1. Weight Adjustment
  - 2.7.3.2. Undersampling
  - 2.7.3.3. Resampling

2.8. Unsupervised Models
- 2.8.1. Unsupervised Models
- 2.8.2. Methods
- 2.8.3. Classification with Unsupervised Models

2.9. Supervised Models
- 2.9.1. Supervised Models
- 2.9.2. Methods
- 2.9.3. Classification with Supervised Models
  - 2.9.3.1. Modeling Phases
  - 2.9.3.2. Dataset Splitting
  - 2.9.3.3. Metrics
  - 2.9.3.4. Application of Techniques

2.10. Tools and Best Practices
- 2.10.1. Best Practices for Data Scientists
- 2.10.2. The Best Model
- 2.10.3. Useful Tools

Module 3. Data Mining: Selection, Preprocessing and Transformation

3.1. Statistical Inference
- 3.1.1. Descriptive Statistics vs. Statistical Inference
- 3.1.2. Parametric Procedures
- 3.1.3. Non-Parametric Procedures

3.2. Exploratory Analysis to Identify Biases and Patterns in AI Data
- 3.2.1. Descriptive Analysis
- 3.2.2. Visualization
- 3.2.3. Data Preparation

3.3. Data Preparation
- 3.3.1. Data Integration and Data Cleaning
- 3.3.2. Data Normalization
- 3.3.3. Transforming Attributes

3.4. Missing Values and Their Treatment in Model Training
- 3.4.1. Handling Missing Values
- 3.4.2. Maximum Likelihood Imputation Methods
- 3.4.3. Missing Value Imputation Using Machine Learning

3.5. Noise in Data and Its Influence on Algorithm Accuracy
- 3.5.1. Classes of Noise and Attributes
- 3.5.2. Noise Filtering
- 3.5.3. The Effect of Noise

3.6. The Curse of Dimensionality and Reduction Techniques for AI
- 3.6.1. *Oversampling*
- 3.6.2. *Undersampling*
- 3.6.3. Multidimensional Data Reduction

3.7. From Continuous to Discrete Attributes
- 3.7.1. Continuous vs. Discrete Data
- 3.7.2. Discretization Process

3.8. Data
- 3.8.1. Data Selection
- 3.8.2. Selection Perspectives and Criteria
- 3.8.3. Selection Methods

3.9. Instance Selection
- 3.9.1. Methods for Instance Selection
- 3.9.2. Prototype Selection
- 3.9.3. Advanced Methods for Instance Selection

3.10. Data Processing in Big Data Environments
- 3.10.1. *Big Data*
- 3.10.2. "Classical" vs. Massive Preprocessing
- 3.10.3. Smart Data

Module 4. Intelligent Systems

4.1. Agent Theory
- 4.1.1. Agents
- 4.1.2. Agents in Artificial Intelligence
- 4.1.3. Agents in Software Engineering

4.2. Agent Architectures
- 4.2.1. The Reasoning Process of an Agent
- 4.2.2. Reactive Agents
- 4.2.3. Deliberative Agents
- 4.2.4. Hybrid Agents
- 4.2.5. Comparison

4.3. Representation of Information and Knowledge
- 4.3.1. Distinction Between Data, Information, and Knowledge
- 4.3.2. Data Quality Assessment
- 4.3.3. Data Collection Methods
- 4.3.4. Information Acquisition Methods
- 4.3.5. Knowledge Acquisition Methods

4.4. Explainable AI (XAI): Principles, Tools, and Application in Intelligent Systems
- 4.4.1. Introduction to Metadata
- 4.4.2. Philosophical Concept of Ontology
- 4.4.3. Computing Concept of Ontology
- 4.4.4. Domain Ontologies and Upper-Level Ontologies
- 4.4.5. How to Build an Ontology

4.5. Ontologies
- 4.5.1. Introduction to Metadata
- 4.5.2. Philosophical Concept of Ontology
- 4.5.3. Computational Concept of Ontology
- 4.5.4. Domain Ontologies and Upper-Level Ontologies
- 4.5.5. How to Build an Ontology

4.6. Ontology Languages and Software for Ontology Creation
- 4.6.1. RDF Triples, Turtle, and N3
- 4.6.2. RDF Schema
- 4.6.3. OWL
- 4.6.4. SPARQL
- 4.6.5. Introduction to Different Tools for Ontology Creation
- 4.6.6. Installation and Use of Protégé

4.7. Semantic Web
- 4.7.1. The Current and Future State of the Semantic Web
- 4.7.2. Applications of the Semantic Web

4.8. Other Knowledge Representation Models
- 4.8.1. Vocabularies
- 4.8.2. Global Vision
- 4.8.3. Taxonomies
- 4.8.4. Thesauri
- 4.8.5. Folksonomies
- 4.8.6. Comparison Structure
- 4.8.7. Mind Maps

4.9. Evaluation and Integration of Knowledge Representations
- 4.9.1. Zero-Order Logic
- 4.9.2. First-Order Logic
- 4.9.3. Description Logic
- 4.9.4. Relationship between Different Types of Logic
- 4.9.5. Prolog: Programming Based on First-Order Logic

4.10. Semantic Reasoners, Knowledge-Based Systems and Expert Systems
- 4.10.1. Concept of Reasoner
- 4.10.2. Applications of a Reasoner
- 4.10.3. Knowledge-Based Systems
- 4.10.4. MYCIN: History of Expert Systems
- 4.10.5. Elements and Architecture of Expert Systems
- 4.10.6. Creation of Expert Systems

Module 5. Machine Learning

5.1. Knowledge in Databases and Its Extraction Through AI Techniques
- 5.1.1. Data Preprocessing
- 5.1.2. Analysis
- 5.1.3. Interpretation and Evaluation of the Results

5.2. *Machine Learning*
- 5.2.1. Supervised and Unsupervised Learning
- 5.2.2. Reinforcement Learning
- 5.2.3. Semi-Supervised Learning and Other Learning Models

5.3. Classification
- 5.3.1. Decision Trees and Rule-Based Learning
- 5.3.2. Support Vector Machines (SVM) and K-Nearest Neighbors (KNN) Algorithms
- 5.3.3. Metrics for Classification Algorithms

5.4. Regression
- 5.4.1. Linear and Logistic Regression
- 5.4.2. Non-Linear Regression Models
- 5.4.3. Time Series Analysis
- 5.4.4. Metrics for Regression Algorithms

5.5. *Clustering*
- 5.5.1. Hierarchical Clustering
- 5.5.2. Partitioning Clustering
- 5.5.3. Metrics for Clustering Algorithms

5.6. Association Rules
- 5.6.1. Definition and Measures of Interest
- 5.6.2. Rule Extraction Methods
- 5.6.3. Metrics for Association Rule Algorithms

5.7. Ensemble Models and Model Combination Strategies
- 5.7.1. Bootstrap Aggregation ("Bagging")
- 5.7.2. Random Forest Algorithm
- 5.7.3. Boosting Algorithm

5.8. Probabilistic Reasoning Models
- 5.8.1. Probabilistic Reasoning
- 5.8.2. Bayesian Networks or Belief Networks
- 5.8.3. Hidden Markov Models

5.9. Multilayer Perceptron
- 5.9.1. Neural Network
- 5.9.2. Machine Learning with Neural Networks
- 5.9.3. Gradient Descent, Backpropagation, and Activation Functions
- 5.9.4. Implementation of an Artificial Neural Network

5.10. Deep Learning and Advanced Neural Architectures
- 5.10.1. Deep Neural Networks. Introduction
- 5.10.2. Convolutional Neural Networks
- 5.10.3. *Sequence Modelling*
- 5.10.4. Tensorflow and PyTorch

Module 6. Neural Networks: The Foundation of Deep Learning

6.1. Deep Learning
- 6.1.1. Types of Deep Learning
- 6.1.2. Applications of Deep Learning
- 6.1.3. Advantages and Disadvantages of Deep Learning

6.2. Operations
- 6.2.1. Addition
- 6.2.2. Subtraction
- 6.2.3. Translation

6.3. Layers
- 6.3.1. Input Layer
- 6.3.2. Hidden Layer
- 6.3.3. Output Layer

6.4. Combining Layers and Operations
- 6.4.1. Architecture Design
- 6.4.2. Connections Between Layers
- 6.4.3. Forward Propagation

6.5. Building the First Neural Network
- 6.5.1. Network Design
- 6.5.2. Setting the Weights
- 6.5.3. Training the Network

6.6. Trainer, Optimizer, and Loss Function in the Learning Process
- 6.6.1. Optimizer Selection
- 6.6.2. Defining a Loss Function
- 6.6.3. Defining a Metric

6.7. Application of Neural Network Principles
- 6.7.1. Activation Functions
- 6.7.2. Backpropagation
- 6.7.3. Parameter Adjustment

6.8. From Biological to Artificial Neurons
- 6.8.1. How a Biological Neuron Works
- 6.8.2. Knowledge Transfer to Artificial Neurons
- 6.8.3. Establishing Relationships Between Both

6.9. Implementation of an MLP (Multilayer Perceptron) with Keras and Model Evaluation
- 6.9.1. Definition of the Network Structure
- 6.9.2. Model Compilation
- 6.9.3. Model Training

6.10. Neural Network Fine-Tuning Hyperparameters
- 6.10.1. Selection of the Activation Function
- 6.10.2. Set the Learning Rate
- 6.10.3. Weight Adjustment

Module 7. Deep Neural Network Training

7.1. Gradient Problems and Solutions in Deep Networks
- 7.1.1. Gradient Optimization Techniques
- 7.1.2. Stochastic Gradients
- 7.1.3. Weight Initialization Techniques

7.2. Reuse of Pretrained Layers
- 7.2.1. Transfer Learning Training
- 7.2.2. Feature Extraction
- 7.2.3. Deep Learning

7.3. Optimizers and Their Impact on Model Convergence
- 7.3.1. Stochastic Gradient Descent Optimizers
- 7.3.2. Adam and RMSprop Optimizers
- 7.3.3. Momentum Optimizers

7.4. Learning Rate Scheduling
- 7.4.1. Automatic Learning Rate Control
- 7.4.2. Learning Cycles
- 7.4.3. Smoothing Terms

7.5. Overfitting
- 7.5.1. Cross-Validation
- 7.5.2. Regularization
- 7.5.3. Evaluation Metrics

7.6. Practical Guidelines
- 7.6.1. Model Design
- 7.6.2. Selection of Metrics and Evaluation Parameters
- 7.6.3. Hypothesis Testing

7.7. *Transfer Learning*
- 7.7.1. Transfer Learning Training
- 7.7.2. Feature Extraction
- 7.7.3. Deep Learning

7.8. *Data Augmentation*
- 7.8.1. Image Transformations
- 7.8.2. Synthetic Data Generation
- 7.8.3. Text Transformation

7.9. Practical Application of Transfer Learning
- 7.9.1. Transfer Learning Training
- 7.9.2. Feature Extraction
- 7.9.3. Deep Learning

7.10. Regularization
- 7.10.1. L1 and L2
- 7.10.2. Maximum Entropy Regularization
- 7.10.3. *Dropout*

Module 8. Model Customization and Training with TensorFlow

8.1. TensorFlow
- 8.1.1. Using the TensorFlow Library
- 8.1.2. Model Education with TensorFlow
- 8.1.3. Operations with Graphs in TensorFlow

8.2. TensorFlow and NumPy
- 8.2.1. NumPy Computational Environment for TensorFlow
- 8.2.2. Using NumPy Arrays with TensorFlow
- 8.2.3. NumPy Operations for TensorFlow Graphs

8.3. Model Customization and Training Algorithms
- 8.3.1. Building Custom Models with TensorFlow
- 8.3.2. Management of Training Parameters
- 8.3.3. Use of Optimization Techniques for Training

8.4. TensorFlow Functions and Graphs
- 8.4.1. Functions with TensorFlow
- 8.4.2. Use of Graphs for Model Training
- 8.4.3. Optimization of Graphs with TensorFlow Operations

8.5. Data Loading and Preprocessing with TensorFlow
- 8.5.1. Loading Datasets with TensorFlow
- 8.5.2. Data Preprocessing with TensorFlow
- 8.5.3. Using TensorFlow Tools for Data Manipulation

8.6. The tf.data API and TFRecord Format
- 8.6.1. Using the tf.data API for Data Processing
- 8.6.2. Constructing Data Streams with tf.data
- 8.6.3. Use of the tf.data API for Training Models

8.7. Using TensorFlow in Generative Models: GANs and Autoencoders
- 8.7.1. Using the TFRecord API for Data Serialization
- 8.7.2. Loading TFRecord Files with TensorFlow
- 8.7.3. Using TFRecord Files for Training Models

8.8. Keras Preprocessing Layers
- 8.8.1. Using the Keras Preprocessing API
- 8.8.2. Construction of Pre-Processing Pipelined with Keras
- 8.8.3. Using the Keras Pre-Processing API for Model Training

8.9. The TensorFlow Datasets Project
- 8.9.1. Using TensorFlow Datasets for Data Loading
- 8.9.2. Data Pre-Processing with TensorFlow Datasets
- 8.9.3. Using TensorFlow Datasets for Model Training

8.10. Building a Deep Learning Application with TensorFlow: Practical Application
- 8.10.1. Building a Deep Learning Application with TensorFlow
- 8.10.2. Training a Model with TensorFlow
- 8.10.3. Using the Application for the Prediction of Results

Module 9. Natural Language Processing (NLP)

9.1. Text Generation Using RNN
- 9.1.1. Training an RNN for Text Generation
- 9.1.2. Natural Language Generation with RNN
- 9.1.3. Text Generation Applications with RNN

9.2. Training Data Set Creation
- 9.2.1. Preparation of the Data for Training an RNN
- 9.2.2. Storage of the Training Dataset
- 9.2.3. Data Cleaning and Transformation

9.3. Classification of Opinions with RNN
- 9.3.1. Classification of Opinions with RNN
- 9.3.2. Detection of Themes in Comments
- 9.3.3. Sentiment Analysis with Deep Learning Algorithms

9.4. Encoder-Decoder Networks for Neural Machine Translation
- 9.4.1. Training an RNN for Machine Translation
- 9.4.2. Using an Encoder-Decoder Network for Machine Translation
- 9.4.3. Improving the Accuracy of Machine Translation with RNNs

9.5. Attention Mechanisms
- 9.5.1. Application of Care Mechanisms in RNN
- 9.5.2. Use of Care Mechanisms to Improve the Accuracy of the Models
- 9.5.3. Advantages of Attention Mechanisms in Neural Networks

9.6. Transformer models
- 9.6.1. Use of Transformers Models for Natural Language Processing
- 9.6.2. Application of Transformers Models for Vision
- 9.6.3. Advantages of Transformers Models

9.7. Transformers for Vision
- 9.7.1. Use of Transformers models for vision
- 9.7.2. Image Data Preprocessing
- 9.7.3. Training of a Transformer model for vision

9.8. Hugging Face Transformer Library
- 9.8.1. Using the Hugging Face Transformers Library
- 9.8.2. Application of the Hugging Face Transformers Library
- 9.8.3. Advantages of the Hugging Face Transformers library

9.9. Comparison of Transformer Libraries: Selection Criteria and Performance
- 9.9.1. Comparison of Different Transformer Libraries
- 9.9.2. Use of Other Libraries
- 9.9.3. Advantages of Other Transformer Libraries

9.10. Development of an NLP Application Combining RNNs, Attention Mechanisms, and Transformers
- 9.10.1. Development of a Natural Language Processing Application with RNNs and Attention Mechanisms
- 9.10.2. Use of RNNs, Attention Mechanisms, and Transformer Models in the Application
- 9.10.3. Evaluation of the Practical Application

Module 10. Bioinspired Computing

10.1. Introduction to Bioinspired Computing
- 10.1.1. Definition of Bioinspired Algorithms: Main Characteristics Main Features
- 10.1.2. Methodology of Bioinspired Algorithms
- 10.1.3. Application

10.2. Social Adaptation Algorithms
- 10.2.1. Bioinspired Computation Based on Ant Colonies
- 10.2.2. Variants of Ant Colony Algorithms
- 10.2.3. Particle Cloud Computing

10.3. Genetic Algorithms
- 10.3.1. General Structure
- 10.3.2. Implementations of the Major Operators

10.4. Exploration-Exploitation Strategies in Genetic Algorithms
- 10.4.1. CHC Algorithm
- 10.4.2. Multimodal Problems

10.5. Evolutionary Computing Models (I)
- 10.5.1. Evolutionary Strategies
- 10.5.2. Evolutionary Programming
- 10.5.3. Algorithms Based on Differential Evolution

10.6. Evolutionary Computation Models (II)
- 10.6.1. Evolutionary Models Based on Estimation of Distributions (EDA)
- 10.6.2. Genetic Programming

10.7. Evolutionary Programming Applied to Learning Problems
- 10.7.1. Rules-Based Learning
- 10.7.2. Evolutionary Methods in Instance Selection Problems

10.8. Multi-Objective Problems
- 10.8.1. Concept of Dominance
- 10.8.2. Application of Evolutionary Algorithms to Multi-Objective Problems

10.9. Evolutionary Optimization of Neural Networks
- 10.9.1. Evolutionary Optimization of Neural Networks
- 10.9.2. Neuroevolution of Topologies: Advanced Algorithms and Methodologies
- 10.9.3. Practical Applications and Success Stories
- 10.9.4. Challenges, Future Directions, and Their Intersection with Deep Learning

10.10. Hybrid Neuro-Evolutionary Models
- 10.10.1. Fundamentals and Motivation for Hybridization
- 10.10.2. Neuro-Evolutionary Hybridization Strategies
- 10.10.3. Common Architectures and Frameworks
- 10.10.4. Integration of Evolutionary Algorithms and Neural Networks
- 10.10.5. Implementation and Practical Considerations
- 10.10.6. Applications and Advanced Use Cases
- 10.10.7. Challenges and Future Directions

You will achieve your objectives thanks to TECH's teaching tools, including explanatory videos and interactive summaries"

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 has been the most widely used learning system among the world's leading Information Technology schools for as long as they have existed. 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 course, students 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

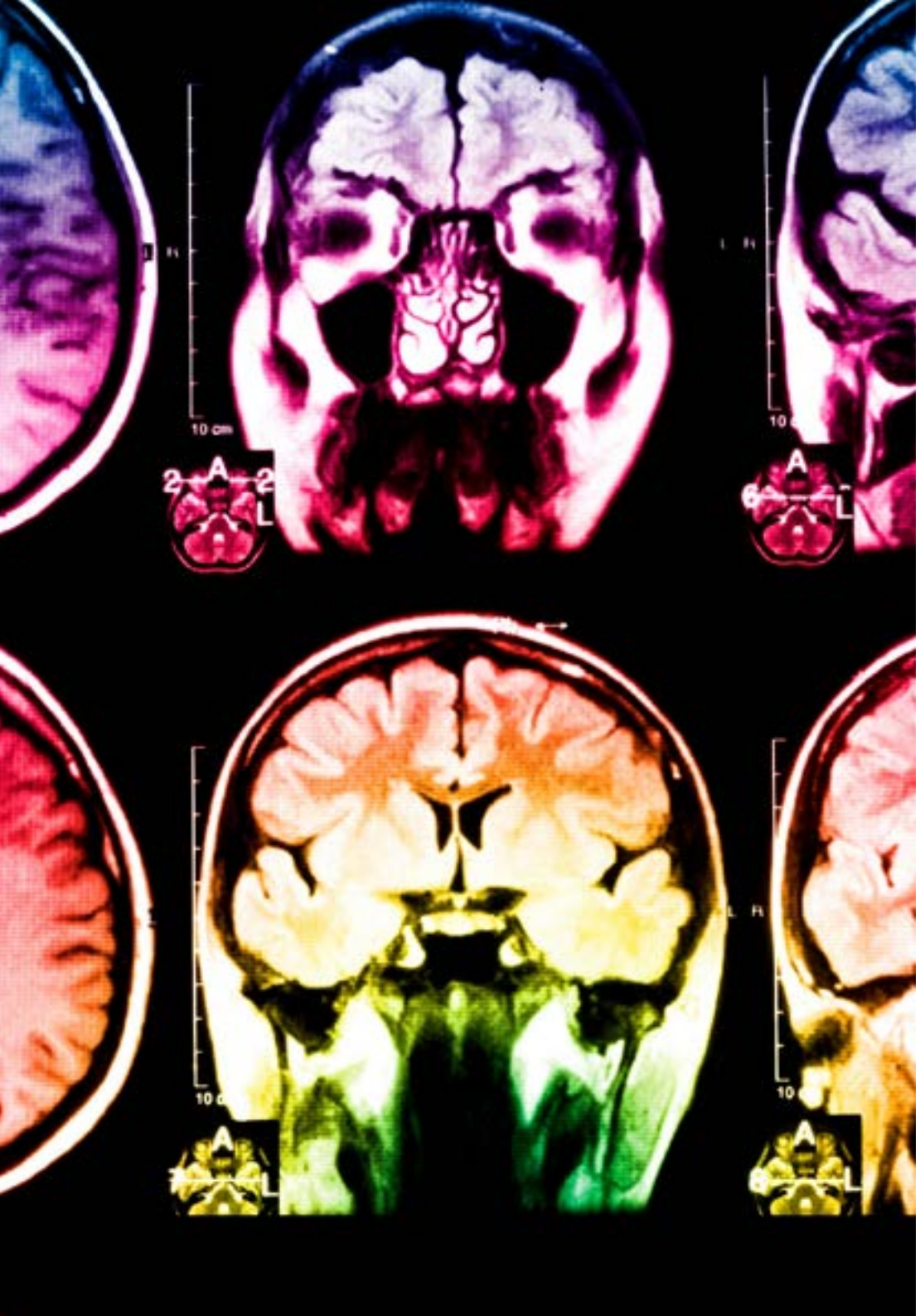
TECH effectively combines the Case Study methodology with a 100% online learning system based on repetition, which combines different teaching elements in each lesson.

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.

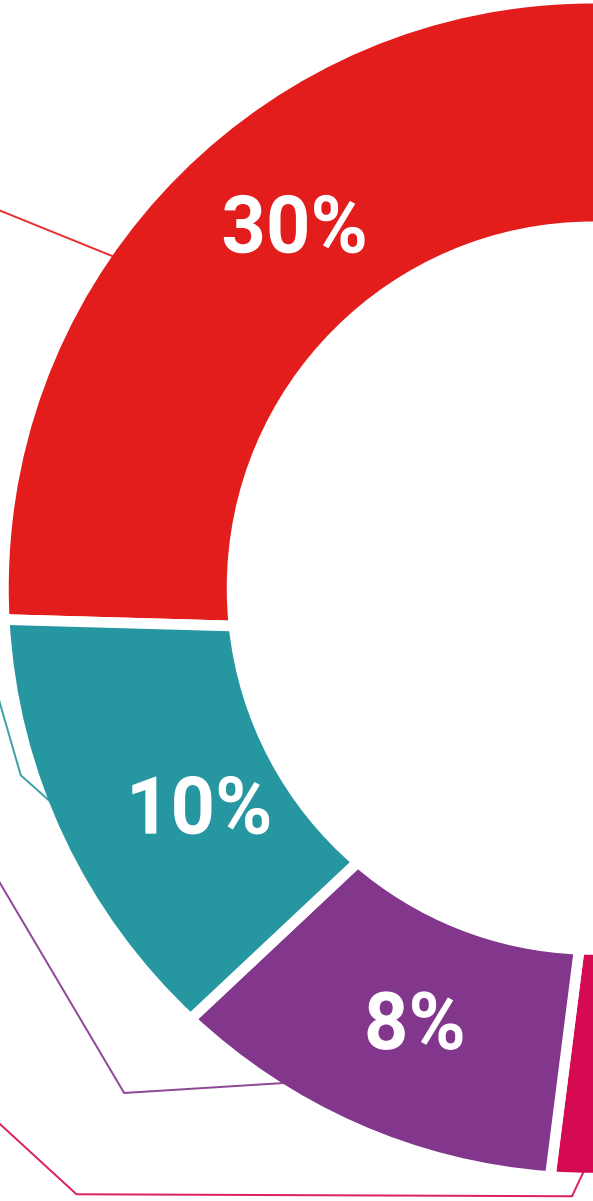
Learning from an Expert strengthens knowledge and memory, and generates confidence in future difficult decisions.

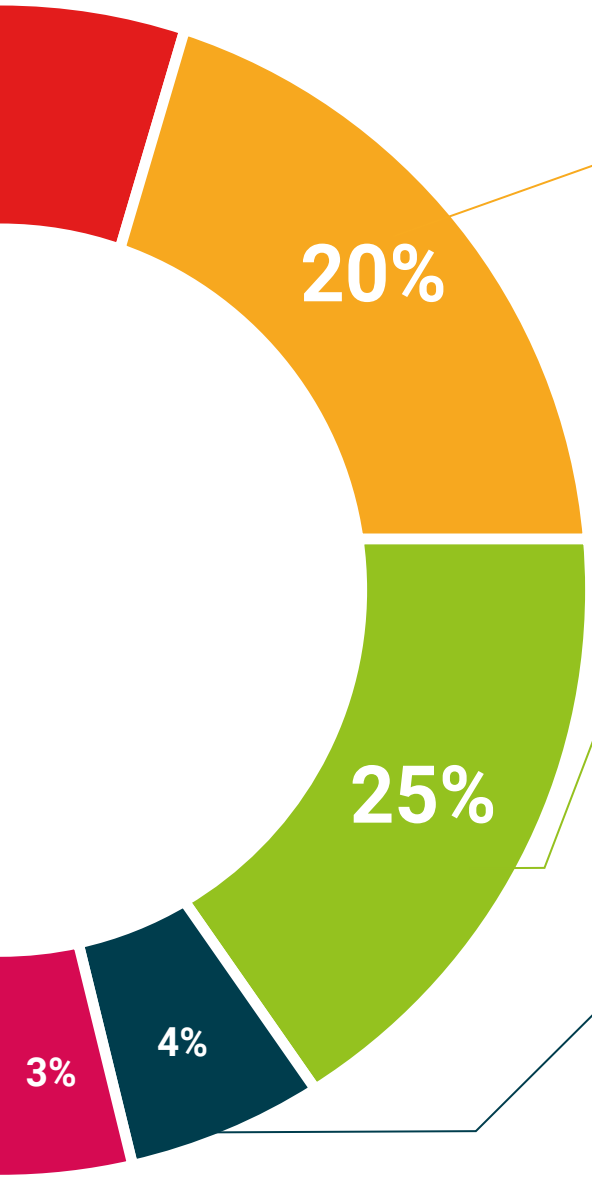
Practising Skills and Abilities

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

Modality: **online**

Duration: **12 months**

Accreditation: **60 ECTS**


tech global university

Mr./Ms. _____, with identification document _____
has successfully passed and obtained the title of:

Master's Degree in Artificial Intelligence

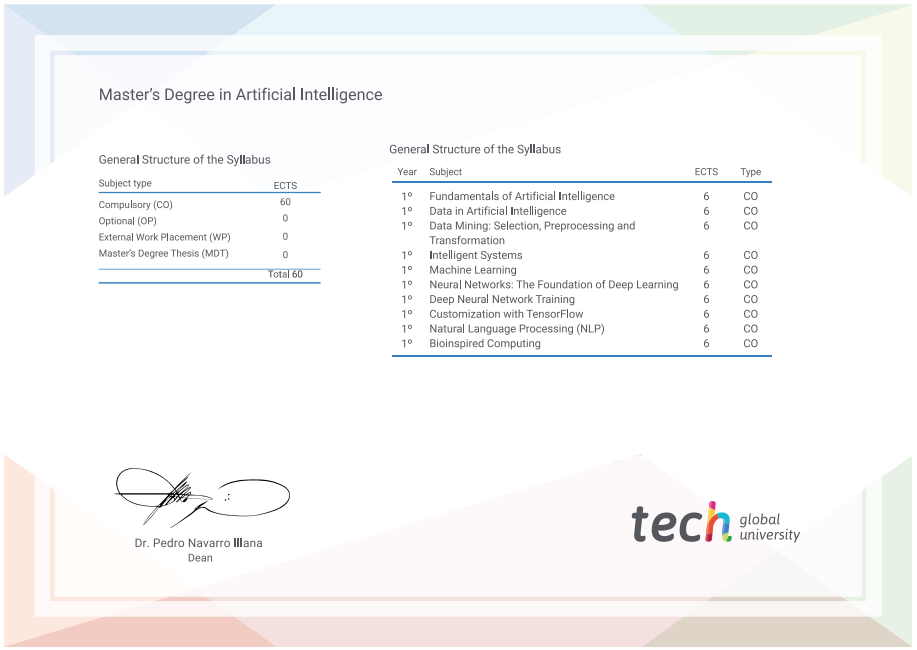
This is a private qualification of 1,800 hours of duration equivalent to 60 ECTS, with a start date of dd/mm/yyyy and an end date of dd/mm/yyyy.

TECH Global University is a university officially recognized by the Government of Andorra on the 31st of January of 2024, which belongs to the European Higher Education Area (EHEA).

In Andorra la Vella, on the 28th of February of 2024

Dr. Pedro Navarro Illana
Dean

Unique TECH Code: AFWORD23S techtitute.com/certificates


Master's Degree in Artificial Intelligence

General Structure of the Syllabus

Subject type	ECTS
Compulsory (CO)	60
Optional (OP)	0
External Work Placement (WP)	0
Master's Degree Thesis (MDT)	0
	Total 60

General Structure of the Syllabus

Year	Subject	ECTS	Type
1º	Fundamentals of Artificial Intelligence	6	CO
1º	Data in Artificial Intelligence	6	CO
1º	Data Mining: Selection, Preprocessing and Transformation	6	CO
1º	Intelligent Systems	6	CO
1º	Machine Learning	6	CO
1º	Neural Networks: The Foundation of Deep Learning	6	CO
1º	Deep Neural Network Training	6	CO
1º	Customization with TensorFlow	6	CO
1º	Natural Language Processing (NLP)	6	CO
1º	Bioinspired Computing	6	CO

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Dean

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*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.

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Master's Degree
Artificial Intelligence

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

Master's Degree
Artificial Intelligence

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