# Professional Master's Degree
## Artificial Intelligence in Architecture

tech global university

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## Artificial Intelligence in Architecture

- Modality: **online**
- Duration: **12 months**
- Certificate: **TECH Global University**
- Accreditation: **90 ECTS**
- Schedule: **at your own pace**
- Exams: **online**

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

# Index

01

# Introduction

Artificial Intelligence (AI) is revolutionizing architecture by introducing tools to optimize the design, planning and construction of buildings. In fact, there is a growing use of machine learning algorithms to generate architectural models, which not only maximize energy efficiency and sustainability, but also explore new aesthetic forms. It is also facilitating the creation of more inclusive spaces tailored to human needs, using data on user behavior and preferences to personalize the built environment. In this context, TECH has developed a completely virtual program, which adapts to the individual and work schedules of the graduates. In addition, it employs an innovative learning methodology known as Relearning, which is unique to this university.

*This 100% online Professional Master's Degree will allow you to optimize design and construction processes through tools such as generative modeling, predictive simulation and energy efficiency based on AI"*

Artificial Intelligence (AI) is rapidly transforming architecture, offering new tools to design, plan and construct buildings more efficiently and sustainably. The use of AI in architecture has expanded, allowing architects to optimize designs through advanced simulations that take into account variables such as natural light, ventilation and energy consumption.

This is how this Professional Master's Degree was created, designed to train architects in the use of advanced technologies to revolutionize the design and construction process. In this sense, it will analyze how Artificial Intelligence can optimize and transform traditional architectural practice. Through the use of tools such as AutoCAD and Fusion 360, as well as an introduction to generative modeling and parametric design, professionals will be able to integrate these innovations into their projects.

Likewise, the use of AI for space optimization and energy efficiency, key elements in contemporary architecture, will be discussed in depth. Using tools such as Autodesk Revit and Google DeepMind, it will be possible to design more sustainable environments through data analysis and advanced energy simulations. This approach will also be complemented by the introduction of smart urban planning, addressing the demands of sustainable design in increasingly complex and urban environments.

Finally, experts will cover cutting-edge technologies such as Grasshopper, MATLAB and laser scanning tools to develop innovative and sustainable projects. In addition, through simulation and predictive modeling, they will be able to anticipate and solve structural and environmental problems before they occur

In this way, TECH has created a detailed, fully online university program, which makes it easy for graduates to access educational materials through any electronic device with an Internet connection. This eliminates the need to travel to a physical location and adapt to a specific schedule. Additionally, it integrates the revolutionary Relearning methodology, which is based on the repetition of essential concepts to improve the understanding of the content.

This **Professional Master's Degree in Artificial Intelligence in Architecture** 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 the self-assessment process can be carried out 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 position yourself at the forefront of the industry, leading innovative and sustainable projects that integrate the latest technologies, which will increase your competitiveness and opportunities in the global job market"*

*You will investigate the importance of cultural heritage preservation, using Artificial Intelligence to conserve and revitalize historic structures, thanks to an extensive library of multimedia resources"*

The program's teaching staff includes professionals from the industry who contribute their work experience to this 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 experts.

*You will master platforms such as Autodesk Revit, SketchUp and Google DeepMind, developing skills to design more sustainable and efficient environments, hand in hand with the best digital university in the world, according to Forbes.*

*You'll work with tools like Grasshopper and Autodesk Fusion 360 to create adaptive and sustainable designs, exploring the integration of robotics in construction and customization in digital fabrication.*

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# Objectives

This university program will aim to prepare professionals capable of integrating advanced Artificial Intelligence technologies in all phases of architectural design and construction. Therefore, it will train experts to optimize design processes through the use of generative modeling tools, predictive simulation and digital fabrication, with a special focus on sustainability and energy efficiency. In addition, a deep understanding of the ethical implications and responsibility associated with the use of AI will be developed, preparing architects to lead innovative projects that respond to current and future architectural challenges.

*You will design Artificial Intelligence solutions to improve the sustainability of architectural projects and significantly optimize energy consumption"*

## 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
- Manage advanced Artificial Intelligence tools to optimize architectural processes such as parametric design
- Apply Generative Modeling techniques to maximize efficiency in infrastructure planning and improve the energy performance of buildings

## Specific Objectives

### Module 1. Fundamentals of Artificial Intelligence

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

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

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

### Module 3. Data in Artificial Intelligence

- Master the fundamentals of data science, covering tools, types and sources for information analysis
- Explore the process of transforming data into information using data mining and visualization techniques
- Study the structure and characteristics of datasets, understanding their importance in the preparation and use of data for Artificial Intelligence models
- 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, Preprocessing 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 pre-processing in Big Data environments

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

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

### Module 6. Intelligent Systems

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

### Module 7. Machine Learning and Data Mining

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

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

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

### Module 9. Deep Neural Networks Training

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

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

- Master the fundamentals of TensorFlow and its integration with NumPy for efficient data management and calculations
- Customize models and training algorithms using the advanced capabilities of TensorFlow

- Explore the tfdata API to efficiently manage and manipulate datasets
- Implement the TFRecord format for storing and accessing large datasets in TensorFlow
- Use Keras preprocessing layers to facilitate the construction of custom models
- Explore the TensorFlow Datasets project to access predefined datasets and improve development efficiency
- Develop a Deep Learning application with TensorFlow, integrating the knowledge acquired in the module
- Apply in a practical way all the concepts learned in building and training custom models with TensorFlow in real-world situations

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

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

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

- Develop 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
- 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 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

### Module 16. Artificial Intelligence-Assisted Design in Architectural Practice

- Utilize AutoCAD and Fusion 360 software to create generative and parametric models that optimize the architectural design process
- Have a holistic understanding of ethical principles in the use of AI in design, ensuring that architectural solutions are both responsible and sustainable

### Module 17. Space Optimization and Energy Efficiency with Artificial Intelligence

- Implement bioclimatic design strategies and AI-assisted technologies to improve the energy efficiency of architectural initiatives
- Acquire skills in the use of simulation tools to improve energy efficiency in urban planning and architecture

**Module 18. Parametric Design and Digital Manufacturing**

- Handle tools such as Grasshopper and Autodesk 360 to create adaptive and customized designs that meet customers' expectations
- Apply topological optimization and sustainable design strategies in parametric projects

**Module 19. Simulation and Predictive Modeling with Artificial Intelligence**

- Employ programs such as TensorFlow, MATLAB or ANSYS to perform simulations that anticipate structural and environmental behavior in architectural projects
- Implement predictive modeling techniques to optimize urban planning and space management, using AI to improve accuracy and efficiency in strategic decision making

**Module 20. Heritage Preservation and Restoration with Artificial Intelligence**

- Master the use of photogrammetry and laser scanning for both documentation and conservation of architectural heritage
- Develop skills to manage cultural heritage preservation projects, considering the ethical implications and responsible use of AI

*The main objective will be to enable architects to integrate Artificial Intelligence technologies in all phases of architectural design and construction”*

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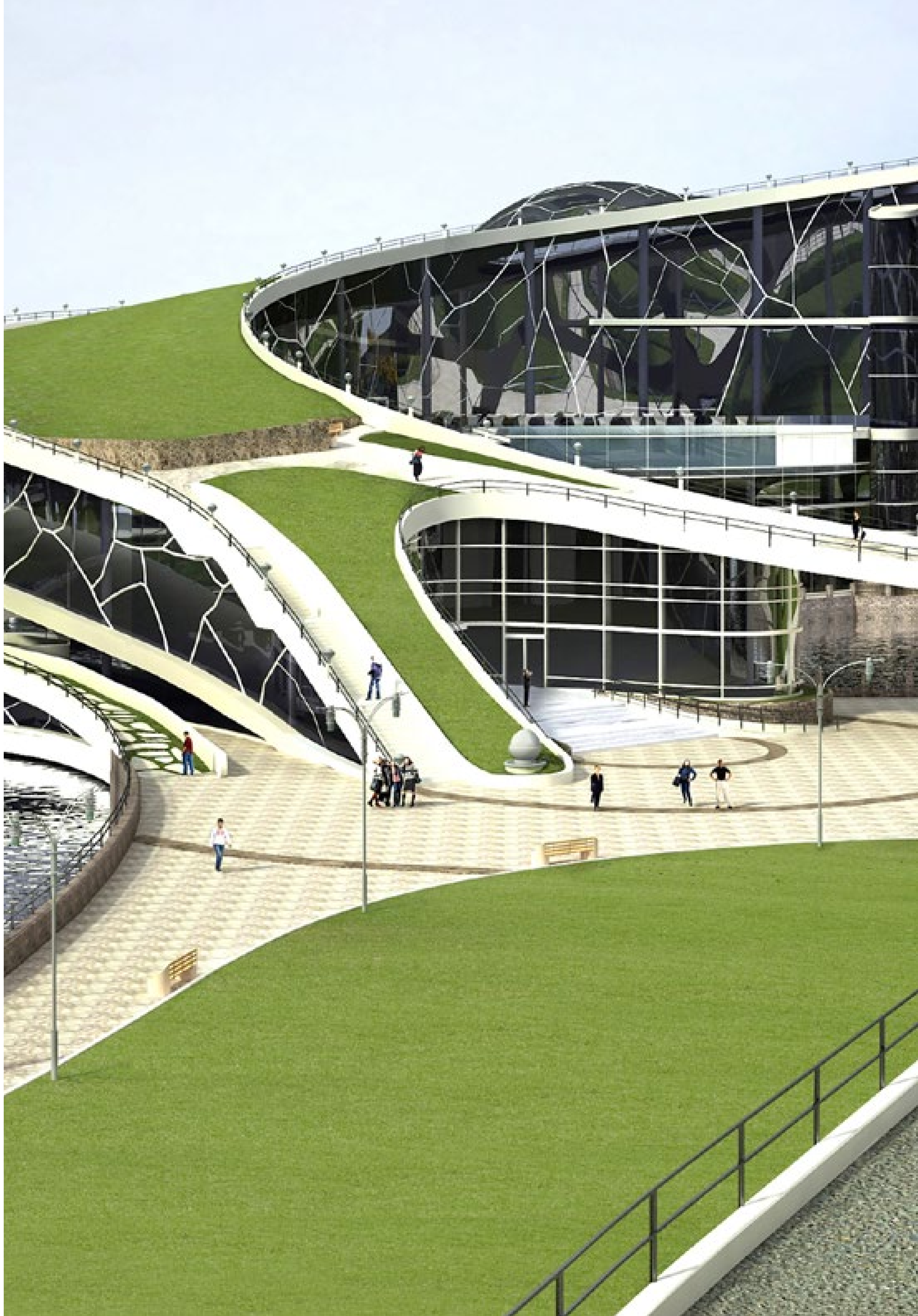
# Skills

This academic program will provide engineers with advanced competencies in the application of AI technologies to architectural design and construction. Therefore, they will develop skills to implement machine learning and data processing algorithms that optimize construction processes, improving energy efficiency and facilitating the creation of intelligent and sustainable structures. In addition, they will gain experience in the use of advanced modeling and simulation tools, enabling them to address complex challenges in urban planning and architectural project management with innovative and solution-oriented approaches.

*Interdisciplinary integration will be fostered, preparing professionals to lead multidisciplinary teams and promote technological advances in the field of modern architecture"*

## 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
- Use AutoCAD and Fusion 360 for generative modeling and design optimization
- Apply AI to improve energy efficiency and urban planning
- Master parametric design techniques and robotics in construction
- Implement advanced simulations and predictive modeling in architectural projects



## 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 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
- Use AI for the restoration and conservation of cultural heritage
- Apply ethical principles in the use of AI in architecture
- Facilitate teamwork and collective design powered by AI
- Explore emerging trends and lead digital transformation in architecture
- Integrate AI to create sustainable and adaptive architectural solutions
- Utilize advanced techniques such as photogrammetry and laser scanning for documentation and preservation

*"You will integrate Machine Learning algorithms, data analytics and predictive modeling in decision making, automating construction processes and improving the energy and structural efficiency of buildings"*

04

# Course Management

The faculty is composed of renowned professionals in the fields of Engineering, Architecture and Artificial Intelligence. In fact, they combine a solid academic background with extensive practical experience in cutting-edge projects, where they have applied AI technologies to revolutionize the design and construction of infrastructures. As a result, graduates will benefit from the experience of experts who have led innovations in the automation of architectural processes, the optimization of resources and the integration of intelligent systems in built environments.

*The faculty will provide advanced technical knowledge, offering a strategic vision of the future of architecture, preparing you to face the challenges and opportunities of a sector in constant evolution"*

## 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
- Master's Degree in Executive MBA from the Isabel I University
- 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



## Professors

### Mr.  Peralta Vide, Javier

- Technological Coordinator and Content Developer at Aranzadi Laley Formación
- Collaborator at CanalCreativo
- Collaborator at Dentsu
- Collaborator at Ai2
- Collaborator at BoaMistura
- Freelance Architect at Editorial Nivola, Biogen Technologies, Releaf, etc.
- Specialization by Revit Architecture Metropa School
- Degree in Architecture and Urbanism from the University of Alcalá

### Ms. Martínez Cerrato, Yésica

- Responsible for Technical Training at Securitas Seguridad España
- Education, Business and Marketing Specialist
- Product Manager in Electronic Security at Securitas Seguridad España
- Business Intelligence Analyst at Ricopia Technologies
- Computer Technician and Responsible for OTEC computer classrooms at the University of Alcalá de Henares
- Collaborator in the ASALUMA Association
- Degree in Electronic Communications Engineering at the Polytechnic School, University of Alcalá de Henares

05

# Structure and Content

The program will cover from the basics of Artificial Intelligence and Machine Learning, to advanced techniques of predictive modeling and analysis of massive data applied to architectural design. Therefore, engineers will master simulation and automation tools to optimize construction processes, improving energy efficiency and sustainability. In addition, modules on the use of algorithms for intelligent project management, the creation of virtual environments and the development of adaptive and innovative architectural solutions will be included.

*The Professional Master's Degree in Artificial Intelligence in Architecture will offer a comprehensive and specialized content, designed for engineers interested in applying cutting-edge technologies in the architectural field"*

## **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 Its 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. 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
2.10. Regulatory Framework
2.10.1. Data Protection Law
2.10.2. Good Practices
2.10.3. Other Regulatory 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. Discreet 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. Result Analysis

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. Operations
- 8.2.1. Sum
- 8.2.2. Product
- 8.2.3. Transfer

8.3. Layers
- 8.3.1. Input Layer
- 8.3.2. Hidden Layer
- 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. Transfer Learning 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. Transfer Learning 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. Transfer Learning 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. Pre-Processing Data with TensorFlow
- 10.5.3. Using TensorFlow Tools for Data Manipulation

10.6. The tfdata 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 Training Models

10.8. Keras Pre-Processing Layers
- 10.8.1. Using the Keras Pre-Processing API
- 10.8.2. Pre-Processing Pipelined Construction with Keras
- 10.8.3. Using the Keras Pre-Processing 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. Using 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. ResNet Architecture

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
- 11.10.1. Edge Detection
- 11.10.1. 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 Pre-Processing
- 12.7.3. Training a Transformers Model for Vision

12.8. Hugging Face's Transformers Library
- 12.8.1. Using 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. Noise Suppression of Automatic Encoders
- 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 Computation 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 Studies
- 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 Healthcare Service
- 15.2.1. Implications of AI in the Healthcare Sector. Opportunities and Challenges
- 15.2.2. Case Studies

15.3. Risks Related to the Use of AI in Healthcare 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 Studies
- 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 Studies

15.6. Potential Risks Related to the Use of AI in Industry
- 15.6.1. Case Studies
- 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 Studies
- 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 Studies
- 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 Studies
- 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 Studies
- 15.10.3. Potential Risks Related to the Use of AI
- 15.10.4. Potential Future Developments/Uses of AI

## **Module 16.** Artificial Intelligence-Assisted Design in Architectural Practice

16.1. Advanced AutoCAD Applications with AI
- 16.1.1. Integration of AutoCAD with AI Tools for Advanced Design
- 16.1.2. Automation of Repetitive Tasks in Architectural Design with AI
- 16.1.3. Case Studies Where AI-Assisted AutoCAD Has Optimized Architectural Projects

16.2. Advanced Generative Modeling with Fusion 360
- 16.2.1. Advanced Generative Modeling Techniques Applied to Complex Projects
- 16.2.2. Using Fusion 360 to Create Innovative Architectural Designs
- 16.2.3. Examples of Applying Generative Modeling in Sustainable and Adaptive Architecture

16.3. Optimizing Designs with AI in Optimus
- 16.3.1. Optimization Strategies for Architectural Design Optimization Using AI Algorithms in Optimus
- 16.3.2. Sensitivity Analysis and Exploration of Optimal Solutions in Real Projects
- 16.3.3. Review of Industry Success Stories Using Optimus for AI-Based Optimization

16.4. Parametric Design and Digital Fabrication with Geomagic Wrap
- 16.4.1. Advances in Parametric Design with AI Integration Using Geomagic Wrap
- 16.4.2. Practical Applications of Digital Fabrication in Architecture
- 16.4.3. Outstanding Architectural Projects Using AI-Assisted Parametric Design for Structural Innovations

16.5. AI-Assisted Parametric Design for Structural Innovations
- 16.5.1. Adaptive and Context Sensitive Design with AI Sensors
- 16.5.2. Implementing Adaptive Design Using AI and Real-Time Data
- 16.5.3. Examples of Ephemeral Architecture and Urban Environments Designed with AI

16.6. Analysis of How Adaptive Design Influences the Sustainability and Efficiency of Architectural Projects
- 16.6.1. Simulation and Predictive Analytics in CATIA for Architects
- 16.6.2. Advanced Use of CATIA for Architectural Simulation
- 16.6.3. Implementing Predictive Analytics in Significant Architectural Projects

16.7. Personalization and UX in Design with IBM Watson Studio
- 16.7.1. IBM Watson Studio's AI Tools for Architectural Personalization
- 16.7.2. User-Centered Design Using AI Analytics
- 16.7.3. Case Studies of AI Use Cases for Personalization of Architectural Spaces and Products

16.8. Collaboration and Collective Design Powered by AI
- 16.8.1. AI-Powered Collaborative Platforms for Design Projects
- 16.8.2. AI Methodologies that Foster Creativity and Collective Innovation
- 16.8.3. Success Stories and Challenges in AI-Assisted Collaborative Design

16.9. Ethics and Responsibility in AI-Assisted Design
- 16.9.1. Ethical Debates in the Use of AI in Architectural Design
- 16.9.2. Study on Biases and Fairness in AI Algorithms Applied to Design
- 16.9.3. Current Regulations and Standards for Responsible AI Design

16.10. Challenges and Future of AI-Assisted Design
- 16.10.1. Emerging Trends and Cutting-Edge Technologies in AI for Architecture
- 16.10.2. Analysis of the Future Impact of AI on the Architectural Profession
- 16.10.3. Foresight on Future Innovations and Developments in AI-Assisted Design

## **Module 17.** Space Optimization and Energy Efficiency with Artificial Intelligence

17.1. Optimizing Spaces with Autodesk Revit and AI
- 17.1.1. Using Autodesk Revit and AI for Spatial Optimization and Energy Efficiency
- 17.1.2. Advanced Techniques for Improving Energy Efficiency in Architectural Designs
- 17.1.3. Case Studies of Successful Projects Combining Autodesk Revit with AI

17.2. Analysis of Energy Efficiency Metrics and Data with SketchUp and Trimble
- 17.2.1. Applying SketchUp and Trimble Tools for Detailed Energy Analysis
- 17.2.2. Developing Energy Efficiency Metrics Using AI
- 17.2.3. Strategies for Setting Energy Efficiency Goals for Architectural Projects

17.3. Bioclimatic Design and AI-Optimized Solar Orientation
- 17.3.1. AI-Assisted Bioclimatic Design Strategies for Maximizing Energy Efficiency
- 17.3.2. Examples of Buildings Using AI-Guided Design to Optimize Thermal Comfort
- 17.3.3. Practical Applications of AI in Solar Orientation and Passive Design

17.4. AI-Assisted Sustainable Materials and Technologies with Cityzenit
- 17.4.1. Innovation in Sustainable Materials Supported by AI Analysis
- 17.4.2. Using AI to Develop and Apply Recycled and Low-Environmental-Impact Materials
- 17.4.3. Study of Projects Using Renewable Energy Systems Integrated with AI

17.5. Urban Planning and Energy Efficiency with WattPredictor and AI
- 17.5.1. AI Strategies for Energy Efficiency in Urban Design
- 17.5.2. Implementing WattPredictor to Optimize Energy Use in Public Spaces
- 17.5.3. Successful Cases of Cities Using AI to Improve Urban Sustainability

17.6. Intelligent Energy Management with Google DeepMind's Energy
- 17.6.1. Applications of DeepMind Technologies for Energy Management
- 17.6.2. Implementing AI for Energy Consumption Optimization
- 17.6.3. Assessment of Cases Where AI Has Transformed Energy Management in Communities and Buildings

17.7. AI-Assisted Energy Efficiency Certifications and Regulations
- 17.7.1. Using AI to Ensure Compliance with Energy Efficiency Standards (LEED, BREEAM)
- 17.7.2. AI Tools for Energy Audit and Certification of Projects
- 17.7.3. Impact of Regulations on AI-Supported Sustainable Architecture

17.8. Life Cycle Assessment and Environmental Footprint with Enernoc
- 17.8.1. AI Integration for Life Cycle Analysis of Building Materials
- 17.8.2. Using Enernoc to Assess Carbon Footprint and Sustainability
- 17.8.3. Model Projects Using AI for Advanced Environmental Assessments

17.9. Energy Efficiency Education and Awareness with Verdigris
- 17.9.1. Role of AI in Energy Efficiency Education and Awareness
- 17.9.2. Using Verdigris to Teach Sustainable Practices to Architects and Designers
- 17.9.3. Initiatives and Educational Programs Using AI to Promote a Cultural Change Toward Sustainability

17.10. Future of Space Optimization and Energy Efficiency with ENBALA
- 17.10.1. Exploration of Future Challenges and the Evolution of Energy Efficiency Technologies
- 17.10.2. Emerging Trends in AI for Spatial and Energy Optimization
- 17.10.3. Perspectives on How AI Will Continue to Transform Architecture and Urban Design

## **Module 18.** Parametric Design and Digital Manufacturing

18.1 Advances in Parametric Design and Digital Fabrication with Grasshopper
- 18.1.1. Using Grasshopper to Create Complex Parametric Designs
- 18.1.2. Integrating AI into Grasshopper to Automate and Optimize Design
- 18.1.3. Flagship Projects Using Parametric Design for Innovative Solutions

18.2. Algorithmic Optimization in Design with Generative Design
- 18.2.1. Application of Generative Design for Algorithmic Optimization in Architecture
- 18.2.2. Using AI to Generate Efficient and Novel Design Solutions
- 18.2.3. Examples of How Generative Design Has Improved the Functionality and Aesthetics of Architectural Projects

18.3. Digital Fabrication and Robotics in Construction with KUKA PRC
- 18.3.1. Implementing Robotics Technologies such as KUKA PRC in Digital Fabrication
- 18.3.2. Advantages of Digital Manufacturing in Precision, Speed and Cost Reduction
- 18.3.3. Digital Fabrication Case Studies Highlighting Successful Integration of Robotics in Architecture

18.4. Adaptive Design and Manufacturing with Autodesk Fusion 360
- 18.4.1. Using Fusion 360 to Design Adaptive Architectural Systems
- 18.4.2. Implementing AI in Fusion 360 for Mass Customization
- 18.4.3. Innovative Projects Demonstrating the Potential for Adaptability and Customization

18.5. Sustainability in Parametric Design with Topology Optimization
 18.5.1. Applying Topology Optimization Techniques to Improve Sustainability
 18.5.2. Integrating AI to Optimize Material Usage and Energy Efficiency
 18.5.3. Examples of How Topological Optimization Has Improved the Sustainability of Architectural Projects
18.6. Interactivity and Spatial Adaptability with Autodesk Fusion 360
 18.6.1. Integrating Real-Time Data and Sensors to Create Interactive Architectural Environments
 18.6.2. Using Autodesk Fusion 360 in Adapting Design in Response to Environmental or Usage Changes
 18.6.3. Examples of Architectural Projects Using Spatial Interactivity to Improve User Experience
18.7. Efficiency in Parametric Design
 18.7.1. Applying Parametric Design to Optimize Sustainability and Energy Efficiency of Buildings
 18.7.2. Using Simulations and Life Cycle Analysis Integrated with AI to Improve Green Decision-Making
 18.7.3. Cases of Sustainable Projects Where Parametric Design Has Been Crucial
18.8. Mass Customization and Digital Manufacturing with Magic (Materialise)
 18.8.1. Exploring the Potential of Mass Customization through Parametric Design and Digital Fabrication
 18.8.2. Applying Tools such as Magic to Customize Architectural and Interior Design
 18.8.3. Outstanding Projects Showcasing Digital Fabrication in the Customization of Spaces and Furniture
18.9. Collaboration and Collective Design Using Ansys Granta
 18.9.1. Using Ansys Granta to Facilitate Collaboration and Decision Making in Distributed Design
 18.9.2. Methodologies to Improve Innovation and Efficiency in Collaborative Design Projects
 18.9.3. Examples of How AI-Enhanced Collaboration Can Lead to Innovative and Sustainable Results
18.10. Challenges and the Future of Digital Manufacturing and Parametric Design
 18.10.1. Identifying Emerging Challenges in Parametric Design and Digital Manufacturing
 18.10.2. Future Trends and the Role of AI in the Evolution of These Technologies
 18.10.3. Discussion of How Continuous Innovation Will Affect Architectural Practice and Design in the Future

## **Module 19.** Simulation and Predictive Modeling with Artificial Intelligence

19.1. Advanced Simulation Techniques with MATLAB in Architecture
 19.1.1. Using MATLAB for Advanced Architectural Simulations
 19.1.2. Integrating Predictive Modeling and Big Data Analytics
 19.1.3. Case Studies Where MATLAB Has Been Fundamental in Architectural Simulation
19.2. Advanced Structural Analysis with ANSYS
 19.2.1. Implementing ANSYS for Advanced Structural Simulations in Architectural Projects
 19.2.2. Integrating Predictive Models to Evaluate Structural Safety and Durability
 19.2.3. Projects Highlighting the Use of Structural Simulations in High Performance Architecture
19.3. Modeling Space Use and Human Dynamics with AnyLogic
 19.3.1. Using AnyLogic to Model the Dynamics of Space Use and Human Mobility
 19.3.2. Applying AI to Predict and Improve the Efficiency of Space Use in Urban and Architectural Environments
 19.3.3. Case Studies Showing How Simulation Influences Urban and Architectural Planning
19.4. Predictive Modeling with TensorFlow in Urban Planning
 19.4.1. Implementing TensorFlow for Modeling Urban Dynamics and Structural Behavior
 19.4.2. Using AI to Predict Future Outcomes in City Design
 19.4.3. Examples of How Predictive Modeling Influences Urban Planning and Design
19.5. Predictive Modeling and Generative Design with GenerativeComponents
 19.5.1. Using GenerativeComponents to Merge Predictive Modeling and Generative Design
 19.5.2. Applying Machine Learning Algorithms to Create Innovative and Efficient Designs
 19.5.3. Examples of Architectural Projects that Have Optimized Their Design Using These Advanced Technologies
19.6. Simulation of Environmental Impact and Sustainability with COMSOL
 19.6.1. Applying COMSOL for Environmental Simulations in Large-Scale Projects
 19.6.2. Using AI to Analyze and Improve the Environmental Impact of Buildings
 19.6.3. Projects that Show How Simulation Contributes to Sustainability

19.7. Simulation of Environmental Performance with COMSOL
- 19.7.1. Applying COMSOL Multiphysics for Environmental and Thermal Performance Simulations
- 19.7.2. Using AI to Optimize Design Based on Daylighting and Acoustics Simulations
- 19.7.3. Examples of Successful Implementations That Have Improved Sustainability and Comfort

19.8. Innovation in Simulation and Predictive Modeling
- 19.8.1. Exploration of Emerging Technologies and Their Impact on Simulation and Modeling
- 19.8.2. Discussion of How AI Is Changing Simulation Capabilities in Architecture
- 19.8.3. Evaluation of Future Tools and Their Potential Applications in Architectural Design

19.9. Simulation of Construction Processes with CityEngine
- 19.9.1. Applying CityEngine to Simulate Construction Sequences and Optimize On-Site Workflows
- 19.9.2. AI Integration for Modeling Construction Logistics and Coordinating Activities in Real-Time
- 19.9.3. Case Studies Showing Improved Construction Efficiency and Safety through Advanced Simulations

19.10. Challenges and Future of Simulation and Predictive Modeling
- 19.10.1. Assessment of Current Challenges in Simulation and Predictive Modeling in Architecture
- 19.10.2. Emerging Trends and the Future of These Technologies in Architectural Practice
- 19.10.3. Discussion on the Impact of Continued Innovation in Simulation and Predictive Modeling in Architecture and Construction

## **Module 20.** Heritage Preservation and Restoration with Artificial Intelligence

20.1. AI Technologies in Heritage Restoration with Photogrammetry
- 20.1.1. Using Photogrammetry and AI for Accurate Heritage Documentation and Restoration
- 20.1.2. Practical Applications in the Restoration of Historic Buildings
- 20.1.3. Outstanding Projects Combining Advanced Techniques and Respect for Authenticity

20.2. Predictive Analysis for Conservation with Laser Scanning
- 20.2.1. Implementing Laser Scanning and Predictive Analytics in Heritage Conservation
- 20.2.2. Using AI to Detect and Prevent Deterioration in Historic Structures
- 20.2.3. Examples of How These Technologies Have Improved Accuracy and Efficiency in Conservation

20.3. Cultural Heritage Management with Virtual Reconstruction
- 20.3.1. Applying AI-Assisted Virtual Reconstruction Techniques
- 20.3.2. Strategies for Digital Heritage Management and Preservation
- 20.3.3. Success Stories in the Use of Virtual Re-Enactment for Education and Preservation

20.4. Preventive Conservation and AI-Assisted Maintenance
- 20.4.1. Using AI Technologies to Develop Strategies for Preventive Conservation and Maintenance of Historic Buildings
- 20.4.2. Implementing AI-Based Monitoring Systems for Early Detection of Structural Problems
- 20.4.3. Examples of How AI Contributes to the Long-Term Conservation of Cultural Heritage

20.5. Digital Documentation and BIM in Heritage Preservation
- 20.5.1. Applying Advanced Digital Documentation Techniques, including BIM and Augmented Reality, Assisted by AI
- 20.5.2. Using BIM Models for Efficient Heritage Management and Restoration
- 20.5.3. Case Studies on the Integration of Digital Documentation in Restoration Projects

20.6. AI-Assisted Preservation Policies and Management
- 20.6.1. Using AI-Based Tools for Management and Policy Making in Heritage Preservation
- 20.6.2. Strategies for Integrating AI into Conservation-Related Decision-Making
- 20.6.3. Discussion of How AI Can Improve Collaboration Among Institutions for Heritage Preservation

20.7. Ethics and Responsibility in AI Restoration and Preservation
- 20.7.1. Ethical Considerations in the Application of AI in Heritage Restoration
- 20.7.2. Debate on the Balance between Technological Innovation and Respect for Historical Authenticity
- 20.7.3. Examples of How AI Can Be Used Responsibly in Heritage Restoration

20.8. Innovation and the Future of Heritage Preservation with AI
- 20.8.1. Perspectives on Emerging AI Technologies and Their Application in Heritage Preservation
- 20.8.2. Assessing the Potential of AI to Transform Restoration and Conservation
- 20.8.3. Discussion on the Future of Heritage Preservation in an Era of Rapid Technological Innovation

20.9. Cultural Heritage Education and Awareness with GIS
- 20.9.1. Importance of Public Education and Awareness in Cultural Heritage Preservation with GIS
- 20.9.2. Using Geographical Information Systems (GIS) to Promote the Valuation and Knowledge of Cultural Heritage
- 20.9.3. Successful Education and Outreach Initiatives Using Technology to Teach about Cultural Heritage

20.10. Challenges and the Future of Heritage Preservation and Restoration
- 20.10.1. Identification of Current Challenges in Cultural Heritage Preservation
- 20.10.2. Role of Technological Innovation and AI in Future Conservation and Restoration Practices
- 20.10.3. Perspectives on How Technology Will Transform Heritage Preservation in the Coming Decades

*This multidisciplinary approach will enable you to develop technical and strategic skills that will transform your ability to tackle complex challenges in construction and design”*

06
# Study Methodology

TECH is the world's first university to combine the **case study** methodology with **Relearning**, a 100% online learning system based on guided repetition.

This disruptive pedagogical strategy has been conceived to offer professionals the opportunity to update their knowledge and develop their skills in an intensive and rigorous way. A learning model that places students at the center of the educational process giving them the leading role, adapting to their needs and leaving aside more conventional methodologies.

*TECH will prepare you to face new challenges in uncertain environments and achieve success in your career"*

## The student: the priority of all TECH programs

In TECH's study methodology, the student is the main protagonist.
The teaching tools of each program have been selected taking into account the demands of time, availability and academic rigor that, today, not only students demand but also the most competitive positions in the market.

With TECH's asynchronous educational model, it is students who choose the time they dedicate to study, how they decide to establish their routines, and all this from the comfort of the electronic device of their choice. The student will not have to participate in live classes, which in many cases they will not be able to attend. The learning activities will be done when it is convenient for them. They can always decide when and from where they want to study.

*At TECH you will NOT have live classes (which you might not be able to attend)"*



## The most comprehensive study plans at the international level

TECH is distinguished by offering the most complete academic itineraries on the university scene. This comprehensiveness is achieved through the creation of syllabi that not only cover the essential knowledge, but also the most recent innovations in each area.

By being constantly up to date, these programs allow students to keep up with market changes and acquire the skills most valued by employers. In this way, those who complete their studies at TECH receive a comprehensive education that provides them with a notable competitive advantage to further their careers.

And what's more, they will be able to do so from any device, pc, tablet or smartphone.

*TECH's model is asynchronous, so it allows you to study with your pc, tablet or your smartphone wherever you want, whenever you want and for as long as you want"*

## Case Studies and Case Method

The case method has been the learning system most used by the world's best business schools. Developed in 1912 so that law students would not only learn the law based on theoretical content, its function was also to present them with real complex situations. In this way, they could make informed decisions and value judgments about how to resolve them. In 1924, Harvard adopted it as a standard teaching method.

With this teaching model, it is students themselves who build their professional competence through strategies such as Learning by Doing or Design Thinking, used by other renowned institutions such as Yale or Stanford.

This action-oriented method will be applied throughout the entire academic itinerary that the student undertakes with TECH. Students will be confronted with multiple real-life situations and will have to integrate knowledge, research, discuss and defend their ideas and decisions. All this with the premise of answering the question of how they would act when facing specific events of complexity in their daily work.

## Relearning Methodology

At TECH, case studies are enhanced with the best 100% online teaching method: Relearning.

This method breaks with traditional teaching techniques to put the student at the center of the equation, providing the best content in different formats. In this way, it manages to review and reiterate the key concepts of each subject and learn to apply them in a real context.

In the same line, and according to multiple scientific researches, reiteration is the best way to learn. For this reason, TECH offers between 8 and 16 repetitions of each key concept within the same lesson, presented in a different way, with the objective of ensuring that the knowledge is completely consolidated during the study process.

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

## A 100% online Virtual Campus with the best teaching resources

In order to apply its methodology effectively, TECH focuses on providing graduates with teaching materials in different formats: texts, interactive videos, illustrations and knowledge maps, among others. All of them are designed by qualified teachers who focus their work on combining real cases with the resolution of complex situations through simulation, the study of contexts applied to each professional career and learning based on repetition, through audios, presentations, animations, images, etc.

The latest scientific evidence in the field of Neuroscience points to the importance of taking into account the place and context where the content is accessed before starting a new learning process. Being able to adjust these variables in a personalized way helps people to remember and store knowledge in the hippocampus to retain it in the long term. This is a model called Neurocognitive context-dependent e-learning that is consciously applied in this university qualification.

In order to facilitate tutor-student contact as much as possible, you will have a wide range of communication possibilities, both in real time and delayed (internal messaging, telephone answering service, email contact with the technical secretary, chat and videoconferences).

Likewise, this very complete Virtual Campus will allow TECH students to organize their study schedules according to their personal availability or work obligations. In this way, they will have global control of the academic content and teaching tools, based on their fast-paced professional update.

> *The online study mode of this program will allow you to organize your time and learning pace, adapting it to your schedule"*

**The effectiveness of the method is justified by four fundamental achievements:**

1. Students who follow this method not only achieve the assimilation of concepts, but also a development of their mental capacity, through exercises that assess real situations and the application of knowledge.
2. Learning is solidly translated into practical skills that allow the student to better integrate into the real world.
3. Ideas and concepts are understood more efficiently, given that the example situations are based on real-life.
4. Students like to feel that the effort they put into their studies is worthwhile. This then translates into a greater interest in learning and more time dedicated to working on the course.



## The university methodology top-rated by its students

The results of this innovative teaching model can be seen in the overall satisfaction levels of TECH graduates.

The students' assessment of the teaching quality, the quality of the materials, the structure of the program and its objectives is excellent. Not surprisingly, the institution became the top-rated university by its students according to the global score index, obtaining a 4.9 out of 5.

*Access the study contents from any device with an Internet connection (computer, tablet, smartphone) thanks to the fact that TECH is at the forefront of technology and teaching.*

*You will be able to learn with the advantages that come with having access to simulated learning environments and the learning by observation approach, that is, Learning from an expert.*

## As such, the best educational materials, thoroughly prepared, will be available in this program:

### 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.

This content is then adapted in an audiovisual format that will create our way of working online, with the latest techniques that allow us to offer you high quality in all of the material that we provide you with.

### Practicing Skills and Abilities

You will carry out activities to develop specific competencies and skills in each thematic field. Exercises and activities to acquire and develop the skills and abilities that a specialist needs to develop within the framework of the globalization we live in.

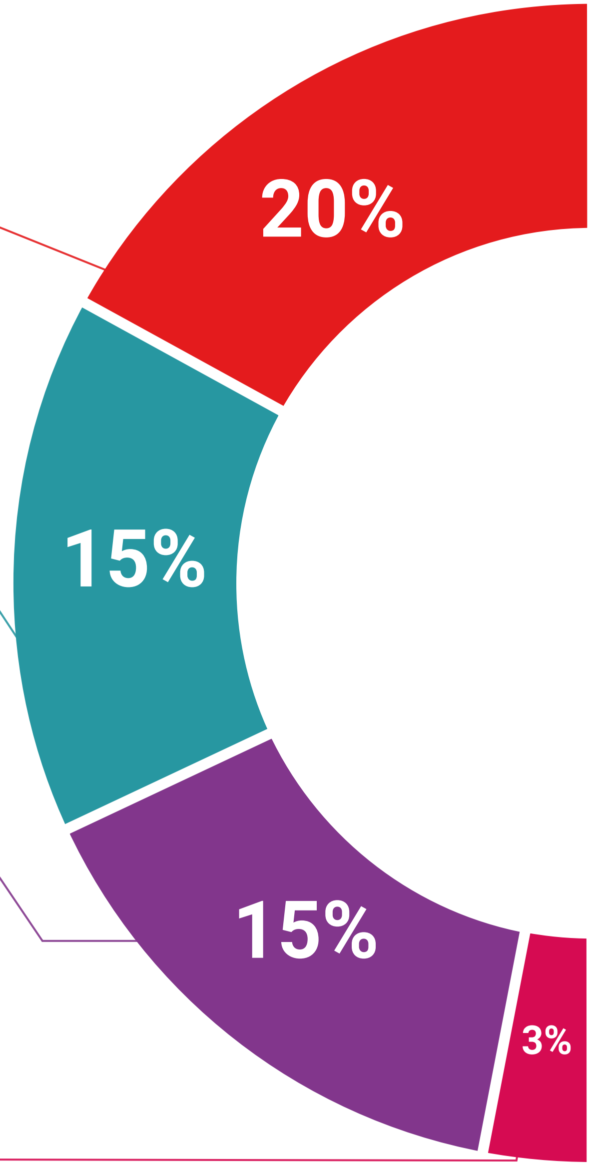
### Interactive Summaries

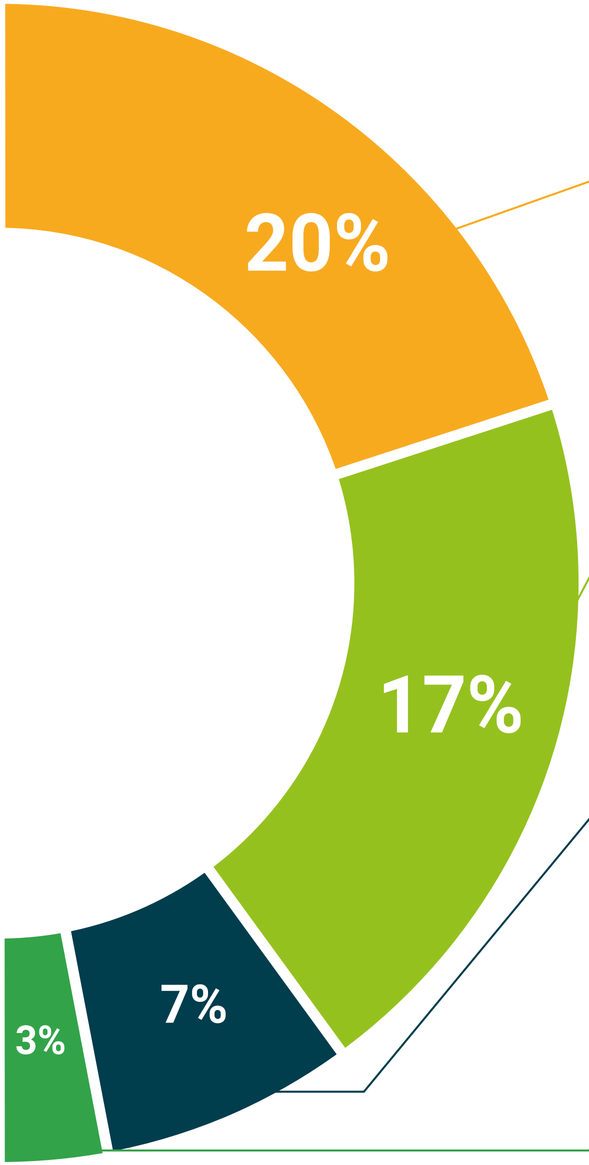
We present the contents attractively and dynamically in multimedia lessons that include audio, videos, images, diagrams, and concept maps in order to reinforce knowledge.

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

### Additional Reading

Recent articles, consensus documents, international guides... In our virtual library you will have access to everything you need to complete your education.






### Case Studies

Students will complete a selection of the best case studies in the field. Cases that are presented, analyzed, and supervised by the best specialists in the world.

### Testing & Retesting

We periodically assess and re-assess your knowledge throughout the program. We do this on 3 of the 4 levels of Miller's Pyramid.

### 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 for future difficult decisions.

### Quick Action Guides

TECH offers the most relevant contents of the course in the form of worksheets or quick action guides. A synthetic, practical and effective way to help students progress in their learning.

07

# Certificate

The Professional Master's Degree in Artificial Intelligence in Architecture guarantees students, in addition to the most rigorous and up-to-date education, access to a Professional Master's Degree diploma 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 **Professional Master's Degree diploma in Artificial Intelligence in Architecture** endorsed by **TECH Global University**, the world's largest online university.

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

Modality: **online**

Duration: **12 months**

Accreditation: **90 ECTS**

tech global university

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

**Professional Master's Degree in Artificial Intelligence in Architecture**

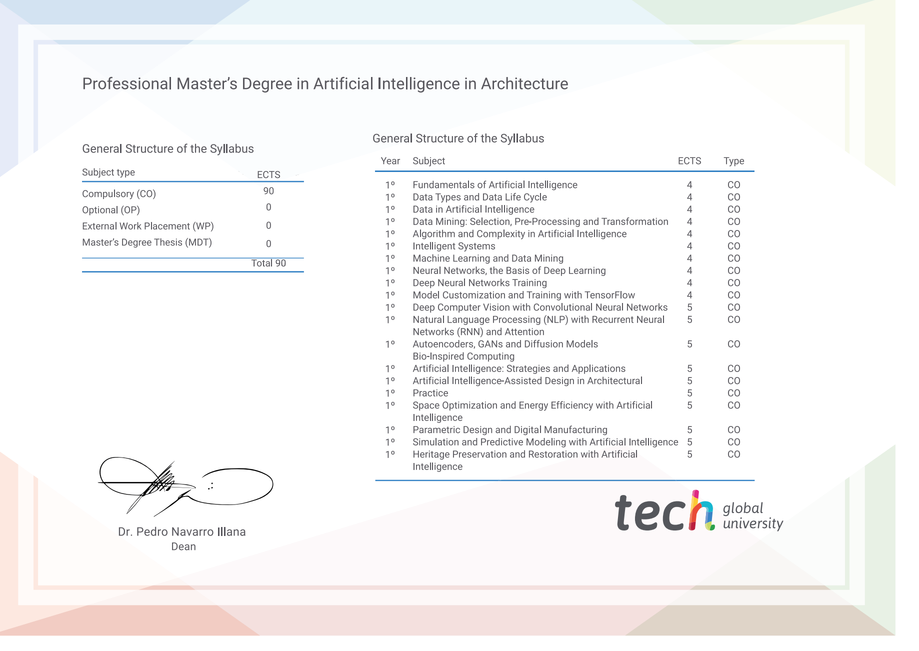
This is a private qualification of 2,700 hours of duration equivalent to 90 ECTS, with a start date of dd/mm/yyyy and an end date of dd/mm/yyyy.

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

This qualification must always be accompanied by the university degree issued by the competent authority to practice professionally in each country. Unique TECH Code: AFWORD23S techtitute.com/certificates



Professional Master's Degree in Artificial Intelligence in Architecture

General Structure of the Syllabus

| Subject type | ECTS |
|---|---|
| Compulsory (CO) | 90 |
| Optional (OP) | 0 |
| External Work Placement (WP) | 0 |
| Master's Degree Thesis (MDT) | 0 |
| | Total 90 |

General Structure of the Syllabus

| Year | Subject | ECTS | Type |
|---|---|---|---|
| 1º | Fundamentals of Artificial Intelligence | 4 | CO |
| 1º | Data Types and Data Life Cycle | 4 | CO |
| 1º | Data in Artificial Intelligence | 4 | CO |
| 1º | Data Mining: Selection, Pre-Processing and Transformation | 4 | CO |
| 1º | Algorithm and Complexity in Artificial Intelligence | 4 | CO |
| 1º | Intelligent Systems | 4 | CO |
| 1º | Machine Learning and Data Mining | 4 | CO |
| 1º | Neural Networks, the Basis of Deep Learning | 4 | CO |
| 1º | Deep Neural Networks Training | 4 | CO |
| 1º | Model Customization and Training with TensorFlow | 4 | CO |
| 1º | Deep Computer Vision with Convolutional Neural Networks | 5 | CO |
| 1º | Natural Language Processing (NLP) with Recurrent Neural Networks (RNN) and Attention | 5 | CO |
| 1º | Autoencoders, GANs and Diffusion Models Bio-Inspired Computing | 5 | CO |
| 1º | Artificial Intelligence: Strategies and Applications | 5 | CO |
| 1º | Artificial Intelligence-Assisted Design in Architectural | 5 | CO |
| 1º | Practice | 5 | CO |
| 1º | Space Optimization and Energy Efficiency with Artificial Intelligence | 5 | CO |
| 1º | Parametric Design and Digital Manufacturing | 5 | CO |
| 1º | Simulation and Predictive Modeling with Artificial Intelligence | 5 | CO |
| 1º | Heritage Preservation and Restoration with Artificial Intelligence | 5 | CO |

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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.

## Professional Master's Degree
Artificial Intelligence in Architecture

» Modality: **online**
» Duration: **12 months**
» Certificate: **TECH Global University**
» Accreditation: **90 ECTS**
» Schedule: **at your own pace**
» Exams: **online**

# Professional Master's Degree
## Artificial Intelligence in Architecture

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