Professional Master's Degree

Artificial Intelligence and Knowledge Engineering

Accreditation/Membership

The Society for the Study of Artificial Intelligence and Simulation of Behaviour

tech global university

tech global university

Professional Master's Degree
Artificial Intelligence and Knowledge Engineering

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

Website: www.techtitute.com/us/information-technology/professional-master-degree/master-artificial-intelligence-knowledge-engineering

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01

Introduction to the Program

Artificial Intelligence and Knowledge Engineering are disciplines that, by combining advanced algorithms and expert systems, enable the simulation of human reasoning, optimization of processes, and the generation of automated solutions. Their impact is undeniable in sectors such as industry, healthcare, and finance. In fact, according to a UNESCO report, global investment in intelligent systems surpassed 150 billion dollars in recent years, reflecting their central role in digital transformation. In this context, TECH offers a 100% online academic opportunity, aimed at training professionals to design innovative solutions in this field. It also provides the flexibility and academic rigor required by the digital age.

An exhaustive and 100% online program, exclusive to TECH, with an international perspective supported by our membership with The Society for the Study of Artificial Intelligence and Simulation of Behaviour"

Currently, the automated analysis of data, the optimization of complex processes, and intelligent decision-making are increasingly dependent on technological development driven by Artificial Intelligence and Knowledge Engineering. In fact, these disciplines not only enable machines to possess cognitive capabilities similar to human ones, but they also facilitate the creation of systems capable of interpreting and reasoning from vast amounts of information.

In this context, TECH launches a cutting-edge Professional Master's Degree in Artificial Intelligence and Knowledge Engineering. The syllabus covers everything from programming fundamentals to advanced algorithmic understanding. Moreover, the learning materials will delve into essential topics such as computational logic, the design of advanced data structures, and the development of efficient algorithms. In this way, the program will provide students with the most modern tools to implement automated, scalable solutions supported by computational reasoning models.

Regarding the program's methodology, TECH employs its disruptive Relearning method. This will ensure progressive, natural, and efficient learning. As a result, IT professionals will not have to invest long hours in studying or costly memorization techniques. Additionally, they will only need an electronic device with internet access to enter the Virtual Campus.

Thanks to **TECH's membership with the Society for the Study of Artificial Intelligence and Simulation of Behaviour (AISB),** students will have access to digital publications such as AISB and Discussions, as well as a weekly newsletter with news and job offers. Additionally, they will enjoy discounted rates for AISB and ECAI conferences, receive travel support, and training to create local groups.

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

- The development of case studies presented by experts in Artificial Intelligence and Knowledge Engineering
- The graphic, schematic, and practical contents with which they are created, provide scientific and practical information on the 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 gain an ethical perspective on the development and impact of machine learning in digital transformation"

Through TECH's disruptive Relearning method, you will assimilate concepts progressively and at your own pace. Forget about memorization!"

You will develop advanced competencies in programming, algorithmic design, and data structuring.

You will master the principles of bio-inspired computing and natural language processing, integrating innovative methodologies into real-world projects.

The program includes instructors from the field of Artificial Intelligence and Knowledge Engineering, who bring their professional experience to the course, alongside recognized 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 an immersive learning experience designed to prepare for real-life situations.

This program is designed around Problem-Based Learning, whereby the student must try to solve the different professional practice situations that arise throughout the program. For this purpose, the professional will be assisted by an innovative interactive video system created by renowned and experienced experts.

02

Why Study at TECH?

TECH is the world's largest online university. With an impressive catalog of more than 14,000 university programs, available in 11 languages, it is positioned as a leader in employability, with a 99% job placement rate. In addition, it has a huge faculty of more than 6,000 professors of the highest international prestige.

Study at the largest online university in the world and ensure your professional success. The future begins at TECH"

The world's best online university, according to FORBES

The prestigious Forbes magazine, specialized in business and finance, has highlighted TECH as "the best online university in the world" This is what they have recently stated in an article in their digital edition in which they echo the success story of this institution, "thanks to the academic offer it provides, the selection of its teaching staff, and an innovative learning method oriented to form the professionals of the future".

The best top international faculty

TECH's faculty is made up of more than 6,000 professors of the highest international prestige. Professors, researchers and top executives of multinational companies, including Isaiah Covington, performance coach of the Boston Celtics; Magda Romanska, principal investigator at Harvard MetaLAB; Ignacio Wistuba, chairman of the department of translational molecular pathology at MD Anderson Cancer Center; and D.W. Pine, creative director of TIME magazine, among others.

The world's largest online university

TECH is the world's largest online university. We are the largest educational institution, with the best and widest digital educational catalog, one hundred percent online and covering most areas of knowledge. We offer the largest selection of our own degrees and accredited online undergraduate and postgraduate degrees. In total, more than 14,000 university programs, in ten different languages, making us the largest educational institution in the world.

The most complete syllabuses on the university scene

TECH offers the most complete syllabuses on the university scene, with programs that cover fundamental concepts and, at the same time, the main scientific advances in their specific scientific areas. In addition, these programs are continuously updated to guarantee students the academic vanguard and the most demanded professional skills. and the most in-demand professional competencies. In this way, the university's qualifications provide its graduates with a significant advantage to propel their careers to success.

A unique learning method

TECH is the first university to use Relearning in all its programs. This is the best online learning methodology, accredited with international teaching quality certifications, provided by prestigious educational agencies. In addition, this innovative academic model is complemented by the "Case Method", thereby configuring a unique online teaching strategy. Innovative teaching resources are also implemented, including detailed videos, infographics and interactive summaries.

The official online university of the NBA

TECH is the official online university of the NBA. Thanks to our agreement with the biggest league in basketball, we offer our students exclusive university programs, as well as a wide variety of educational resources focused on the business of the league and other areas of the sports industry. Each program is made up of a uniquely designed syllabus and features exceptional guest hosts: professionals with a distinguished sports background who will offer their expertise on the most relevant topics.

Leaders in employability

TECH has become the leading university in employability. Ninety-nine percent of its students obtain jobs in the academic field they have studied within one year of completing any of the university's programs. A similar number achieve immediate career enhancement. All this thanks to a study methodology that bases its effectiveness on the acquisition of practical skills, which are absolutely necessary for professional development.

Google Premier Partner

The American technology giant has awarded TECH the Google Premier Partner badge. This award, which is only available to 3% of the world's companies, highlights the efficient, flexible and tailored experience that this university provides to students. The recognition not only accredits the maximum rigor, performance and investment in TECH's digital infrastructures, but also places this university as one of the world's leading technology companies.

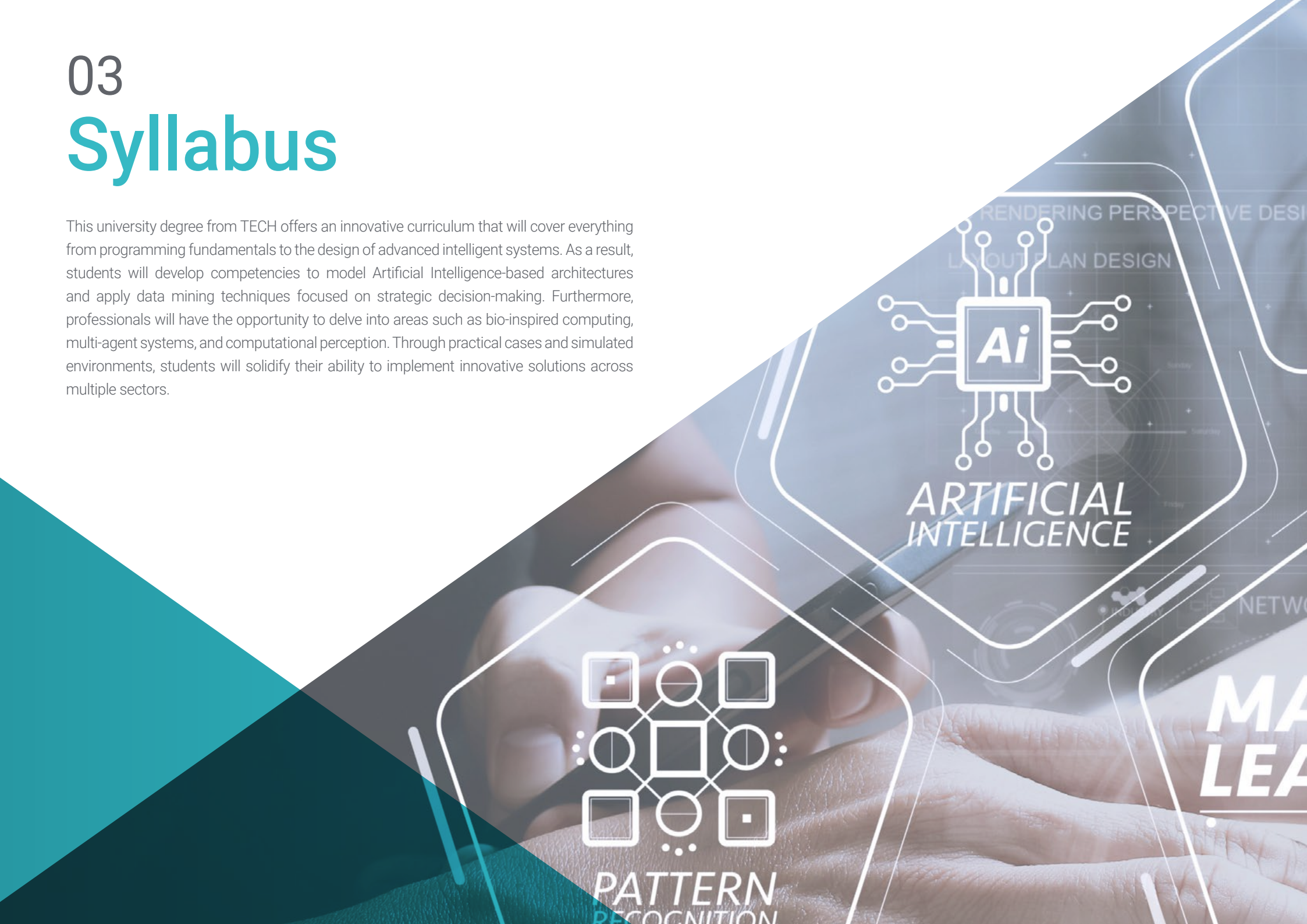
The top-rated university by its students

Students have positioned TECH as the world's top-rated university on the main review websites, with a highest rating of 4.9 out of 5, obtained from more than 1,000 reviews. These results consolidate TECH as the benchmark university institution at an international level, reflecting the excellence and positive impact of its educational model.

03

Syllabus

This university degree from TECH offers an innovative curriculum that will cover everything from programming fundamentals to the design of advanced intelligent systems. As a result, students will develop competencies to model Artificial Intelligence-based architectures and apply data mining techniques focused on strategic decision-making. Furthermore, professionals will have the opportunity to delve into areas such as bio-inspired computing, multi-agent systems, and computational perception. Through practical cases and simulated environments, students will solidify their ability to implement innovative solutions across multiple sectors.



You will design intelligent architectures that integrate multiple data sources, inference rules, and continuous learning"

Module 1. Programming Fundamentals

1.1. Introduction to Programming
- 1.1.1. Basic Structure of a Computer
- 1.1.2. *Software*
- 1.1.3. Programming Languages
- 1.1.4. Life Cycle of a Software Application

1.2. Algorithm Design
- 1.2.1. Problem Solving
- 1.2.2. Descriptive Techniques
- 1.2.3. Algorithm Elements and Structure

1.3. Elements of a Program
- 1.3.1. C++ Origin and Features
- 1.3.2. Development Environment
- 1.3.3. Concept of Program
- 1.3.4. Types of Fundamental Data
- 1.3.5. Operators
- 1.3.6. Expressions
- 1.3.7. Statements
- 1.3.8. Data Input and Output

1.4. Control Sentences
- 1.4.1. Statements
- 1.4.2. Branches
- 1.4.3. Loops

1.5. Abstraction and Modularity: Functions
- 1.5.1. Modular Design
- 1.5.2. Concept of Function and Utility
- 1.5.3. Definition of a Function
- 1.5.4. Execution Flow in a Function Call
- 1.5.5. Function Prototypes
- 1.5.6. Results Return
- 1.5.7. Calling a Function: Parameters
- 1.5.8. Passing Parameters by Reference and by Value
- 1.5.9. Scope Identifier

1.6. Static Data Structures
- 1.6.1. Arrays
- 1.6.2. Matrices. Polyhedra
- 1.6.3. Searching and Sorting
- 1.6.4. Chaining: I/O Functions for Chains
- 1.6.5. Structures. Unions
- 1.6.6. New Types of Data

1.7. Dynamic Data Structures: Pointers
- 1.7.1. Concept Definition of Pointer
- 1.7.2. Pointer Operators and Operations
- 1.7.3. Pointer Arrays
- 1.7.4. Pointers and *Arrays*
- 1.7.5. Chain Pointers
- 1.7.6. Structure Pointers
- 1.7.7. Multiple Indirection
- 1.7.8. Function Pointers
- 1.7.9. Function, Structure and *Array* Passing as Function Parameters

1.8. Files
- 1.8.1. Basic Concepts
- 1.8.2. File Operations
- 1.8.3. Types of Files
- 1.8.4. File Organization
- 1.8.5. Introduction to C++ Files
- 1.8.6. Managing Files

1.9. Recursion
- 1.9.1. Definition of Recursion
- 1.9.2. Types of Recursion
- 1.9.3. Advantages and Disadvantages
- 1.9.4. Considerations
- 1.9.5. Recursive to Iterative Conversion
- 1.9.6. Recursion Stack

1.10. Testing and Documentation
- 1.10.1. Program Testing
- 1.10.2. White Box Testing
- 1.10.3. Black Box Testing
- 1.10.4. Testing Tools
- 1.10.5. Program Documentation

Module 2. Data Structures

2.1. Introduction to C++ Programming
- 2.1.1. Classes, Constructors, Methods and Attributes
- 2.1.2. Variables
- 2.1.3. Conditional Expressions and Loops
- 2.1.4. Objects

2.2. Abstract Data Types (ADT)
- 2.2.1. Types of Data
- 2.2.2. Basic Structures and TADs
- 2.2.3. Vectors and Arrays

2.3. Linear data Structures
- 2.3.1. ADT Ready Definition
- 2.3.2. Linked and Doubly Linked Lists
- 2.3.3. Sorted Lists
- 2.3.4. Lists in C++
- 2.3.5. ADT Stack
- 2.3.6. ADT Queue
- 2.3.7. Stack and Queue in C++

2.4. Hierarchical Data Structures
- 2.4.1. ADT Tree
- 2.4.2. Paths
- 2.4.3. N-Ary Trees
- 2.4.4. Binary Trees
- 2.4.5. Binary Search Trees

2.5. Hierarchical Data Structures: Complex Trees
- 2.5.1. Perfectly Balanced or Minimum Height Trees
- 2.5.2. Multipath Trees
- 2.5.3. Bibliographic References

2.6. Priority Mounds and Queue
- 2.6.1. ADT Heaps
- 2.6.2. ADT Priority Queues

2.7. Hash Tables
- 2.7.1. ADT Hash Table
- 2.7.2. Hash Functions
- 2.7.3. Hash Function in Hash Tables
- 2.7.4. Rehashing
- 2.7.5. Open Hash Tables

2.8. Graphs
- 2.8.1. ADT Graph
- 2.8.2. Types of Graphs
- 2.8.3. Graphical Representation and Basic Operations
- 2.8.4. Graph Design

2.9. Algorithms and Advanced Graph Concepts
- 2.9.1. Problems about Graphs
- 2.9.2. Path Algorithms
- 2.9.3. Search or Path Algorithms
- 2.9.4. Other Algorithms

2.10. Other Data Structures
- 2.10.1. Sets
- 2.10.2. Parallel Arrays
- 2.10.3. Symbol Tables
- 2.10.4. Tries

Module 3. Algorithmics and Complexity

3.1. Introduction to Algorithm Design Strategies
- 3.1.1. Recursion
- 3.1.2. Divide and Conquer
- 3.1.3. Other Strategies

3.2. Efficiency and Analysis of Algorithms
- 3.2.1. Efficiency Measures
- 3.2.2. Measuring the Size of the Input
- 3.2.3. Measuring Execution Time
- 3.2.4. Worst, Best and Average Case
- 3.2.5. Asymptotic Notation
- 3.2.6. Criteria for Mathematical Analysis of Non-Recursive Algorithms
- 3.2.7. Mathematical Analysis of Recursive Algorithms
- 3.2.8. Empirical Analysis of Algorithms

3.3. Sorting Algorithms
- 3.3.1. Concept of Sorting
- 3.3.2. Bubble Sorting
- 3.3.3. Sorting by Selection
- 3.3.4. Sorting by Insertion
- 3.3.5. Merge Sort
- 3.3.6. Quick Sort

3.4. Algorithms with Trees
- 3.4.1. Tree Concept
- 3.4.2. Binary Trees
- 3.4.3. Tree Paths
- 3.4.4. Representing Expressions
- 3.4.5. Ordered Binary Trees
- 3.4.6. Balanced Binary Trees

3.5. Algorithms Using Heaps
- 3.5.1. Heaps
- 3.5.2. The Heapsort Algorithm
- 3.5.3. Priority Queues

3.6. Graph Algorithms
- 3.6.1. Representation
- 3.6.2. Traversal in Width
- 3.6.3. Depth Travel
- 3.6.4. Topological Sorting

3.7. Greedy Algorithms
- 3.7.1. Greedy Strategy
- 3.7.2. Greedy Strategy Elements
- 3.7.3. Currency Exchange
- 3.7.4. Traveler's Problem
- 3.7.5. Backpack Problem

3.8. Minimal Path Finding
- 3.8.1. The Minimum Path Problem
- 3.8.2. Negative Arcs and Cycles
- 3.8.3. Dijkstra's Algorithm

3.9. Greedy Algorithms on Graphs
- 3.9.1. Minimum Spanning Tree
- 3.9.2. Prim's Algorithm
- 3.9.3. Kruskal's Algorithm
- 3.9.4. Complexity Analysis

3.10. *Backtracking*
- 3.10.1. Backtracking Algorithm
- 3.10.2. Alternative Techniques

Module 4. Advanced Algorithms Design

4.1. Analysis of Recursive and Divide and Conquer Algorithms
- 4.1.1. Posing and Solving Homogeneous and Non-Homogeneous Recurrence Equations
- 4.1.2. General Description of the Divide and Conquer Strategy

4.2. Amortized Analysis
- 4.2.1. Aggregate Analysis
- 4.2.2. The Accounting Method
- 4.2.3. The Potential Method

4.3. Dynamic Programming and Algorithms for NP Problems
- 4.3.1. Characteristics of Dynamic Programming
- 4.3.2. Backtracking
- 4.3.3. Branch and Bound

4.4. Combinatorial Optimization
- 4.4.1. Representation
- 4.4.2. 1D Optimization

4.5. Randomization Algorithms
- 4.5.1. Examples of Randomization Algorithms
- 4.5.2. Buffon's Theorem
- 4.5.3. Monte Carlo Algorithm
- 4.5.4. Las Vegas Algorithm

4.6. Local Search and Candidate Search
- 4.6.1. *Gradient Ascent*
- 4.6.2. *Hill Climbing*
- 4.6.3. *Simulated Annealing*
- 4.6.4. *Taboo Search*
- 4.6.5. Candidate Search

4.7. Formal Verification of Programs
- 4.7.1. Specification of Functional Abstractions
- 4.7.2. The Language of First-Order Logic
- 4.7.3. Hoare's Formal System

4.8. Verification of Iterative Programs
- 4.8.1. Rules of Hoare's Formal System
- 4.8.2. Concept of Invariant Iterations

4.9. Numeric Methods
- 4.9.1. The Bisection Method
- 4.9.2. The Newton-Raphson Method
- 4.9.3. The Secant Method

4.10. Parallel Algorithms
- 4.10.1. Parallel Binary Operations
- 4.10.2. Parallel Operations with Networks
- 4.10.3. Parallelism in Divide and Conquer
- 4.10.4. Parallelism in Dynamic Programming

Module 5. Logic in Computer Science

5.1. Justification of the Logic
- 5.1.1. Object of Logic Study
- 5.1.2. What Is Logic for?
- 5.1.3. Components and Types of Reasoning
- 5.1.4. Components of a Logic Calculation
- 5.1.5. Semantics
- 5.1.6. Justification of the Existence of a Logic
- 5.1.7. How to Check that a Logic is Adequate

5.2. Calculation of Natural Deduction from Statements
- 5.2.1. Formal Language
- 5.2.2. Deductive Mechanism

5.3. Formalization and Deduction Strategies for Propositional Logic
- 5.3.1. Formalization Strategies
- 5.3.2. Natural Reasoning
- 5.3.3. Laws and Rules
- 5.3.4. Axiomatic Deduction and Natural Deduction
- 5.3.5. Calculating Natural Deduction
- 5.3.6. Primitive Rules of Propositional Calculus

5.4. Semantics of Propositional Logic
- 5.4.1. Truth Tables
- 5.4.2. Equivalence
- 5.4.3. Tautologies and Contradictions
- 5.4.4. Validation of Propositional Sentences
- 5.4.5. Validation by Means of Truth Tables
- 5.4.6. Validation Using Semantic Trees
- 5.4.7. Validation by Refutation

5.5. Applications of Propositional Logic: Logic Circuits
- 5.5.1. Basic Gates
- 5.5.2. Circuits
- 5.5.3. Mathematical Models of the Circuits
- 5.5.4. Minimization
- 5.5.5. The Second Canonical Form and the Minimum Form in Product of Additions
- 5.5.6. Other Gates

5.6. Natural Predicate Deduction Calculus
- 5.6.1. Formal Language
- 5.6.2. Deductive Mechanism

5.7. Formalization Strategies for Predicate Logic
- 5.7.1. Introduction to Formalization in Predicate Logic
- 5.7.2. Formalization Strategies with Quantifiers

5.8. Deduction Strategies for Predicate Logic
- 5.8.1. Reason for Omission
- 5.8.2. Presentation of the New Rules
- 5.8.3. Predicate Logic as a Natural Deduction Calculus

5.9. Applications of Predicate Logic: Introduction to Logic Programming
- 5.9.1. Informal Presentation
- 5.9.2. Prolog Elements
- 5.9.3. Re-Evaluation and Cut-Off

5.10. Set Theory, Predicate Logic and Its Semantics
- 5.10.1. Intuitive Set Theory
- 5.10.2. Introduction to Predicate Semantics

Module 6. Artificial Intelligence and Knowledge Engineering

6.1. Introduction to Artificial Intelligence and Knowledge Engineering
- 6.1.1. Brief History of Artificial Intelligence
- 6.1.2. Artificial Intelligence Today
- 6.1.3. Knowledge Engineering

6.2. Searching
- 6.2.1. Common Search Concepts
- 6.2.2. Uninformed Search
- 6.2.3. Informed Search

6.3. Boolean Satisfiability, Constraint Satisfiability and Automatic Planning
- 6.3.1. Boolean Satisfiability
- 6.3.2. Constraint Satisfiability Problems
- 6.3.3. Automatic Planning and PDDL
- 6.3.4. Planning as a Heuristic Search
- 6.3.5. Planning with SAT

6.4. Artificial Intelligence in Games
- 6.4.1. Game Theory
- 6.4.2. Minimax and Alpha-Beta Pruning
- 6.4.3. Simulation: Monte Carlo

6.5. Supervised and Unsupervised Learning
- 6.5.1. Introduction to Machine Learning
- 6.5.2. Classification
- 6.5.3. Regression
- 6.5.4. Validation of Results
- 6.5.5. Clustering

6.6. Neural Networks
- 6.6.1. Biological Fundamentals
- 6.6.2. Computational Model
- 6.6.3. Supervised and Unsupervised Neural Networks
- 6.6.4. Simple Perceptron
- 6.6.5. Multilayer Perceptron

6.7. Genetic Algorithms
- 6.7.1. History
- 6.7.2. Biological Basis
- 6.7.3. Problem Coding
- 6.7.4. Generation of the Initial Population
- 6.7.5. Main Algorithm and Genetic Operators
- 6.7.6. Evaluation of Individuals: *Fitness*

6.8. Thesauri, Vocabularies, Taxonomies
- 6.8.1. Vocabulary
- 6.8.2. Taxonomy
- 6.8.3. Thesauri
- 6.8.4. Ontologies

6.9. Knowledge Representation: Semantic Web
- 6.9.1. Semantic Web
- 6.9.2. Specifications: RDF, RDFS and OWL
- 6.9.3. Inference/ Reasoning
- 6.9.4. Linked Data

6.10. Expert Systems and DSS
- 6.10.1. Expert Systems
- 6.10.2. Decision Support Systems

Module 7. Intelligent Systems

7.1. Agent Theory
- 7.1.1. Concept History
- 7.1.2. Agent Definition
- 7.1.3. Agents in Artificial Intelligence
- 7.1.4. Agents in Software Engineering

7.2. Agent Architectures
- 7.2.1. The Reasoning Process of an Agent
- 7.2.2. Reactive Agents
- 7.2.3. Deductive Agents
- 7.2.4. Hybrid Agents
- 7.2.5. Comparison

7.3. Information and Knowledge
- 7.3.1. Difference between Data, Information and Knowledge
- 7.3.2. Data Quality Assessment
- 7.3.3. Data Collection Methods
- 7.3.4. Information Acquisition Methods
- 7.3.5. Knowledge Acquisition Methods

7.4. Knowledge Representation
- 7.4.1. The Importance of Knowledge Representation
- 7.4.2. Definition of Knowledge Representation According to Roles
- 7.4.3. Knowledge Representation Features

7.5. Ontologies
- 7.5.1. Introduction to Metadata
- 7.5.2. Philosophical Concept of Ontology
- 7.5.3. Computing Concept of Ontology
- 7.5.4. Domain Ontologies and Higher-Level Ontologies
- 7.5.5. Building an Ontology

7.6. Languages for Ontologies and Software for Ontology Creation
- 7.6.1. RDF Triplets, Turtle, and N3
- 7.6.2. RDF Schema
- 7.6.3. OWL
- 7.6.4. SPARQL
- 7.6.5. Introduction to Ontology Creation Tools
- 7.6.6. Installing and Using Protégé

7.7. Semantic Web
- 7.7.1. Current and Future Status of the Semantic Web
- 7.7.2. Semantic Web Applications

7.8. Other Knowledge Representation Models
- 7.8.1. Vocabulary
- 7.8.2. Global Vision
- 7.8.3. Taxonomy
- 7.8.4. Thesauri
- 7.8.5. Folksonomy
- 7.8.6. Comparison
- 7.8.7. Mind Maps

7.9. Knowledge Representation Assessment and Integration
- 7.9.1. Zero-Order Logic
- 7.9.2. First-Order Logic
- 7.9.3. Descriptive Logic
- 7.9.4. Relationship between Different Types of Logic
- 7.9.5. Prolog: Programming Based on First-Order Logic

7.10. Semantic Reasoners, Knowledge-Based Systems and Expert Systems
- 7.10.1. Concept of Reasoner
- 7.10.2. Reasoner Applications
- 7.10.3. Knowledge-Based Systems
- 7.10.4. MYCIN: History of Expert Systems
- 7.10.5. Expert Systems Elements and Architecture
- 7.10.6. Creating Expert Systems

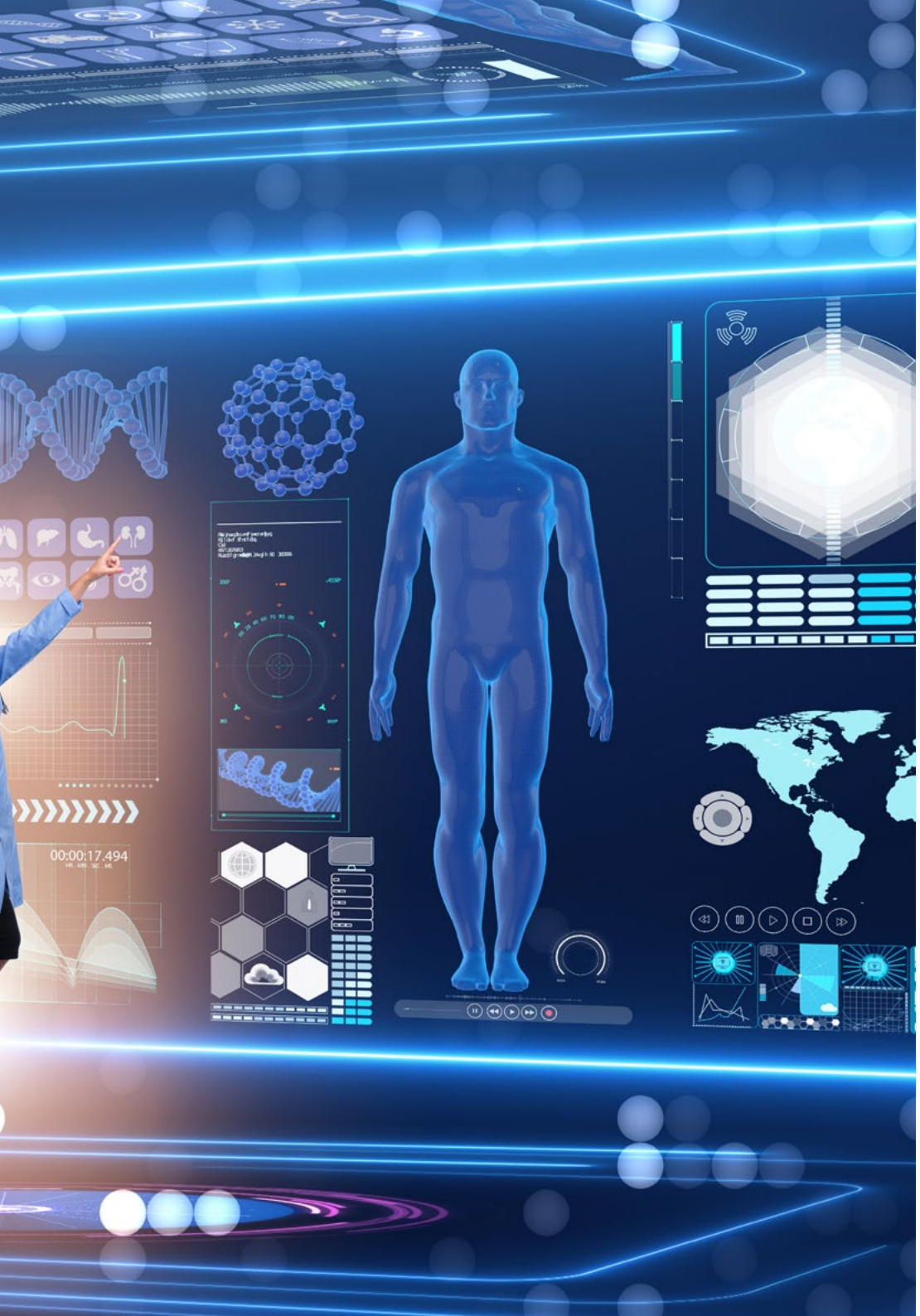
Module 8. Machine Learning and Data Mining

8.1. Introduction to Knowledge Discovery Processes and Basic Concepts of Machine Learning
- 8.1.1. Key Concepts of Knowledge Discovery Processes
- 8.1.2. Historical Perspective of Knowledge Discovery Processes
- 8.1.3. Stages of Knowledge Discovery Processes
- 8.1.4. Techniques Used in Knowledge Discovery Processes
- 8.1.5. Characteristics of Good Machine Learning Models
- 8.1.6. Types of Machine Learning Information
- 8.1.7. Basic Learning Concepts
- 8.1.8. Basic Concepts of Unsupervised Learning

8.2. Data Exploration and Pre-Processing
- 8.2.1. Data Processing
- 8.2.2. Data Processing in the Data Analysis Flow
- 8.2.3. Types of Data
- 8.2.4. Data Transformations
- 8.2.5. Visualization and Exploration of Continuous Variables
- 8.2.6. Visualization and Exploration of Categorical Variables
- 8.2.7. Correlation Measures
- 8.2.8. Most Common Graphic Representations
- 8.2.9. Introduction to Multivariate Analysis and Dimensionality Reduction

8.3. Decision Trees
- 8.3.1. ID3 Algorithm
- 8.3.2. C4.5. Algorithm
- 8.3.3. Overtraining and Pruning
- 8.3.4. Result Analysis

8.4. Evaluation of Classifiers
- 8.4.1. Confusion Matrices
- 8.4.2. Numerical Evaluation Matrices
- 8.4.3. Kappa Statistic
- 8.4.4. ROC Curves



8.5. Classification Rules
- 8.5.1. Rule Evaluation Measures
- 8.5.2. Introduction to Graphic Representation
- 8.5.3. Sequential Overlay Algorithm

8.6. Neural Networks
- 8.6.1. Basic Concepts
- 8.6.2. Simple Neural Networks
- 8.6.3. Backpropagation Algorithm
- 8.6.4. Introduction to Recurrent Neural Networks

8.7. Bayesian Methods
- 8.7.1. Basic Probability Concepts
- 8.7.2. Bayes' Theorem
- 8.7.3. Naive Bayes
- 8.7.4. Introduction to Bayesian Networks

8.8. Regression and Continuous Response Models
- 8.8.1. Simple Linear Regression
- 8.8.2. Multiple Linear Regression
- 8.8.3. Logistic Regression
- 8.8.4. Regression Trees
- 8.8.5. Introduction to Support Vector Machines (SVM)
- 8.8.6. Goodness-of-Fit Measures

8.9. *Clustering*
- 8.9.1. Basic Concepts
- 8.9.2. Hierarchical Clustering
- 8.9.3. Probabilistic Methods
- 8.9.4. EM Algorithm
- 8.9.5. B-Cubed Method
- 8.9.6. Implicit Methods

8.10. Text Mining and Natural Language Processing (NLP)
- 8.10.1. Basic Concepts
- 8.10.2. Corpus Creation
- 8.10.3. Descriptive Analysis
- 8.10.4. Introduction to Feelings Analysis

Module 9. Multi-Agent Systems and Computational Perception

9.1. Agents and Multi-Agent Systems
- 9.1.1. Concept of Agent
- 9.1.2. Architecture
- 9.1.3. Communication and Coordination
- 9.1.4. Programming Languages and Tools
- 9.1.5. Applications of the Agents
- 9.1.6. The FIPA

9.2. The Standard for Agents: FIPA
- 9.2.1. Communication between Agents
- 9.2.2. Agent Management
- 9.2.3. Abstract Architecture
- 9.2.4. Other Specifications

9.3. The JADE Platform
- 9.3.1. Software Agents According to JADE
- 9.3.2. Architecture
- 9.3.3. Installation and Execution
- 9.3.4. JADE Packages

9.4. Basic Programming with JADE
- 9.4.1. The Management Console
- 9.4.2. Basic Creation of Agents

9.5. Advanced Programming with JADE
- 9.5.1. Advanced Creation of Agents
- 9.5.2. Communication between Agents
- 9.5.3. Discovering Agents

9.6. Computer Vision
- 9.6.1. Processing and Digital Analysis of Images
- 9.6.2. Image Analysis and Artificial Vision
- 9.6.3. Image Processing and Human Vision
- 9.6.4. Image Capturing System
- 9.6.5. Image Formation and Perception

9.7. Digital Image Analysis
- 9.7.1. Stages of the Image Analysis Process
- 9.7.2. Pre-Processing
- 9.7.3. Basic Operations
- 9.7.4. Spatial Filtering

9.8. Digital Image Transformation and Image Segmentation
- 9.8.1. Fourier Transform
- 9.8.2. Frequency Filtering
- 9.8.3. Basic Concepts
- 9.8.4. Thresholding
- 9.8.5. Contour Detection

9.9. Shape Recognition
- 9.9.1. Feature Extraction
- 9.9.2. Classification Algorithms

9.10. Natural Language Processing
- 9.10.1. Automatic Speech Recognition
- 9.10.2. Computational Linguistics

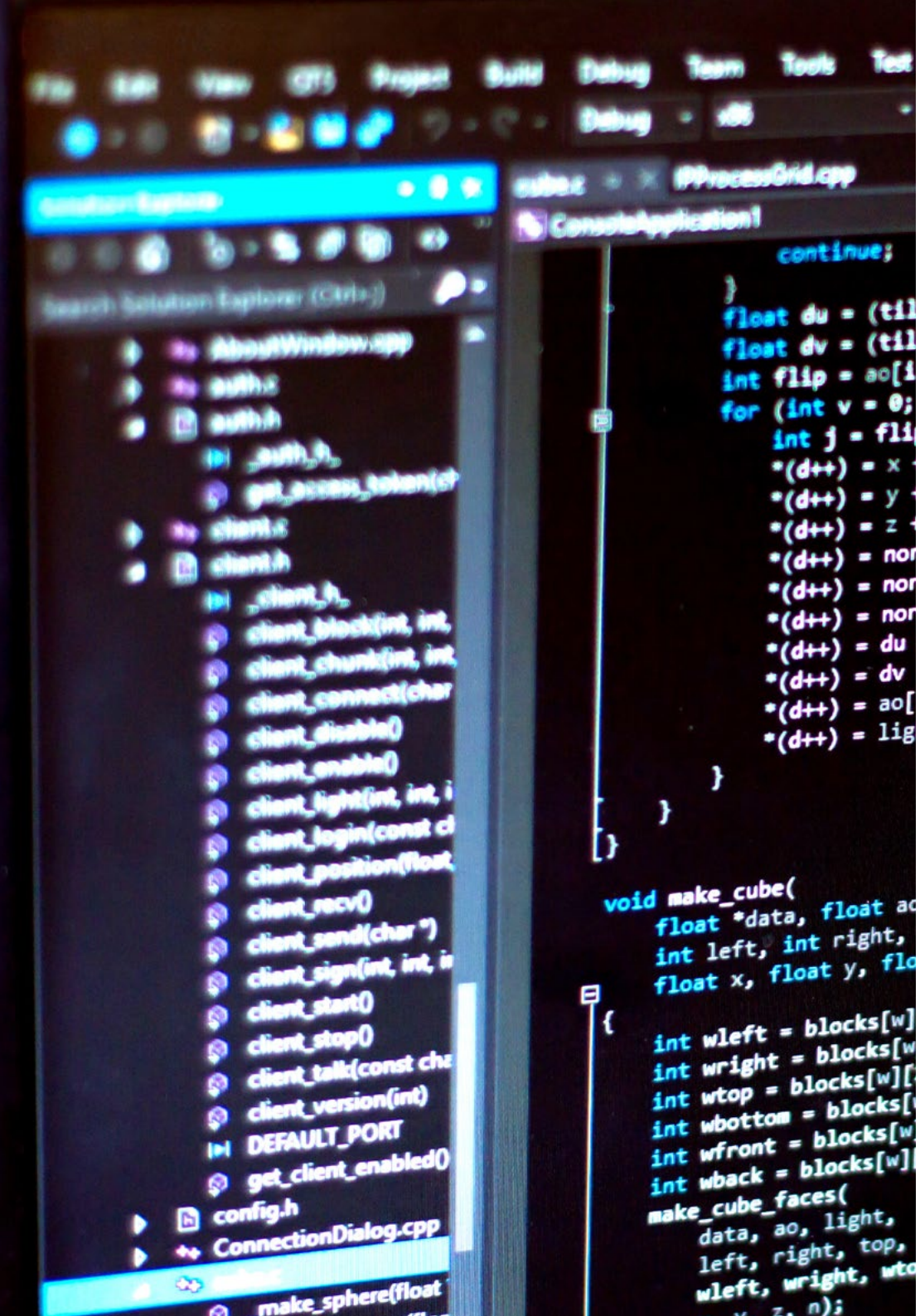
Module 10. Bio-Inspired Computing

10.1. Introduction to Bio-Inspired Computing
- 10.1.1. Concept and Foundations of Bio-Inspired Computing

10.2. Social Adaptation Algorithms
- 10.2.1. Bio-Inspired 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. Space Exploration-Exploitation Strategies for 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. Neural Networks (I)
- 10.9.1. Introduction to Neural Networks
- 10.9.2. Practical Example with Neural Networks

10.10. Neural Networks (II)
- 10.10.1. Use Cases of Neural Networks in Medical Research
- 10.10.2. Use Cases of Neural Networks in Economics
- 10.10.3. Use Cases of Neural Networks in Artificial Vision

You will apply knowledge representation techniques and computational logic to create automated solutions"

04

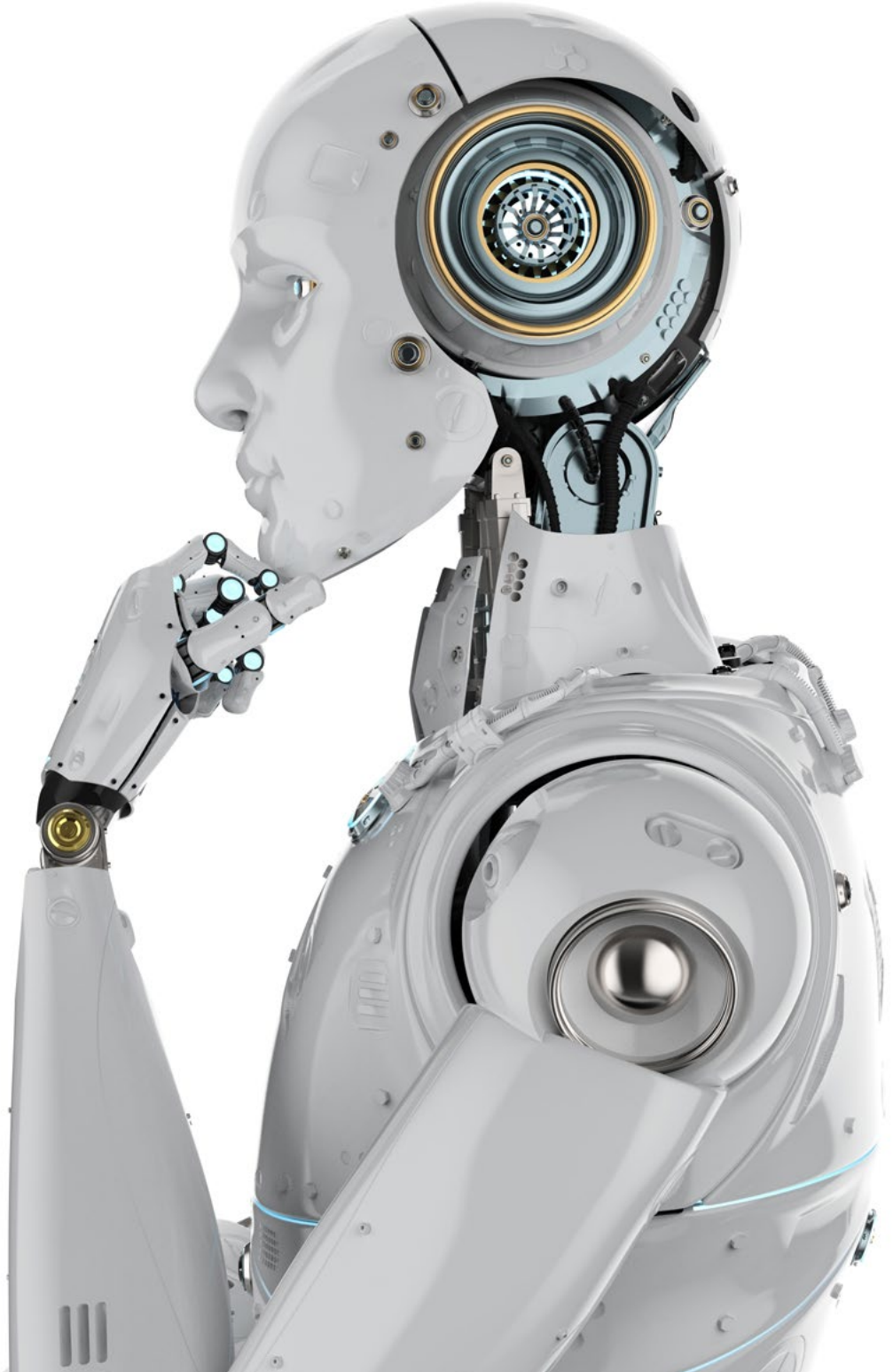
Teaching Objectives

This university program will enhance the technical expertise of IT professionals in designing advanced solutions based on Artificial Intelligence and Knowledge Engineering. Throughout the academic journey, students will refine their key skills in programming, algorithm design, data abstraction, and building intelligent architectures. They will also develop expertise in automation, process optimization, and the application of innovative methodologies. As a result, students will integrate emerging technologies, improve operational efficiency, and strengthen decision-making in complex institutional environments.

You will be capable of building autonomous agents, multi-agent systems, and environments with automated reasoning"

General Objectives

- Understand the fundamentals of programming and their application in developing intelligent solutions
- Design efficient data structures for managing and analyzing information
- Apply advanced algorithms and optimization techniques to computational problems
- Integrate modern Artificial Intelligence models for process automation
- Develop intelligent systems capable of analyzing environments and making autonomous decisions
- Implement sophisticated machine learning and data mining techniques for extracting relevant patterns
- Explore the functioning of multi-agent systems and their impact on solving distributed problems
- Apply computational perception methodologies in image analysis and pattern recognition



Specific Objectives

Module 1. Programming Fundamentals

- Recognize the fundamental elements of the C++ language and its development environment to build functional programs from a structured perspective
- Design efficient algorithms applying descriptive techniques and control structures to solve computational problems with precision
- Implement static and dynamic data structures, including pointers and arrays, to optimize information handling in various contexts
- Apply testing, documentation, and recursion strategies in software development, ensuring quality, maintenance, and functionality

Module 2. Data Structures

- Understand abstract data types, data structure types, and their implementation in C++
- Delve into the functioning of advanced data structures beyond the common ones

Module 3. Algorithmics and Complexity

- Master various testing techniques in software programs and source code
- Examine the fundamentals of programming in C++, including classes, variables, conditional expressions, and objects
- Understand graph theory, as well as advanced algorithms and concepts related to graphs

Module 4. Advanced Algorithms Design

- Analyze the main algorithm design strategies and various methods and metrics for calculating them
- Learn the key sorting algorithms used in software development
- Understand the operation of algorithms involving trees, heaps, and graphs

Module 5. Logic in Computer Science

- Understand the fundamentals of computational logic, its applications, and justification for its use
- Learn various formalization and deduction strategies in propositional logic

Module 6. Artificial Intelligence and Knowledge Engineering

- Analyze in-depth the foundations of Artificial Intelligence and Knowledge Engineering
- Examine how Artificial Intelligence works in games
- Delve into the fundamental concepts of neural networks and the use of genetic algorithms
- Understand the operation of expert systems and decision support systems

Module 7. Intelligent Systems

- Explore the theoretical foundations and functional architectures of intelligent agents, addressing their reasoning process
- Compare knowledge representation models such as vocabularies, taxonomies, thesauruses, or mind maps
- Analyze the operation and projection of the semantic web, recognizing its current applications

Module 8. Machine Learning and Data Mining

- Investigate the fundamentals of Knowledge Discovery and essential concepts related to machine learning
- Develop skills in exploring and preprocessing data, applying decision tree-based algorithms
- Examine the functioning of Bayesian methods, regression techniques, and those focused on continuous responses
- Address the principles of text mining and natural language processing, as well as fundamental clustering techniques

Module 9. Multi-Agent Systems and Computational Perception

- Understand both the fundamentals and advanced applications related to agents and multi-agent systems
- Address the principles of natural language processing, including automatic speech recognition and computational linguistics

Module 10. Bio-Inspired Computing

- Delve into the fundamentals of bio-inspired computing and the principles that govern various algorithms
- Analyze evolutionary programming focused on machine learning and its application in multi-objective contexts

You will achieve your objectives with the support of TECH's multimedia resources, including explanatory videos and interactive summaries"

05

Career Opportunities

This TECH program provides a unique opportunity for IT professionals who wish to refine their skills in Artificial Intelligence and Knowledge Engineering. Through a practical approach, students will gain key knowledge in advanced algorithms, intelligent systems, and knowledge representation. In this way, experts will master the most innovative tools to tackle the most complex technological challenges in highly dynamic digital environments.

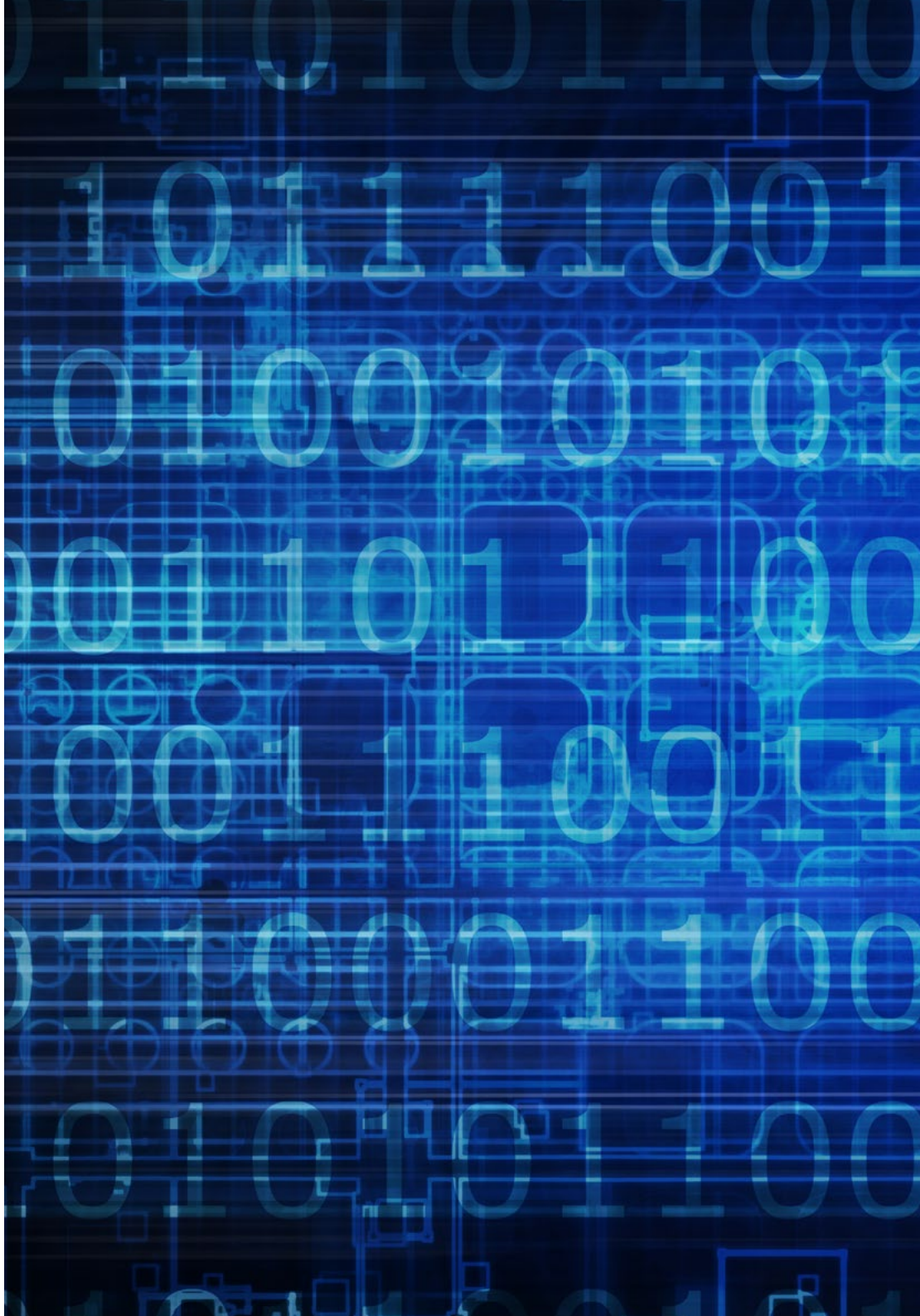
You will design IT solutions that improve the efficiency, personalization, and autonomy of intelligent systems"

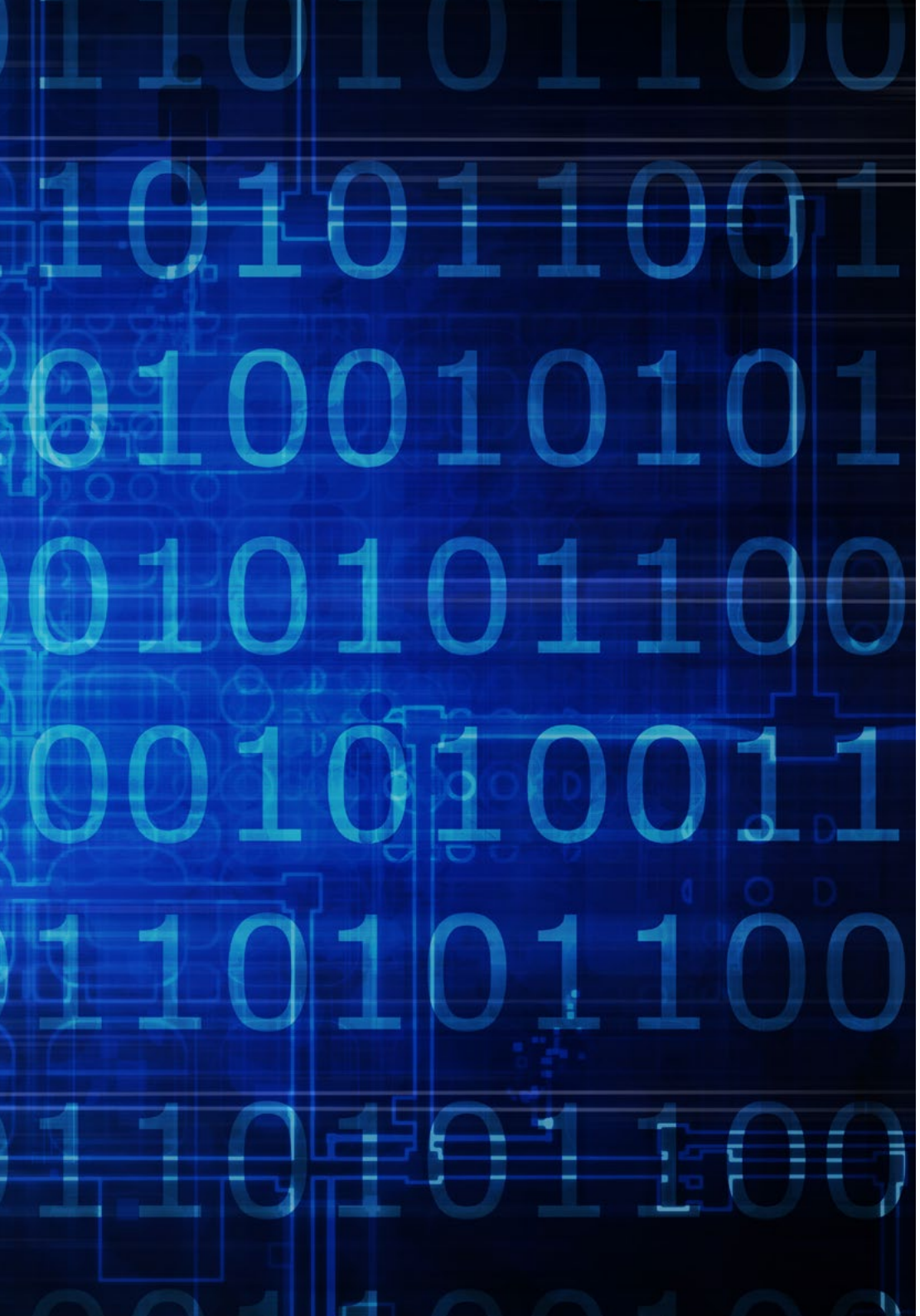
Graduate Profile

The graduate will be capable of designing intelligent solutions adapted to complex and changing environments. In fact, they will connect advanced tools for data mining, machine learning, and computational perception to develop autonomous systems. They will also combine logical thinking with technical creativity to structure data-based models, optimize algorithms, and build scalable architectures. As a result, they will actively participate in high-impact projects, leading initiatives that integrate automation, predictive analytics, and the development of emerging technologies in various professional contexts.

Do you want to work as a Data Mining and Machine Learning Technician? Achieve it thanks to this university program.

- **Critical Thinking:** Ability to question assumptions, analyze problems from multiple perspectives, and design coherent solutions in complex and dynamic environments.
- **Multidisciplinary and Effective Communication:** Professionals are able to clearly convey technical and strategic ideas, facilitating effective collaboration among diverse profiles within a team.
- **Autonomous Learning:** Skill in continuously updating knowledge, especially in the ever-evolving and expanding field of Artificial Intelligence.
- **Problem Solving:** Ability to tackle challenges in a structured manner, combining creativity, logic, and technological tools in the search for efficient solutions.





After completing the university program, you will be able to apply your knowledge and skills in the following positions:

1. **Consultant in Smart Solutions Integration:** Responsible for guiding organizations in the adoption of Artificial Intelligence-based technologies, ensuring their alignment with strategic and operational objectives.
2. **AI System Implementation Technician:** Responsible for executing, maintaining, and adjusting intelligent platforms, ensuring their proper functioning and adaptability to existing technological environments.
3. **Administrator of Intelligent Environments and Data:** Specialist in managing infrastructures that support intelligent systems, ensuring security, scalability, and optimal performance of digital resources.
4. **Consultant in Automation and Computational Efficiency:** Designs and evaluates strategies to optimize processes through Artificial Intelligence, generating customized solutions for business and government environments.

> *You will manage the development and implementation environments of cognitive systems, ensuring their availability and operational efficiency"*

06

Software Licenses Included

TECH is a leading reference in the academic world for combining the latest technology with teaching methodologies to enhance the teaching-learning process. To achieve this, it has established a network of alliances that grants access to the most advanced software tools used in the professional world.

Upon enrolling, you will receive, completely free of charge, academic credentials for the following professional software applications"

TECH has established a network of professional alliances with the leading providers of software applied to various professional fields. These alliances allow TECH to access hundreds of software applications and licenses, making them available to its students.

The academic software licenses will allow students to use the most advanced applications in their professional field, so they can become familiar with them and master their use without incurring additional costs. TECH will handle the hiring process so that students can use them unlimited during the time they are studying the Professional Master's Degree in Artificial Intelligence and Knowledge Engineering, and they will be able to do so completely free of charge.

TECH will provide free access to the following software applications:

Google Career Launchpad

Google Career Launchpad is a solution for developing digital skills in technology and data analysis. With an estimated value of **$5,000**, it is included **for free** in TECH's university program, providing access to interactive labs and certifications recognized in the industry.

This platform combines technical training with practical cases, using technologies such as BigQuery and Google AI. It offers simulated environments to work with real data, along with a network of experts for personalized guidance.

Key Features:

- **Specialized Courses:** Updated content in cloud computing, machine learning, and data analysis
- **Live Labs:** Hands-on practice with real Google Cloud tools, no additional configuration required
- **Integrated Certifications:** Preparation for official exams with international validity
- **Professional Mentoring:** Sessions with Google experts and technology partners
- **Collaborative Projects:** Challenges based on real-world problems from leading companies

In conclusion, **Google Career Launchpad** connects users with the latest market technologies, facilitating their entry into fields such as artificial intelligence and data science with industry-backed credentials.

Thanks to TECH, you will be able to use the best professional software applications in your field for free"

07

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.

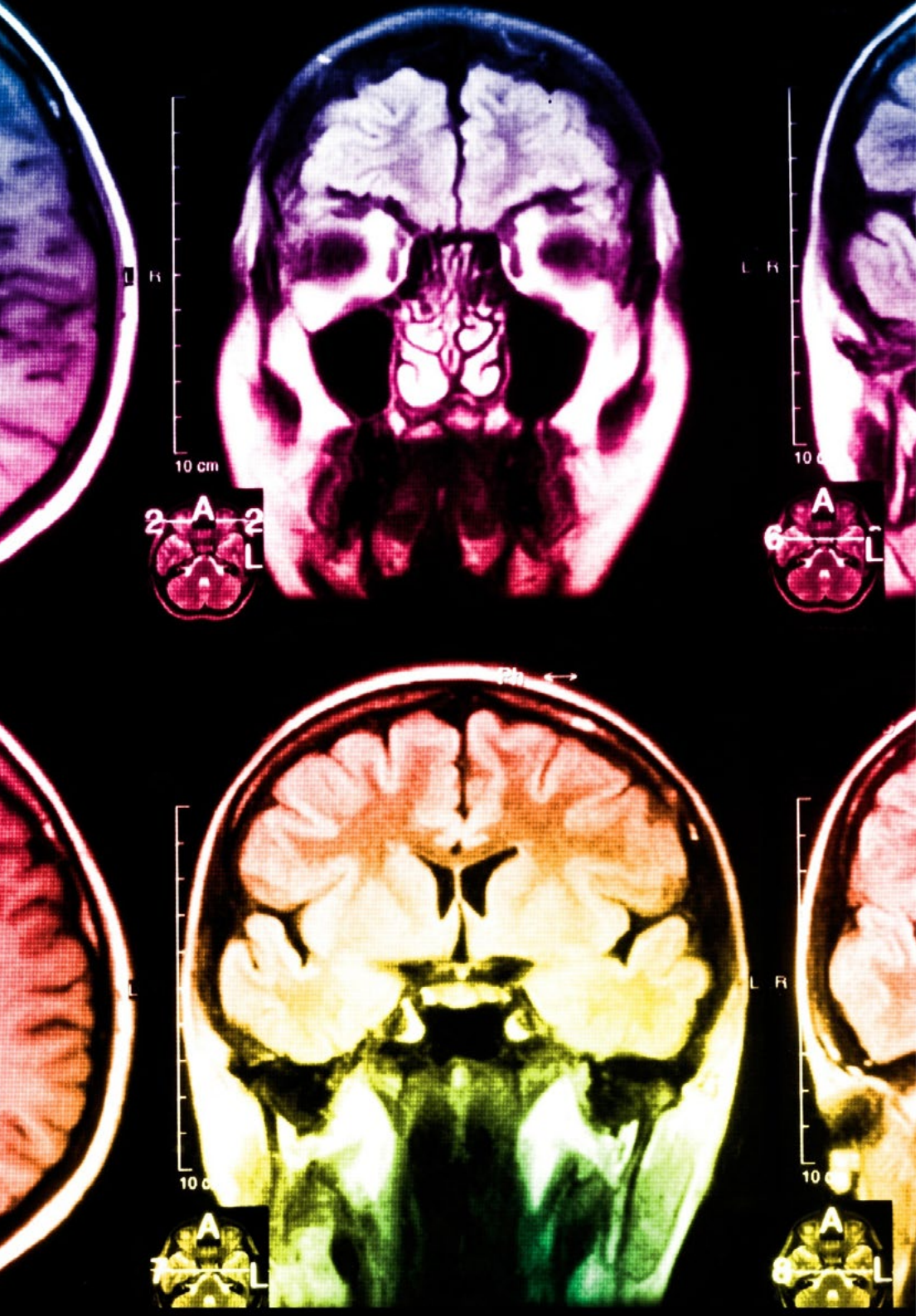
In order to facilitate tutor-student contact as much as possible, you will have a wide range of communication possibilities, both in real time and delayed (internal messaging, telephone answering service, email contact with the technical secretary, chat and videoconferences).

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.

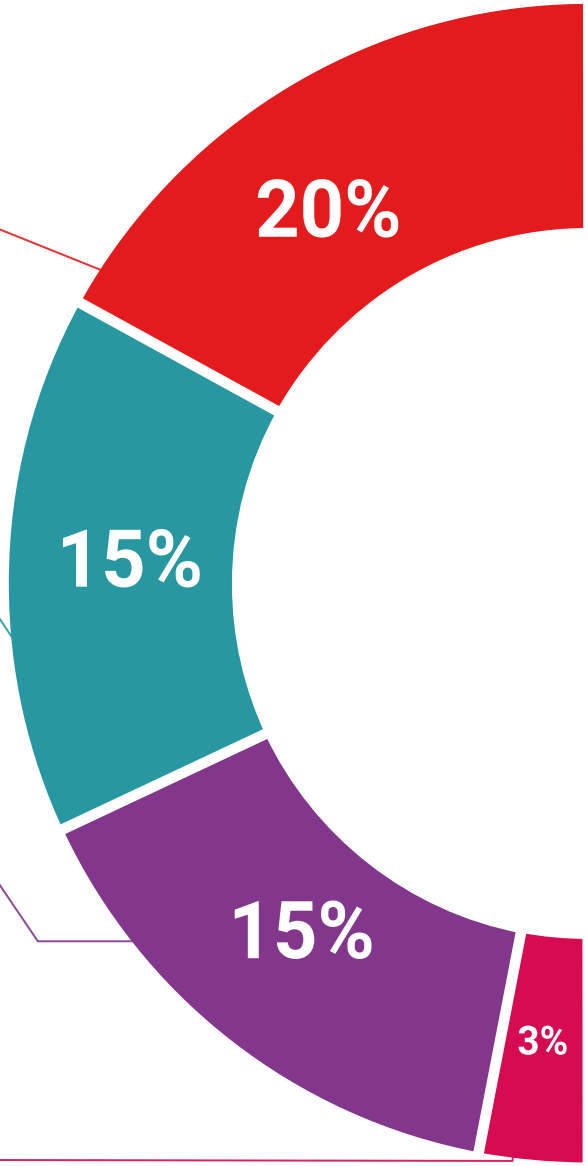
Interactive Summaries

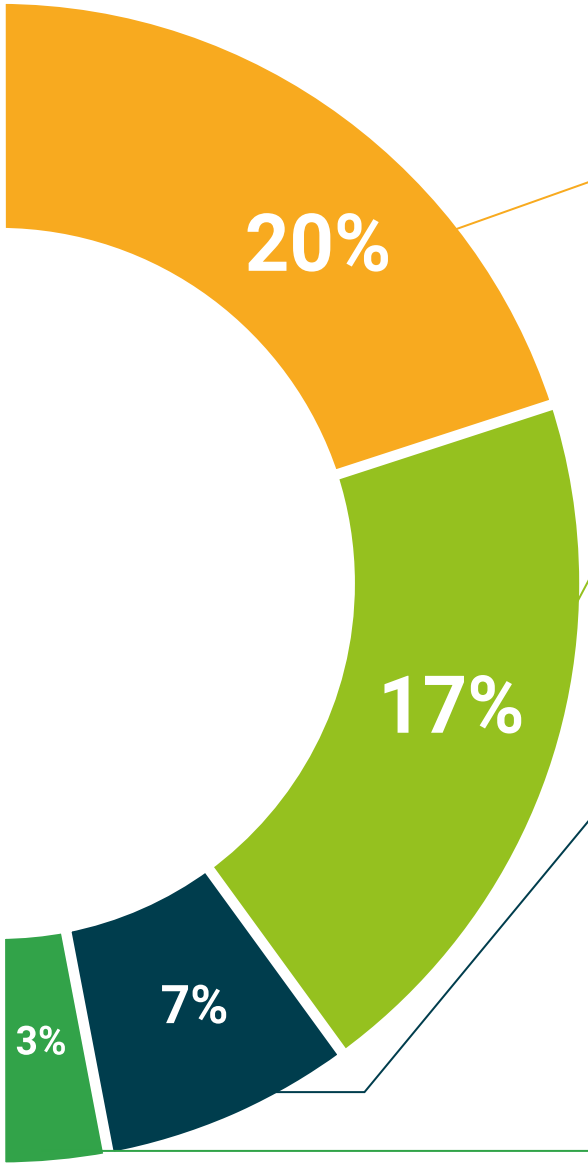
We present the contents attractively and dynamically in multimedia lessons that include audio, videos, images, diagrams, and concept maps in order to reinforce knowledge.

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.

08

Certificate

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

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

This private qualification will allow you to obtain a**Professional Master's Degree in Artificial Intelligence and Knowledge Engineering**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.

TECH is a member of the **Society for the Study of Artificial Intelligence and Simulation of Behaviour (AISB)**, the largest European organization dedicated to the development of Artificial Intelligence. This membership reaffirms its active role in scientific advancements related to new technologies.

Accreditation/Membership

Title: **Professional Master's Degree in Artificial Intelligence and Knowledge Engineering**

Modality: **online**

Duration: **12 months**

Accreditation: **60 ECTS**

tech global university

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

Professional Master's Degree in Artificial Intelligence and Knowledge Engineering

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: AFWOR023S techtitute.com/certificates

Professional Master's Degree in Artificial Intelligence and Knowledge Engineering

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
1°	Programming Fundamentals	6	CO
1°	Data Structures	6	CO
1°	Algorithmics and Complexity	6	CO
1°	Advanced Algorithms Design	6	CO
1°	Logic in Computer Science	6	CO
1°	Artificial Intelligence and Knowledge Engineering	6	CO
1°	Intelligent Systems	6	CO
1°	Machine Learning and Data Mining	6	CO
1°	Multi-Agent Systems and Computational Perception	6	CO
1°	Bio-Inspired Computing	6	CO

Dr. Pedro Navarro Illana
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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Professional Master's Degree

Artificial Intelligence and Knowledge Engineering

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

Professional Master's Degree

Artificial Intelligence and Knowledge Engineering

Accreditation/Membership

The Society for the Study of Artificial Intelligence and Simulation of Behaviour

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