Master's Degree

Artificial Intelligence in Clinical Research

tech global university

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Master's Degree
Artificial Intelligence in Clinical Research

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

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

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01

Introduction

The application of Artificial Intelligence (AI) in Clinical Research has revolutionized the way medical data is analyzed and understood. This approach has streamlined research processes by enabling faster and more accurate analysis of large data sets, identifying patterns and correlations that might go unnoticed by traditional methods. In this way, AI facilitates the prediction of clinical trial results, helps to personalize treatments according to individual profiles and optimizes the early identification of diseases. That is why TECH has developed an academic program that will immerse physicians in innovation in this field. Based on the revolutionary Relearning methodology, the learning system consists of repetition of key concepts.

The ability of AI to integrate data from various sources, as well as to predict results, contributes to more precise and personalized medicine"

Through the application of Artificial Intelligence (AI) in Clinical Research, it is possible to streamline the process of analyzing large medical data sets, allowing researchers to identify patterns, correlations and trends more efficiently. In addition, AI contributes to the personalization of medicine, thanks to the adaptation of treatments according to the individual characteristics of patients. In fact, new technologies not only optimize processes, but also open up new perspectives for addressing medical challenges and improving the quality of care.

For this reason, TECH has created this program in which AI and biomedicine converge, providing professionals with a deep and practical understanding of the specific applications of this technology in the field of Clinical Research. Accordingly, the syllabus includes specialized modules such as computational simulation in biomedicine and advanced analysis of clinical data, which will enable graduates to acquire advanced skills in the application of AI in complex biomedical situations. In addition, the focus on ethics, regulations and legal considerations in the use of AI in the clinical setting will be addressed.

Likewise, the degree integrates cutting-edge technologies, such as genomic sequencing and biomedical image analysis, addressing emerging issues, such as sustainability in biomedical research and the management of large volumes of data. In this context, students will be equipped with the necessary skills to lead at the convergence of AI and Clinical Research. TECH has designed a comprehensive program based on the innovative methodology of Relearning with the purpose of forging highly competent specialists in AI. This learning modality focuses on reiterating key concepts to consolidate an optimal understanding. Only an electronic device connected to the Internet will be required to access the contents at any time, eliminating the need for on-site attendance or to adhere to fixed schedules.

This **Master's Degree in Artificial Intelligence in Clinical Research** contains the most complete and up-to-date scientific program on the market. Its most notable features are:

- The development of case studies presented by experts in Artificial Intelligence in Clinical Research
- The graphic, schematic and practical contents with which it is conceived provide scientific 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

This program in Artificial Intelligence in Clinical Research is highly relevant on the current healthcare and technology scene"

You will explore the latest technologies and the most innovative applications of Artificial Intelligence in Clinical Research, using the best multimedia resources"

Thanks to this 100% online program, you will thoroughly analyze the essential principles of machine learning and its implementation in the analysis of clinical and biomedical data.

You will gain in-depth knowledge of the implementation of Big Data and machine learning techniques in Clinical Research. Enroll now!

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

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

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

02

Objectives

This program not only aims to provide a deep understanding of Artificial Intelligence applied to Clinical Research, but also to train leaders capable of facing current and future challenges in medicine. When embarking on this degree, graduates will be immersed in an academic environment where innovation and ethics intersect to transform medical care. They will therefore address medical data analysis techniques, the development of predictive models for clinical trials and the implementation of innovative solutions for the personalization of treatments. In this way, they will address clinical problems with data-based solutions.

Bet on TECH! You will develop AI skills and address clinical problems with data-driven solutions"

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
- Analyze bio-inspired computing and its relevance in the development of intelligent systems
- Analyze current strategies of Artificial Intelligence in various fields, identifying opportunities and challenges
- Obtain a comprehensive view of the transformation of Clinical Research through AI, from its historical foundations to current applications
- Learn effective methods for integrating heterogeneous data into clinical research, including natural language processing and advanced data visualization
- Acquire a solid understanding of model validation and simulations in the biomedical domain, exploring the use of synthetic datasets and practical applications of AI in health research
- Understand and apply genomic sequencing technologies, AI data analysis and use of AI in biomedical imaging
- Acquire expertise in key areas such as personalization of therapies, precision medicine, AI-assisted diagnostics, and clinical trial management
- Obtain a solid understanding of Big Data concepts in the clinical setting and become familiar with essential tools for its analysis
- Delve into ethical dilemmas, review legal considerations, explore the socioeconomic impact and future of AI in healthcare, and promote innovation and entrepreneurship in the field of clinical AI

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

Module 2. Data Types and Data Life Cycle

- Understand the fundamental concepts of statistics and their application in data analysis
- Identify and classify the different types of statistical data, from quantitative to qualitative data
- Analyze the life cycle of data, from generation to disposal, identifying key stages
- Explore the initial stages of the data life cycle, highlighting the importance of data planning and structure
- Study data collection processes, including methodology, tools and collection channels
- Explore the Data Warehouse concept, with emphasis on the elements that comprise it and its design
- Analyze the regulatory aspects related to data management, complying with privacy and security regulations, as well as best practices

Module 3. Data in Artificial Intelligence

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

Module 4. Data Mining. Selection, 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 preprocessing in Big Data environments

Module 5. Algorithm and Complexity in Artificial Intelligence

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

Module 6. Intelligent Systems

- Explore agent theory, understanding the fundamental concepts of its operation and its application in Artificial Intelligence and software engineering
- Study the representation of knowledge, including the analysis of ontologies and their application in the organization of structured information
- Analyze the concept of the semantic web and its impact on the organization and retrieval of information in digital environments

- Evaluate and compare different knowledge representations, integrating these to improve the efficiency and accuracy of intelligent systems
- Study semantic reasoners, knowledge-based systems and expert systems, understanding their functionality and applications in intelligent decision making

Module 7. Machine Learning and Data Mining

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

Module 8. Neural Networks, the Basis of Deep Learning

- Master the fundamentals of Deep Learning, understanding its essential role in Deep Learning
- Explore the fundamental operations in neural networks and understand their application in model building
- Analyze the different layers used in neural networks and learn how to select them appropriately
- 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
- Tuning hyperparameters for *Fine Tuning* of neural networks, optimizing their performance on specific tasks

Module 9. Deep Neural Networks Training

- Solve gradient-related problems in deep neural network training
- Explore and apply different optimizers to improve the efficiency and convergence of models
- Program the learning rate to dynamically adjust the convergence speed of the model
- Understand and address overfitting through specific strategies during training
- Apply practical guidelines to ensure efficient and effective training of deep neural networks

- Implement *Transfer Learning* as an advanced technique to improve model performance on specific tasks
- Explore and apply *Data Augmentation* techniques to enrich datasets and improve model generalization
- Develop practical applications using *Transfer Learning* to solve real-world problems
- Understand and apply regularization techniques to improve generalization and avoid overfitting in deep neural networks

Module 10. Model Customization and Training with *TensorFlow*

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

Module 11. Deep Computer Vision with Convolutional Neural Networks

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

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

- Developing skills in text generation using Recurrent Neural Networks (RNN)
- Apply RNNs in opinion classification for sentiment analysis in texts
- Understand and apply attentional mechanisms in natural language processing models
- Analyze and use Transformers models in specific NLP tasks

- Explore the application of Transformers models in the context of image processing and computer vision
- Become familiar with the *Hugging Face Transformers* library for efficient implementation of advanced models
- Compare different Transformers libraries to evaluate their suitability for specific tasks
- Develop a practical application of NLP that integrates RNN and attention mechanisms to solve real-world problems

Module 13. Autoencoders, GANs, and Diffusion Models

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

Module 14. Bio-Inspired Computing

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

Module 15. Artificial Intelligence: Strategies and Applications

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

Module 16. Artificial Intelligence Methods and Tools for Clinical Research

- Gain a comprehensive view of how AI is transforming Clinical Research, from its historical foundations to current applications
- Implement advanced statistical methods and algorithms in clinical studies to optimize data analysis
- Design experiments with innovative approaches and perform comprehensive analysis of results in Clinical Research
- Apply natural language processing to improve scientific and clinical documentation in the Research context
- Effectively integrate heterogeneous data using state-of-the-art techniques to enhance interdisciplinary clinical research

Module 17. Biomedical Research with AI

- Acquire solid knowledge on the validation of models and simulations in the biomedical field, ensuring their accuracy and clinical relevance
- Integrate heterogeneous data using advanced methods to enrich the multidisciplinary analysis in Clinical Research
- Develop deep learning algorithms to improve the interpretation and analysis of biomedical data in clinical trials
- Explore the use of synthetic datasets in clinical studies and understand the practical applications of AI in health research
- Understand the crucial role of computational simulation in drug discovery, analysis of molecular interactions, and modeling of complex diseases

Module 18. Practical Application of Artificial Intelligence in Clinical Research

- Acquire expertise in key areas such as personalization of therapies, precision medicine, AI-assisted diagnosis, clinical trial management and vaccine development
- Incorporate robotics and automation in clinical laboratories to optimize processes and improve the quality of results
- Explore the impact of AI in microbiome, microbiology, wearables and remote monitoring in clinical studies
- Address contemporary challenges in the biomedical field, such as efficient management of clinical trials, development of AI-assisted treatments, and application of AI in immunology and immune response studies
- Innovate in AI-assisted diagnostics to improve early detection and diagnostic accuracy in clinical and biomedical research settings

Module 19. Big Data Analytics and Machine Learning in Clinical Research

- Gain a solid understanding of the fundamental concepts of Big Data in the clinical setting and become familiar with the essential tools used for its analysis
- Explore advanced data mining techniques, machine learning algorithms, predictive analytics, and AI applications in epidemiology and public health
- Analyze biological networks and disease patterns to identify connections and potential treatments

- Address data security and manage challenges associated with large volumes of data in biomedical research
- Investigate case studies that demonstrate the potential of Big Data in biomedical research

Module 20. Ethical, Legal and Future Aspects of Artificial Intelligence in Clinical Research

- Understand the ethical dilemmas that arise when applying AI in clinical research and review the relevant legal and regulatory considerations in the biomedical setting
- Address specific challenges in the management of informed consent in AI studies
- Investigate how AI can influence equity and access to healthcare
- Analyze future perspectives on how AI will shape Clinical Research, exploring its role in the sustainability of biomedical research practices and identifying opportunities for innovation and entrepreneurship
- Comprehensively address the ethical, legal and socioeconomic aspects of AI-driven Clinical Research

Update your daily clinical practice to be at the forefront of the technological revolution in health, contributing to the advancement of Clinical Research"

03

Skills

This Master's Degree will provide graduates with an exceptionally comprehensive and specialized update on the application of Artificial Intelligence in the field of Clinical Research. In this way, they will be equipped with advanced and practical skills to address complex biomedical challenges, from data analysis to the simulation of biological processes. In addition, it will offer a comprehensive understanding of cutting-edge technologies, such as genomic sequencing and biomedical image analysis. Not forgetting the ethical, legal and regulatory aspects, which are crucial in the implementation of AI in clinical contexts.

Thanks to this program, you will enhance diagnostic accuracy and the design of personalized treatments, revolutionizing medical care with innovation and efficiency"

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 AI tools, platforms and techniques, from data analysis to the application of neural networks and predictive modeling
- Apply computational models to simulate biological processes and treatment responses, using AI to improve understanding of complex biomedical phenomena
- Face contemporary challenges in the biomedical field, including the efficient management of clinical trials and the application of AI in immunology

Specific Skills

- Apply AI techniques and strategies to improve efficiency in the retail sector
- Delve into understanding and application of genetic algorithms
- Implement noise removal techniques using automatic encoders
- Effectively create training data sets for natural language processing (NLP) tasks
- Run grouping layers and their use in Deep Computer Vision models with Keras
- Use *TensorFlow* features and graphs to optimize the performance of custom models
- Optimize the development and application of chatbots and virtual assistants, understanding their operation and potential applications
- Master reuse of pre-workout layers to optimize and accelerate the training process
- Build the first neural network, applying the concepts learned in practice
- Activate Multilayer Perceptron (MLP) using the Keras library
- Apply data scanning and preprocessing techniques, identifying and preparing data for effective use in machine learning models
- Implement effective strategies for handling missing values in datasets, applying imputation or elimination methods according to context
- Investigate languages and software for the creation of ontologies, using specific tools for the development of semantic models
- Develop data cleaning techniques to ensure the quality and accuracy of the information used in subsequent analyses
- Master the AI tools, platforms and techniques used in Clinical Research, covering everything from data analysis to the application of neural networks and predictive modeling
- Apply computational models in the simulation of biological processes, diseases and responses to treatments, using AI tools to improve the understanding and representation of complex biomedical phenomena
- Apply genome sequencing and data analysis technologies with AI intelligence
- Use AI in biomedical image analysis
- Acquire skills in advanced visualization and effective communication of complex data, with a focus on the development of AI-based tools

You will lead innovation in the convergence of Artificial Intelligence and Clinical Research. What are you waiting for to enroll?"

04

Course Management

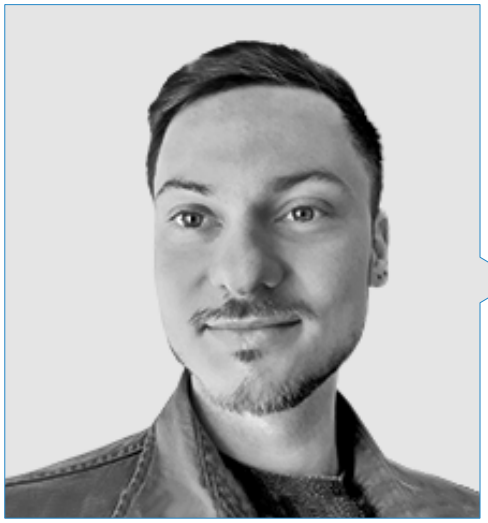
The teaching staff of the Artificial Intelligence in Clinical Research program represents academic excellence and practical experience in the convergence of medicine and technology. These outstanding professionals not only have in-depth knowledge of AI and data analysis, but also have an outstanding background in the application of these tools in medical research. Their commitment will be focused on transmitting not only theoretical knowledge, but also sharing their real experiences, providing graduates with an invaluable perspective for facing current and future challenges in the field of healthcare.

The teaching team will offer you invaluable and practical guidance, merging AI and Clinical Research to create significant advances in healthcare"

Management

Dr. Peralta Martín-Palomino, Arturo

- CEO and CTO at Prometeus Global Solutions
- CTO at Korporate Technologies
- CTO at AI Shephers GmbH
- Consultant and Strategic Business Advisor at Alliance Medical
- Director of Design and Development at DocPath
- PhD in Computer Engineering 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
- Master's Degree in Expert 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



Mr. Popescu Radu, Daniel Vasile

- Independent Specialist in Pharmacology, Nutrition and Dietetics
- Freelance Producer of Teaching and Scientific Contents
- Nutritionist and Community Dietitian
- Community Pharmacist
- Researcher
- Master's Degree in Nutrition and Health at the Open University of Cataluña
- Master's Degree in Psychopharmacology from the University of Valencia
- Pharmacist from the Complutense University of Madrid
- Nutritionist-Dietician from the European University Miguel de Cervantes

Professors

Dr. Carrasco González, Ramón Alberto

- Computer Science and Artificial Intelligence Specialist
- Researcher
- Head of Business Intelligence (Marketing) at Caja General de Ahorros de Granada and Banco Mare Nostrum.
- Head of Information Systems (Data Warehousing and Business Intelligence) at General Savings Bank of Granada and Mare Nostrum Bank.
- PhD in Artificial Intelligence from the University of Granada
- Higher Engineering Degree in Computer Science from the University of Granada

05

Structure and Content

This program is carefully designed to merge the scientific rigor of clinical research with the disruptive innovations of Artificial Intelligence. Its structure is based on specialized modules, from the interpretation of medical data to the development of predictive algorithms and the implementation of technological solutions in clinical environments. The content is a blend of theory and practice, covering the basics of AI and its specific application in the medical field. In this way, graduates will be prepared to lead advances in the personalization of treatments and the optimization of healthcare.

Benefit from a syllabus created by experts and top-quality content. Update your clinical practice thanks to TECH!"

Module 1. Fundamentals of Artificial Intelligence

1.1. History of Artificial Intelligence
- 1.1.1. When Do We Start Talking About Artificial Intelligence?
- 1.1.2. References in Films
- 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 Life Cycle

2.1. Statistics
- 2.1.1. Statistics: Descriptive Statistics, Statistical Inferences
- 2.1.2. Population, Sample, Individual
- 2.1.3. Variables: Definition, Measurement Scales

2.2. Types of Data Statistics
- 2.2.1. According to Type
  - 2.2.1.1. Quantitative: Continuous Data and Discrete Data
  - 2.2.1.2. Qualitative. Binomial Data, Nominal Data and Ordinal Data
- 2.2.2. According to their Shape
  - 2.2.2.1. Numeric
  - 2.2.2.2. Text
  - 2.2.2.3. Logical
- 2.2.3. According to its Source
  - 2.2.3.1. Primary
  - 2.2.3.2. Secondary

2.3. Life Cycle of Data
- 2.3.1. Stages of the Cycle
- 2.3.2. Milestones of the Cycle
- 2.3.3. FAIR Principles

2.4. Initial Stages of the Cycle
- 2.4.1. Definition of Goals
- 2.4.2. Determination of Resource Requirements
- 2.4.3. Gantt Chart
- 2.4.4. Data Structure

2.5. Data Collection
- 2.5.1. Methodology of Data Collection
- 2.5.2. Data Collection Tools
- 2.5.3. Data Collection Channels

2.6. Data Cleaning
- 2.6.1. Phases of Data Cleansing
- 2.6.2. Data Quality
- 2.6.3. Data Manipulation (with R)

2.7. Data Analysis, Interpretation and Evaluation of Results
- 2.7.1. Statistical Measures
- 2.7.2. Relationship Indexes
- 2.7.3. Data Mining

2.8. 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 Preprocessing

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, Preprocessing 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 Preprocessing 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. Criteria for Mathematical Analysis of 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. Sorting by Mixing (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 Preprocessing
- 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. C Algorithm
- 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. Surgery
- 8.2.1. Sum
- 8.2.2. Product
- 8.2.3. Transfer

8.3. Layers
- 8.3.1. Input Layer
- 8.3.2. Cloak
- 8.3.3. Output Layer

8.4. Layer Bonding and Operations
- 8.4.1. Architecture Design
- 8.4.2. Connection between Layers
- 8.4.3. Forward Propagation

8.5. Construction of the first neural network
- 8.5.1. Network Design
- 8.5.2. Establish the Weights
- 8.5.3. Network Training

8.6. Trainer and Optimizer
- 8.6.1. Optimizer Selection
- 8.6.2. Establishment of a Loss Function
- 8.6.3. Establishing a Metric

8.7. Application of the Principles of Neural Networks
- 8.7.1. Activation Functions
- 8.7.2. Backward Propagation
- 8.7.3. Parameter Adjustment

8.8. From Biological to Artificial Neurons
- 8.8.1. Functioning of a Biological Neuron
- 8.8.2. Transfer of Knowledge to Artificial Neurons
- 8.8.3. Establish Relations Between the Two

8.9. Implementation of MLP (Multilayer Perceptron) with Keras
- 8.9.1. Definition of the Network Structure
- 8.9.2. Model Compilation
- 8.9.3. Model Training

8.10. Fine Tuning Hyperparameters of Neural Networks
- 8.10.1. Selection of the Activation Function
- 8.10.2. Set the Learning Rate
- 8.10.3. Adjustment of Weights

Module 9. Deep Neural Networks Training

9.1. Gradient Problems
- 9.1.1. Gradient Optimization Techniques
- 9.1.2. Stochastic Gradients
- 9.1.3. Weight Initialization Techniques

9.2. Reuse of Pre-Trained Layers
- 9.2.1. Learning Transfer Training
- 9.2.2. Feature Extraction
- 9.2.3. Deep Learning

9.3. Optimizers
- 9.3.1. Stochastic Gradient Descent Optimizers
- 9.3.2. Optimizers Adam and RMSprop
- 9.3.3. Moment Optimizers

9.4. Learning Rate Programming
- 9.4.1. Automatic Learning Rate Control
- 9.4.2. Learning Cycles
- 9.4.3. Smoothing Terms

9.5. Overfitting
- 9.5.1. Cross Validation
- 9.5.2. Regularization
- 9.5.3. Evaluation Metrics

9.6. Practical Guidelines
- 9.6.1. Model Design
- 9.6.2. Selection of Metrics and Evaluation Parameters
- 9.6.3. Hypothesis Testing

9.7. *Transfer Learning*
- 9.7.1. Learning Transfer Training
- 9.7.2. Feature Extraction
- 9.7.3. Deep Learning

9.8. *Data Augmentation*
- 9.8.1. Image Transformations
- 9.8.2. Synthetic Data Generation
- 9.8.3. Text Transformation

9.9. Practical Application of Transfer Learning
- 9.9.1. Learning Transfer Training
- 9.9.2. Feature Extraction
- 9.9.3. Deep Learning

9.10. Regularization
- 9.10.1. L and L
- 9.10.2. Regularization by Maximum Entropy
- 9.10.3. *Dropout*

Module 10. Model Customization and training with TensorFlow

10.1. *TensorFlow*
- 10.1.1. Use of the TensorFlow Library
- 10.1.2. Model Training with TensorFlow
- 10.1.3. Operations with Graphs in TensorFlow

10.2. *TensorFlow* and NumPy
- 10.2.1. NumPy Computing Environment for *TensorFlow*
- 10.2.2. Using NumPy Arrays with *TensorFlow*
- 10.2.3. NumPy Operations for *TensorFlow* Graphs

10.3. Model Customization and Training Algorithms
- 10.3.1. Building Custom Models with *TensorFlow*
- 10.3.2. Management of Training Parameters
- 10.3.3. Use of Optimization Techniques for Training

10.4. TensorFlow Features and Graphs
- 10.4.1. Functions with *TensorFlow*
- 10.4.2. Use of Graphs for Model Training
- 10.4.3. Grap Optimization with *TensorFlow* Operations

10.5. Loading and Preprocessing Data with TensorFlow
- 10.5.1. Loading Data Sets with *TensorFlow*
- 10.5.2. Preprocessing Data with TensorFlow
- 10.5.3. Using TensorFlow Tools for Data Manipulation

10.6. The tf.data API
- 10.6.1. Using the *tf.data*API for Data Processing
- 10.6.2. Construction of Data Streams with tf.data
- 10.6.3. Using the tf.data API for Model Training

10.7. The *TFRecord* Format
- 10.7.1. Using the *TFRecord* API for Data Serialization
- 10.7.2. *TFRecord* File Upload with *TensorFlow*
- 10.7.3. Using *TFRecord* Files for Model Training

10.8. Keras Preprocessing Layers
- 10.8.1. Using the Keras Preprocessing API
- 10.8.2. Construction of preprocessing *Pipelined* with Keras
- 10.8.3. Using the Keras Preprocessing API for Model Training

10.9. The *TensorFlow Datasets* Project
- 10.9.1. Using *TensorFlow Datasets* for Data Loading
- 10.9.2. Preprocessing Data with TensorFlow Datasets
- 10.9.3. Using *TensorFlow Datasets* for Model Training

10.10. Building a Deep *Learning* App with *TensorFlow*
- 10.10.1. Practical Applications
- 10.10.2. Building a Deep *Learning* App with *TensorFlow*
- 10.10.3. Model Training with TensorFlow
- 10.10.4. Use of the Application for the Prediction of Results

Module 11. Deep Computer Vision with Convolutional Neural Networks

11.1. The Visual Cortex Architecture
- 11.1.1. Functions of the Visual Cortex
- 11.1.2. Theories of Computational Vision
- 11.1.3. Models of Image Processing

11.2. Convolutional Layers
- 11.2.1. Reuse of Weights in Convolution
- 11.2.2. Convolution D
- 11.2.3. Activation Functions

11.3. Grouping Layers and Implementation of Grouping Layers with Keras
- 11.3.1. *Pooling* and *Striding*
- 11.3.2. *Flattening*
- 11.3.3. Types of Pooling

11.4. CNN Architecture
- 11.4.1. VGG Architecture
- 11.4.2. AlexNet Architecture
- 11.4.3. 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. Learning by Transfer
- 11.7.2. Transfer Learning Process
- 11.7.3. Advantages of Transfer Learning

11.8. Deep Computer Vision Classification and Localization
- 11.8.1. Image Classification
- 11.8.2. Localization of Objects in Images
- 11.8.3. Object Detection

11.9. Object Detection and Object Tracking
- 11.9.1. Object Detection Methods
- 11.9.2. Object Tracking Algorithms
- 11.9.3. Tracking and Localization Techniques

11.10. Semantic Segmentation
- 11.10.1. Deep Learning for Semantic Segmentation
- 11.10.2. Edge Detection
- 11.10.3. Rule-based Segmentation Methods

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

12.1. Text Generation using RNN
- 12.1.1. Training an RNN for Text Generation
- 12.1.2. Natural Language Generation with RNN
- 12.1.3. Text Generation Applications with RNN

12.2. Training Data Set Creation
- 12.2.1. Preparation of the Data for Training an RNN
- 12.2.2. Storage of the Training Dataset
- 12.2.3. Data Cleaning and Transformation
- 12.2.4. Sentiment Analysis

12.3. Classification of Opinions with RNN
- 12.3.1. Detection of Themes in Comments
- 12.3.2. Sentiment Analysis with Deep Learning Algorithms

12.4. Encoder-Decoder Network for Neural Machine Translation
- 12.4.1. Training an RNN for Machine Translation
- 12.4.2. Use of an Encoder-Decoder Network for Machine Translation
- 12.4.3. Improving the Accuracy of Machine Translation with RNNs

12.5. Attention Mechanisms
- 12.5.1. Application of Care Mechanisms in RNN
- 12.5.2. Use of Care Mechanisms to Improve the Accuracy of the Models
- 12.5.3. Advantages of Attention Mechanisms in Neural Networks

12.6. Transformer Models
- 12.6.1. Use of Transformers models for Natural Language Processing
- 12.6.2. Application of Transformers Models for Vision
- 12.6.3. Advantages of Transformers Models

12.7. Transformers for Vision
- 12.7.1. Use of Transformers Models for Vision
- 12.7.2. Image Data Preprocessing
- 12.7.3. Training a TransformersModel for Vision

12.8. *Hugging Face's* Transformers Library
- 12.8.1. Using the *Hugging Face's* Transformers Library
- 12.8.2. *Hugging Face´s* Transformers Library App
- 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 Applications
- 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 Autoencoders
- 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 Uses
- 15.1.3. Potential Risks Related to the Use of AI
- 15.1.4. Potential Future Developments/Uses of AI

15.2. Implications of Artificial Intelligence in the Healthcare Service
- 15.2.1. Implications of AI in the Healthcare Sector. Opportunities and Challenges
- 15.2.2. Case Uses

15.3. Risks Related to the Use of AI in the Health Service
- 15.3.1. Potential Risks Related to the Use of AI
- 15.3.2. Potential Future Developments/Uses of AI

15.4. *Retail*
- 15.4.1. Implications of AI in Retail. Opportunities and Challenges
- 15.4.2. Case Uses
- 15.4.3. Potential Risks Related to the Use of AI
- 15.4.4. Potential Future Developments/Uses of AI

15.5. Industry
- 15.5.1. Implications of AI in Industry. Opportunities and Challenges
- 15.5.2. Case Uses

15.6. Potential Risks Related to the Use of AI in Industry
- 15.6.1. Case Uses
- 15.6.2. Potential Risks Related to the Use of AI
- 15.6.3. Potential Future Developments/Uses of AI

15.7. Public Administration
- 15.7.1. AI Implications for Public Administration. Opportunities and Challenges
- 15.7.2. Case Uses
- 15.7.3. Potential Risks Related to the Use of AI
- 15.7.4. Potential Future Developments/Uses of AI

15.8. Education
- 15.8.1. AI Implications for Education. Opportunities and Challenges
- 15.8.2. Case Uses
- 15.8.3. Potential Risks Related to the Use of AI
- 15.8.4. Potential Future Developments/Uses of AI

15.9. Forestry and Agriculture
- 15.9.1. Implications of AI in Forestry and Agriculture. Opportunities and Challenges
- 15.9.2. Case Uses
- 15.9.3. Potential Risks Related to the Use of AI
- 15.9.4. Potential Future Developments/Uses of AI

15.10. Human Resources
- 15.10.1. Implications of AI for Human Resources. Opportunities and Challenges
- 15.10.2. Case Uses
- 15.10.3. Potential Risks Related to the Use of AI
- 15.10.4. Potential Future Developments/Uses of AI

Module 16. Artificial Intelligence Methods and Tools for Clinical Research

16.1. AI Technologies and Tools in Clinical Research
- 16.1.1. Using Machine Learning to Identify Patterns in Clinical Data
- 16.1.2. Development of Predictive Algorithms for Clinical Trials
- 16.1.3. Implementation of AI Systems to Improve Patient Recruitment
- 16.1.4. AI Tools for Real-Time Analysis of Research Data with Tableau

16.2. Statistical Methods and Algorithms in Clinical Trials
- 16.2.1. Application of Advanced Statistical Techniques for Clinical Data Analysis
- 16.2.2. Use of Algorithms for the Validation and Verification of Trial Results
- 16.2.3. Implementation of Regression and Classification Models in Clinical Studies
- 16.2.4. Analysis of Large Data Sets using Computational Statistical Methods

16.3. Design of Experiments and Analysis of Results
- 16.3.1. Strategies for the Efficient Design of Clinical Trials Using AI with IBM Watson Health
- 16.3.2. AI Techniques for Analysis and Interpretation of Experimental Data
- 16.3.3. Optimization of Research Protocols Using AI Simulations
- 16.3.4. Evaluation of Efficacy and Safety of Treatments Using AI Models

16.4. Interpretation of Medical Images Using AI in Research Using Aidoc
- 16.4.1. Development of AI Systems for the Automatic Detection of Diseases in Images
- 16.4.2. Use of Deep Learning for Classification and Segmentation in Medical Images
- 16.4.3. AI Tools to Improve Accuracy in Image Diagnostics
- 16.4.4. Analysis of Radiological and Magnetic Resonance Imaging Using AI

16.5. Clinical Analysis and Biomedical Data Analysis
- 16.5.1. AI in the Processing and Analysis of Genomic and Proteomic Data DeepGenomics
- 16.5.2. Tools for the Integrated Analysis of Clinical and Biomedical Data
- 16.5.3. Use of AI to Identify Biomarkers in Clinical Research
- 16.5.4. Predictive Analysis of Clinical Outcomes Based on Biomedical Data

16.6. Advanced Data Visualization in Clinical Research
- 16.6.1. Development of Interactive Visualization Tools for Clinical Data
- 16.6.2. Use of AI in the Creation of Graphical Representations of Complex Data in Microsoft Power BI
- 16.6.3. Visualization Techniques for Easy Interpretation of Research Results
- 16.6.4. Augmented and Virtual Reality Tools for Visualization of Biomedical Data

16.7. Natural Language Processing in Scientific and Clinical Documentation
- 16.7.1. Application of NLP for the Analysis of Scientific Literature and Clinical Records with Linguamatics
- 16.7.2. AI Tools for the Extraction of Relevant Information from Medical Texts
- 16.7.3. AI Systems for Summarizing and Categorizing Scientific Publications
- 16.7.4. Use of NLP to Identify Trends and Patterns in Clinical Documentation

16.8. Processing Heterogeneous Data in Clinical Research with Google Cloud Healthcare API and IBM Watson Health
- 16.8.1. AI Techniques for Integrating and Analyzing Data from Diverse Clinical Sources
- 16.8.2. Tools for the Management of Unstructured Clinical Data
- 16.8.3. AI Systems for Correlating Clinical and Demographic Data
- 16.8.4. Analysis of Multidimensional Data for Clinical Insights

16.9. Applications of Neural Networks in Biomedical Research
- 16.9.1. Use of Neural Networks for Disease Modeling and Treatment Prediction
- 16.9.2. Implementation of Neural Networks in Genetic Disease Classification
- 16.9.3. Development of Diagnostic Systems Based on Neural Networks
- 16.9.4. Application of Neural Networks in the Personalization of Medical Treatments

16.10. Predictive Modeling and its Impact on Clinical Research
- 16.10.1. Development of Predictive Models for the Anticipation of Clinical Outcomes
- 16.10.2. Use of AI in the Prediction of Side Effects and Adverse Reactions
- 16.10.3. Implementation of Predictive Models in the Optimization of Clinical Trials
- 16.10.4. Risk Analysis in Medical Treatments Using Predictive Modeling

Module 17. Biomedical Research with AI

17.1. Design and Implementation of Observational Studies with AI
- 17.1.1. Implementation of AI for the Selection and Segmentation of Populations in Studies
- 17.1.2. Use of Algorithms for Real-Time Monitoring of Observational Study Data
- 17.1.3. AI Tools for Identifying Patterns and Correlations in Observational Studies with Flatiron Health
- 17.1.4. Automation of the Data Collection and Analysis Process in Observational Studies

17.2. Validation and Calibration of Models in Clinical Research
- 17.2.1. AI Techniques to Ensure the Accuracy and Reliability of Clinical Models
- 17.2.2. Use of AI in the Calibration of Predictive Models in Clinical Research
- 17.2.3. Cross-Validation Methods Applied to Clinical Models Using AI with KNIME Analytics Platform
- 17.2.4. AI Tools for the Evaluation of Generalization of Clinical Models

17.3. Methods for Integration of Heterogeneous Data in Clinical Research
- 17.3.1. AI Techniques for Combining Clinical, Genomic and Environmental Data with DeepGenomics
- 17.3.2. Use of Algorithms to Manage and Analyze Unstructured Clinical Data
- 17.3.3. AI Tools for the Normalization and Standardization of Clinical Data with Informatica's Healthcare Data Management
- 17.3.4. AI Systems for Correlation of Different Types of Data in Research

17.4. Integration of Multidisciplinary Biomedical Data Using Flatiron Health's OncologyCloud and AutoML
- 17.4.1. AI Systems to Combine Data from Different Biomedical Disciplines
- 17.4.2. Algorithms for Integrated Analysis of Laboratory and Clinical Data
- 17.4.3. AI Tools for Visualization of Complex Biomedical Data
- 17.4.4. Use of AI in the Creation of Holistic Health Models from Multidisciplinary Data

17.5. Deep Learning Algorithms in Biomedical Data Analysis
- 17.5.1. Implementation of Neural Networks in the Analysis of Genetic and Proteomic Data
- 17.5.2. Use of Deep Learning for Pattern Identification in Biomedical Data
- 17.5.3. Development of Predictive Models in Precision Medicine with Deep Learning
- 17.5.4. Application of AI in the Advanced Analysis of Biomedical Images Using Aidoc

17.6. Optimization of Research Processes with Automation
- 17.6.1. Automation of Laboratory Routines Using AI Systems with Beckman Coulter
- 17.6.2. Use of AI for Efficient Management of Resources and Time in Research
- 17.6.3. AI Tools for Optimization of Workflows in Clinical Research
- 17.6.4. Automated Systems for Tracking and Reporting Progress in Research

17.7. Simulation and Computational Modeling in Medicine with AI
- 17.7.1. Development of Computational Models to Simulate Clinical Scenarios
- 17.7.2. Using AI to Simulate Molecular and Cellular Interactions with Schrödinger
- 17.7.3. AI Tools in the Creation of Predictive Disease Models with GNS Healthcare
- 17.7.4. Application of AI in the Simulation of Drug and Treatment Effects

17.8. Use of Virtual and Augmented Reality in Clinical Studies with Surgical Theater
- 17.8.1. Implementation of Virtual Reality for Training and Simulation in Medicine
- 17.8.2. Use of Augmented Reality in Surgical and Diagnostic Procedures
- 17.8.3. Virtual Reality Tools for Behavioral and Psychological Studies
- 17.8.4. Application of Immersive Technologies in Rehabilitation and Therapy

17.9. Data Mining Tools Applied to Biomedical Research
- 17.9.1. Use of Data Mining Techniques to Extract Knowledge from Biomedical Databases
- 17.9.2. Implementation of AI Algorithms to Discover Patterns in Clinical Data
- 17.9.3. AI Tools for Trend Identification in Large Data Sets with Tableau
- 17.9.4. Application of Data Mining in the Generation of Research Hypotheses

17.10. Development and Validation of Biomarkers with Artificial Intelligence
- 17.10.1. Use of AI for the Identification and Characterization of Novel Biomarkers
- 17.10.2. Implementation of AI Models for the Validation of Biomarkers in Clinical Studies
- 17.10.3. AI Tools in the Correlation of Biomarkers with Clinical Outcomes
- 17.10.4. Application of AI in Biomarker Analysis for Personalized Medicine

Module 18. Practical Application of Artificial Intelligence in Clinical Research

18.1. Genome Sequencing Technologies and Data Analysis with AI with DeepGenomics
- 18.1.1. Use of AI for Rapid and Accurate Analysis of Genetic Sequences
- 18.1.2. Implementation of Machine Learning Algorithms in the Interpretation of Genomic Data
- 18.1.3. AI Tools for Identification of Genetic Variants and Mutations
- 18.1.4. Development of AI Systems for Anomaly Detection in Medical Images

18.2. AI in the Analysis of Biomedical Images with Aidoc
- 18.2.1. Development of AI Systems for the Detection of Anomalies in Medical Images
- 18.2.2. Use of Deep Learning in the Interpretation of X-rays, MRI and CT Scans
- 18.2.3. AI Tools to Improve Accuracy in Diagnostic Imaging
- 18.2.4. Implementation of AI in Biomedical Image Classification and Segmentation

18.3. Robotics and Automation in Clinical Laboratories
- 18.3.1. Use of Robots for the Automation of Tests and Processes in Laboratories
- 18.3.2. Implementation of Automatic Systems for the Management of Biological Samples
- 18.3.3. Development of Robotic Technologies to Improve Efficiency and Accuracy in Clinical Analysis
- 18.3.4. Application of AI in the Optimization of Laboratory Workflows with Optum

18.4. AI in the Personalization of Therapies and Precision Medicine
- 18.4.1. Development of AI Models for the Personalization of Medical Treatments
- 18.4.2. Use of Predictive Algorithms in the Selection of Therapies based on Genetic Profiling
- 18.4.3. AI Tools in the Adaptation of Drug Doses and Combinations with PharmGKB
- 18.4.4. Application of AI in the Identification of Effective Treatments for Specific Groups

18.5. Innovations in AI-assisted Diagnosis using ChatGPT and Amazon Comprehend Medical
- 18.5.1. Implementation of AI Systems for Rapid and Accurate Diagnostics
- 18.5.2. Use of AI in Early Identification of Diseases through Data Analysis
- 18.5.3. Development of AI Tools for Clinical Test Interpretation
- 18.5.4. Application of AI in Combining Clinical and Biomedical Data for Comprehensive Diagnostics

18.6. AI Applications in Microbiome and Microbiology Studies with Metabiomics
- 18.6.1. Use of AI in the Analysis and Mapping of the Human Microbiome
- 18.6.2. Implementation of Algorithms to Study the Relation between Microbiome and Diseases
- 18.6.3. AI Tools in the Identification of Patterns in Microbiological Studies
- 18.6.4. Application of AI in Microbiome-Based Therapeutics Research

18.7. Wearables and Remote Monitoring in Clinical Trials
- 18.7.1. Development of Wearable Devices with AI for Continuous Health Monitoring with FitBit
- 18.7.2. Use of AI in the Interpretation of Data Collected by Wearables
- 18.7.3. Implementation of Remote Monitoring Systems in Clinical Trials
- 18.7.4. Application of AI in the Prediction of Clinical Events through Wearable Data

18.8. AI in the Management of Clinical Trials with Oracle Health Sciences
- 18.8.1. Use of AI Systems for Optimization of Clinical Trial Management
- 18.8.2. Implementation of AI in the Selection and Monitoring of Participants
- 18.8.3. AI Tools for Analysis of Clinical Trial Data and Results
- 18.8.4. Application of AI to Improve Trial Efficiency and Reduce Trial Costs

18.9. Development of AI-Assisted Vaccines and Treatments with Benevolent AI
- 18.9.1. Use of AI to Accelerate Vaccine Development
- 18.9.2. Implementation of Predictive Models in the Identification of Potential Treatments
- 18.9.3. AI Tools to Simulate Responses to Vaccines and Drugs
- 18.9.4. Application of AI in the Personalization of Vaccines and Therapies

18.10. AI Applications in Immunology and Immune Response Studies
- 18.10.1. Development of AI Models to Understand Immunological Mechanisms with Immuneering
- 18.10.2. Use of AI in the Identification of Patterns in Immune Responses
- 18.10.3. Implementation of AI in Autoimmune Disorders Research
- 18.10.4. Application of AI in the Design of Personalized Immunotherapies

Module 19. Big Data Analytics and Machine Learning in Clinical Research

19.1. Big Data in Clinical Research: Concepts and Tools
- 19.1.1. The Explosion of Data in the Field of Clinical Research
- 19.1.2. Concept of Big Data and Main Tools
- 19.1.3. Applications of Big Data in Clinical Research

19.2. Data Mining in Clinical and Biomedical Records with KNIME and Python
- 19.2.1. Main Methodologies for Data Mining
- 19.2.2. Data Integration of Clinical and Biomedical Registry Data
- 19.2.3. Detection of Patterns and Anomalies in Clinical and Biomedical Records

19.3. Machine Learning Algorithms in Biomedical Research with KNIME and Python
- 19.3.1. Classification Techniques in Biomedical Research
- 19.3.2. Regression Techniques in Biomedical Research
- 19.3.4. Unsupervised Techniques in Biomedical Research

19.4. Predictive Analytics in Clinical Research with KNIME and Python
- 19.4.1. Classification Techniques in Clinical Research
- 19.4.2. Regression Techniques in Clinical Research
- 19.4.3. Deep Learning in Clinical Research

19.5. AI Models in Epidemiology and Public Health with KNIME and Python
- 19.5.1. Classification Techniques for Epidemiology and Public Health
- 19.5.2. Regression Techniques for Epidemiology and Public Health
- 19.5.3. Unsupervised Techniques for Epidemiology and Public Health

19.6. Analysis of Biological Networks and Disease Patterns with KNIME and Python
- 19.6.1. Exploration of Interactions in Biological Networks for the Identification of Disease Patterns
- 19.6.2. Integration of Omics Data in Network Analysis to Characterize Biological Complexities
- 19.6.3. Application of Machine Learning Algorithms for the Discovery of Disease Patterns

19.7. Development of Tools for Clinical Prognosis with Workflow-type Platforms and Python
- 19.7.1. Creation of Innovative Clinical Prognostic Tools based on Multidimensional Data
- 19.7.2. Integration of Clinical and Molecular Variables in the Development of Prognostic Tools
- 19.7.3. Evaluating the Effectiveness of Prognostic Tools in Diverse Clinical Contexts

19.8. Advanced Visualization and Communication of Complex Data with Tools like PowerBI and Python
- 19.8.1. Use of Advanced Visualization Techniques to Represent Complex Biomedical Data
- 19.8.2. Development of Effective Communication Strategies to Present Results of

Complex Analyses

19.8.3. Implementation of Interactivity Tools in Visualizations to Enhance Understanding

19.9. Data Security and Challenges in Big Data Management

19.9.1. Addressing Data Security Challenges in the Context of Biomedical Big Data

19.9.2. Strategies for Privacy Protection in the Management of Large Biomedical Datasets

19.9.3. Implementation of Security Measures to Mitigate Risks in the Handling of Sensitive Data

19.10. Practical Applications and Case Studies on Biomedical Big Data

19.10.1. Exploration of Successful Cases in the Implementation of Biomedical Big Data in Clinical Research

19.10.2. Development of Practical Strategies for the Application of Big Data in Clinical Decision Making

19.10.3. Evaluation of Impact and Lessons Learned through Case Studies in the Biomedical Field

Module 20. Ethical, Legal and Future Aspects of Artificial Intelligence in Clinical Research

20.1. Ethics in the Application of AI in Clinical Research

20.1.1. Ethical Analysis of AI-Assisted Decision Making in Clinical Research Settings

20.1.2. Ethics in the Use of AI Algorithms for Participant Selection in Clinical Trials

20.1.3. Ethical Considerations in the Interpretation of Results Generated by AI Systems in Clinical Research

20.2. Legal and Regulatory Considerations in Biomedical AI

20.2.1. Analysis of Legal Regulations in the Development and Application of AI Technologies in the Biomedical Field

20.2.2. Assessment of Compliance with Specific Regulations to Ensure the Safety and Efficacy of AI-Based Solutions

20.2.3. Addressing Emerging Regulatory Challenges Associated with the Use of AI in Biomedical Research

20.3. Informed Consent and Ethical Aspects in the Use of Clinical Data

20.3.1. Development of Strategies to Ensure Effective Informed Consent in AI Projects

20.3.2. Ethics in the Collection and Use of Sensitive Clinical Data in the Context of AI-Driven Research

20.3.3. Addressing Ethical Issues Related to Ownership and Access to Clinical Data in Research Projects

20.4. AI and Liability in Clinical Research

20.4.1. Evaluation of Ethical and Legal Accountability in the Implementation of AI Systems in Clinical Research Protocols

20.4.2. Development of Strategies to Address Potential Adverse Consequences of the Application of AI in Biomedical Research

20.4.3. Ethical Considerations in the Active Participation of AI in Clinical Research Decision Making

20.5. Impact of AI on Equity and Access to Health Care

20.5.1. Evaluation of the Impact of AI Solutions on Equity in Clinical Trial Participation

20.5.2. Development of Strategies to Improve Access to AI Technologies in Diverse Clinical Settings

20.5.3. Ethics in the Distribution of Benefits and Risks Associated with the Application of AI in Health Care

20.6. Privacy and Data Protection in Research Projects

20.6.1. Ensuring the Privacy of Participants in Research Projects Involving the Use of AI

20.6.2. Development of Policies and Practices for Data Protection in Biomedical Research

20.6.3. Addressing Specific Privacy and Security Challenges in the Handling of Sensitive Data in the Clinical Environment

20.7. AI and Sustainability in Biomedical Research

20.7.1. Assessment of the Environmental Impact and Resources Associated with the Implementation of AI in Biomedical Research

20.7.2. Development of Sustainable Practices in the Integration of AI Technologies into Clinical Research Projects

20.7.3. Ethics in Resource Management and Sustainability in the Adoption of AI in Biomedical Research

20.8. Auditing and Explainability of AI Models in the Clinical Setting
- 20.8.1. Development of Audit Protocols for Assessing the Reliability and Accuracy of AI Models in Clinical Research
- 20.8.2. Ethics in Explainability of Algorithms to Ensure Understanding of Decisions Made by AI Systems in Clinical Contexts
- 20.8.3. Addressing Ethical Challenges in the Interpretation of AI Model Results in Biomedical Research

20.9. Innovation and Entrepreneurship in the Field of Clinical AI
- 20.9.1. Responsible Innovation Ethics in Developing AI Solutions for Clinical Applications
- 20.9.2. Development of Ethical Business Strategies in the Field of Clinical AI
- 20.9.3. Ethical Considerations in the Commercialization and Adoption of AI Solutions in the Clinical Sector

20.10. Ethical Considerations in International Collaboration in Clinical Research
- 20.10.1. Development of Ethical and Legal Arrangements for International Collaboration in AI-Driven Research Projects
- 20.10.2. Ethics in Multi-Institutional and Multi-Country Involvement in Clinical Research using AI Technologies
- 20.10.3. Addressing Emerging Ethical Challenges Associated with Global Collaboration in Biomedical Research

The program includes the analysis of ethical, legal and regulatory aspects, committing to responsibility and awareness of contemporary challenges"

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.

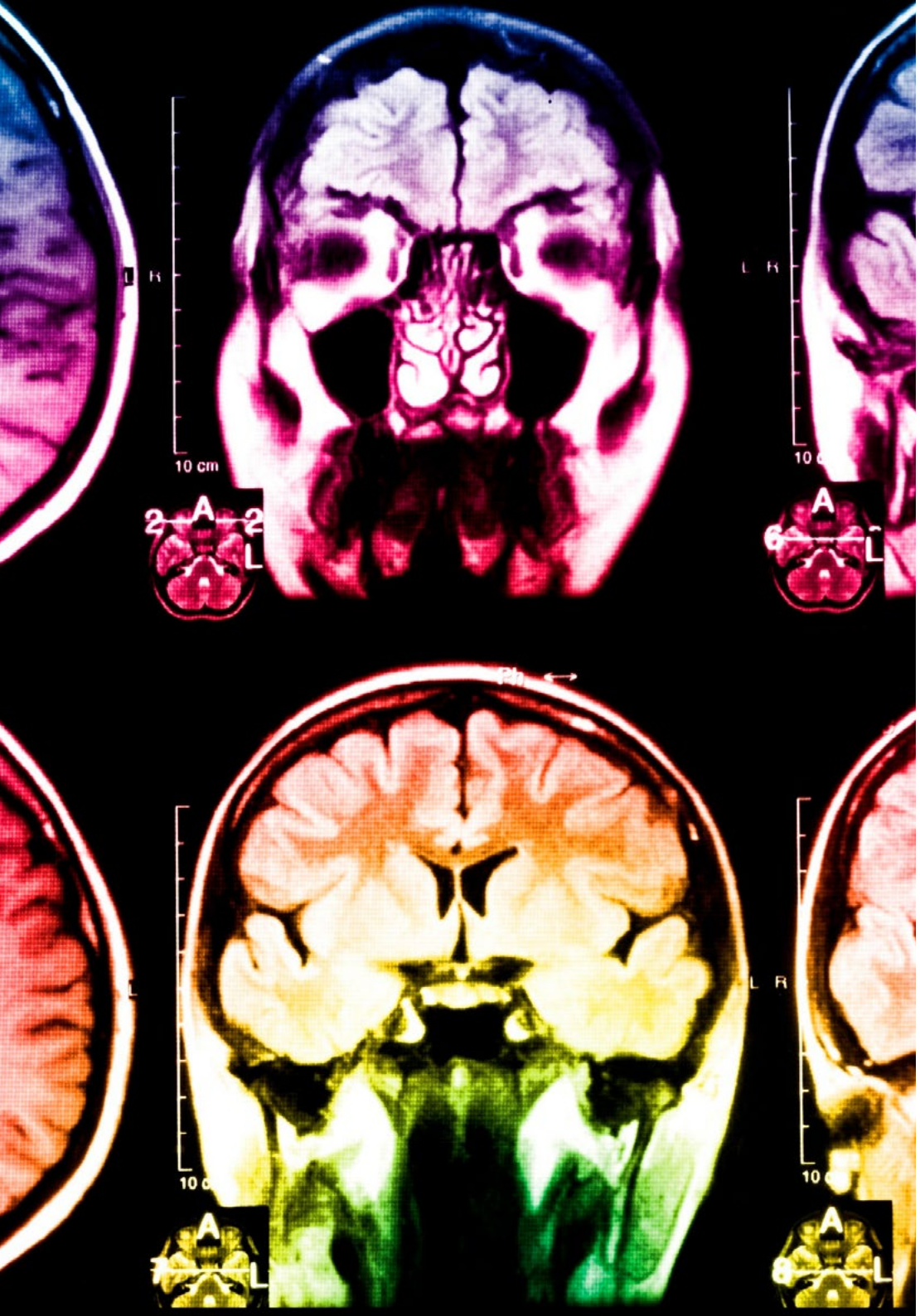
In order to facilitate tutor-student contact as much as possible, you will have a wide range of communication possibilities, both in real time and delayed (internal messaging, telephone answering service, email contact with the technical secretary, chat and videoconferences).

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.

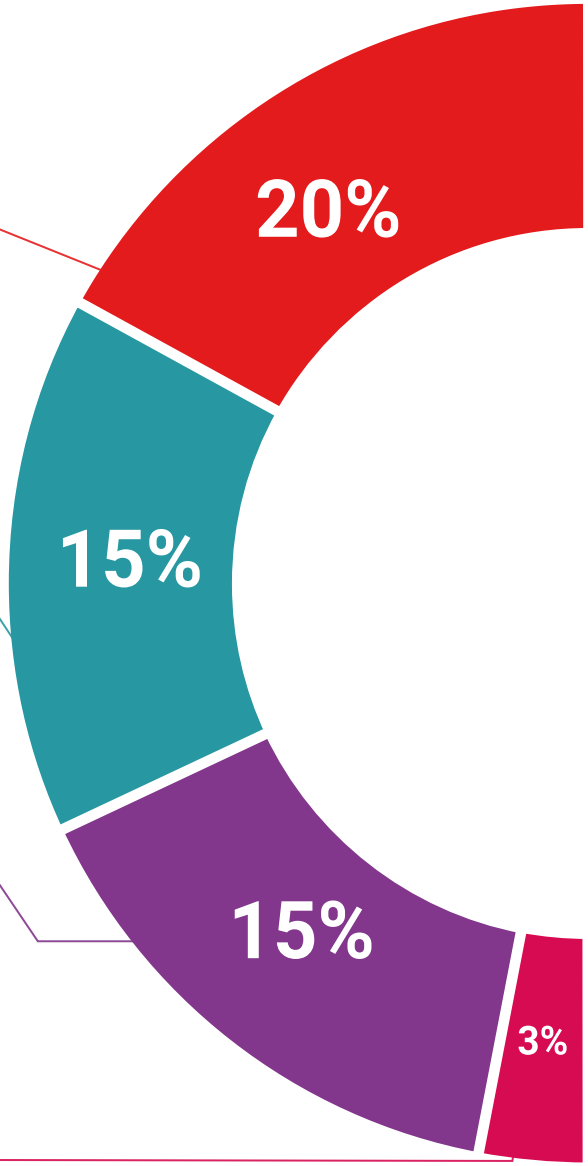
Interactive Summaries

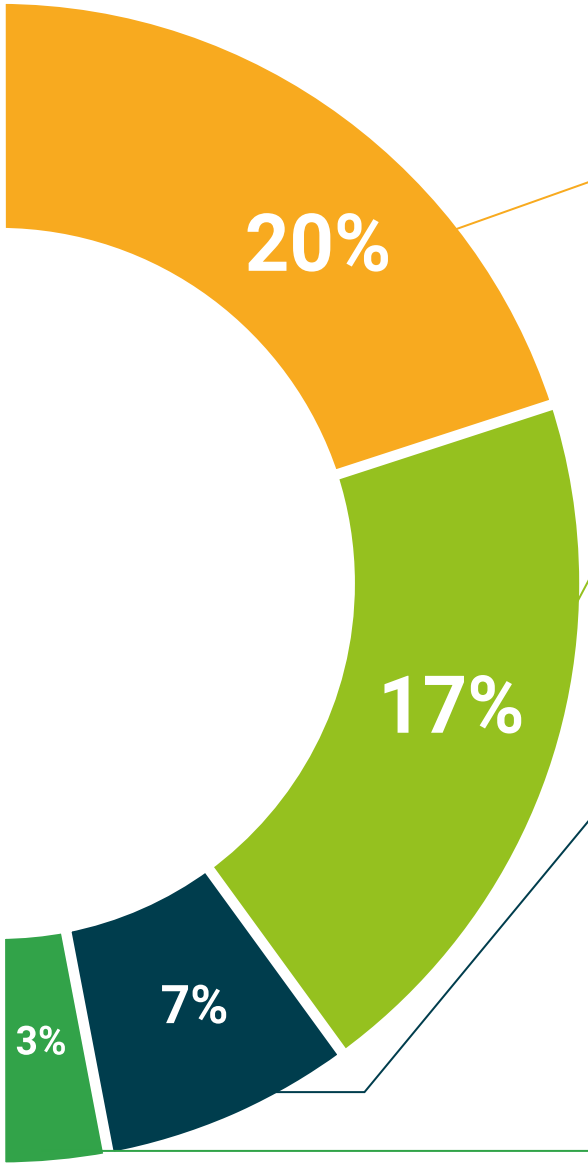
We present the contents attractively and dynamically in multimedia lessons that include audio, videos, images, diagrams, and concept maps in order to reinforce knowledge.

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 Master's Degree in Artificial Intelligence in Clinical Research guarantees students, in addition to the most rigorous and up-to-date education, access to a 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**Master's Degree diploma in Artificial Intelligence in Clinical Research** 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: **Master's Degree in Artificial Intelligence in Clinical Research**

Modality: **online**

Duration: **12 months**

Accreditation: **90 ECTS**

tech global university

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

Master's Degree in Artificial Intelligence in Clinical Research

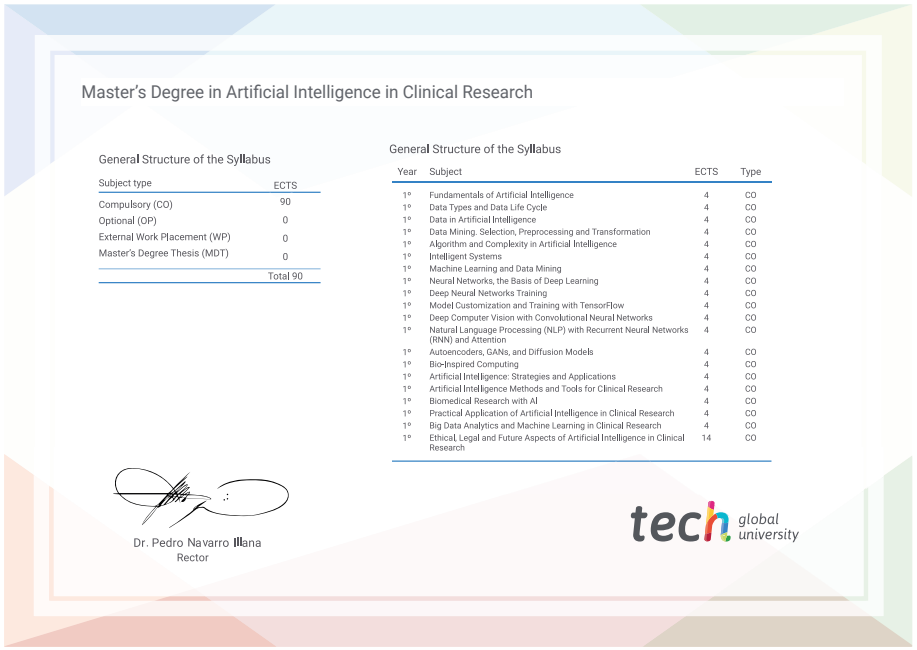
This is a private qualification of 2,700 hours of duration equivalent to 90 ECTS, with a start date of dd/mm/yyyy and an end date of dd/mm/yyyy.

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


Master's Degree in Artificial Intelligence in Clinical Research

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, Preprocessing 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	4	CO
1º	Natural Language Processing (NLP) with Recurrent Neural Networks (RNN) and Attention	4	CO
1º	Autoencoders, GANs, and Diffusion Models	4	CO
1º	Bio-Inspired Computing	4	CO
1º	Artificial Intelligence: Strategies and Applications	4	CO
1º	Artificial Intelligence Methods and Tools for Clinical Research	4	CO
1º	Biomedical Research with AI	4	CO
1º	Practical Application of Artificial Intelligence in Clinical Research	4	CO
1º	Big Data Analytics and Machine Learning in Clinical Research	4	CO
1º	Ethical, Legal and Future Aspects of Artificial Intelligence in Clinical Research	14	CO

Dr. Pedro Navarro Illana
Rector

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

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Master's Degree
Artificial Intelligence in Clinical Research

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

Master's Degree

Artificial Intelligence in Clinical Research

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