

# Master's Degree Deep Learning





## Master's Degree Deep Learning

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

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

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# 01

# Introduction

From voice recognition and automatic translation of YouTube videos, the interpretation of objects and shapes in Google Photos to the anti-fraud method used by private banks is based on Deep Learning. Progress in automation, image analysis and detection, and prediction for rapid decision making has made the profile of the professional engineer more relevant. A work that contributes to the growth of other sectors, so it is necessary to have real specialists in this field. For this reason, this 100% online program was created to provide the graduate with advanced knowledge to develop Artificial Intelligence and Deep Learning projects. All this, in addition, with an innovative and updated didactic material, elaborated by authentic specialists with an accumulated experience in the sector.



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*Raise your level of knowledge in Deep Learning with this Master's Degree of 1,800 teaching hours. Enroll now”*

Undoubtedly, one of the fastest growing sectors in recent years has been the technology sector, sponsored by the advances in engineering brought about by the development of Deep Learning. In this way, Chatbots proliferate, facial recognition applications, early detection of diseases such as cancer by identifying medical images of higher quality.

An endless number of possibilities that require an exhaustive mastery of Deep Learning by engineering professionals. In this sense, TECH has promoted the development of this 12-month Master's Degree, which provides students with the most advanced and current knowledge in this field.

It is a program that will lead the graduate to delve into the mathematical foundations, the construction of neural networks, the personalization of models and training with TensorFlow or delve into Deep Computer Vision with Convolutional Neural Networks. All this, together with didactic material based on video summaries of each topic, videos in detail, specialized readings and case studies that you can access, comfortably, 24 hours a day, from any electronic device with an Internet connection.

A syllabus that will allow you to enhance your skills to create projects that focus on data analysis, natural language processing or have their direct application in areas such as robotics, finance, gaming or autonomous cars, among others.

In this way, TECH opens up a world of possibilities thanks to a quality university degree, developed by real experts and offering greater freedom of self-management of study. And the fact is that, with no classroom attendance or class schedules, graduates will be able to access the syllabus at any time and reconcile their daily activities with an education that is at the academic forefront.

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

- ♦ The development of practical cases presented by experts in Data Engineering and Science
- ♦ The graphic, schematic and practical contents of the book provide technical and practical information on those disciplines that are essential for professional practice
- ♦ Practical exercises where self-assessment can be used to improve learning
- ♦ Its special emphasis on innovative methodologies
- ♦ Theoretical lessons, questions to the expert, debate forums on controversial topics, and individual reflection assignments
- ♦ Content that is accessible from any fixed or portable device with an Internet connection



*You are looking at a university program that will give you the necessary impulse to become part of the big technology companies of the moment. Enroll now*

“

*With this program you don't have to worry about class attendance, you don't have to attend classes or fixed schedules. Access the syllabus whenever and wherever you want”*

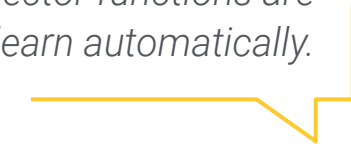
The program's teaching staff includes professionals from the field who contribute their work experience to this educational program, as well as renowned specialists from leading societies and prestigious universities.

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

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

*Master GANS and Diffusion Models and improve your projects to generate new, realistic and high quality images.*

*A program that will allow you to go deeper into Backward Pass and how the derivatives of vector functions are applied to learn automatically.*



02

# Objectives

TECH provides all its students with a large amount of innovative teaching material so that in just 12 months they can obtain the necessary knowledge in Deep Learning that will allow them to grow in one of today's most cutting-edge sectors. Therefore, at the end of this program, the graduate will have developed the necessary skills and abilities to get involved in Artificial Intelligence and Deep Learning projects oriented to improve different socioeconomic sectors.







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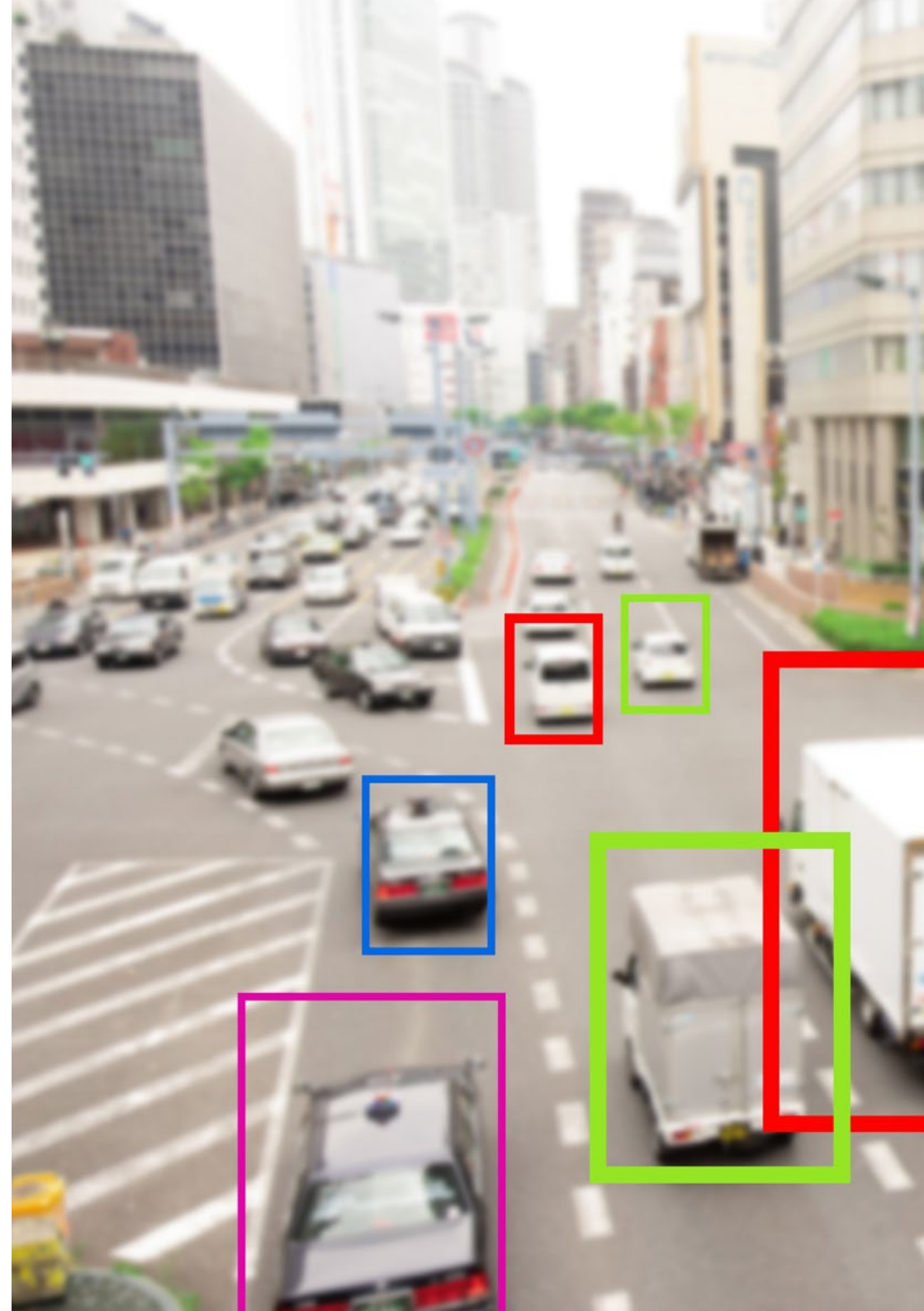
*You will obtain the knowledge you need to create OpenAI environments and advance in your professional career”*



## General Objectives

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- ♦ Fundamentalize the key concepts of mathematical functions and their derivatives
- ♦ Apply these principles to deep learning algorithms to learn automatically
- ♦ Examine the key concepts of Supervised Learning and how they apply to neural network models
- ♦ Analyze the training, evaluation and analysis of neural network models
- ♦ Fundamentals of the key concepts and main applications of deep learning
- ♦ Implement and optimize neural networks with Keras
- ♦ Develop expertise in the training of deep neural networks
- ♦ Analyze the optimization and regularization mechanisms required for deep neural network training





## Specific Objectives

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### Module 1. Mathematical Basis of Deep Learning

- ◆ Develop the chain rule for calculating derivatives of nested functions
- ◆ Analyze how to create new functions from existing functions and how to compute the derivatives of these functions
- ◆ Examine the concept of Backward Pass and how derivatives of vector functions are applied to automatic learning
- ◆ Learn how to use TensorFlow to build custom models
- ◆ Understand how to load and process data using TensorFlow tools
- ◆ Fundamentalize the key concepts of NLP natural language processing with RNN and attention mechanisms
- ◆ Explore the functionality of Hugging Face transformer libraries and other natural language processing tools for application to vision problems
- ◆ Learn how to build and train autoencoder models, GANs, and diffusion models
- ◆ Understand how autoencoders can be used to efficiently encode data

### Module 2. Deep Learning Principles

- ◆ Analyze how linear regression works and how it can be applied to neural network models
- ◆ Understand the rationale for optimizing hyperparameters to improve the performance of neural network models
- ◆ Determine how the performance of neural network models can be evaluated using the training set and the test set



### Module 3. Neural Networks, the Basis of Deep Learning

- ♦ Analyze the architecture of neural networks and their principles of operation
- ♦ Determine how neural networks can be applied to a variety of problems
- ♦ Establish how to optimize the performance of deep learning models by tuning hyperparameters

### Module 4. Deep Neural Networks Training

- ♦ Analyze gradient problems and how they can be avoided
- ♦ Determine how to reuse pre-trained layers to train deep neural networks
- ♦ Establish how to schedule the learning rate to get the best results

### Module 5. Model Customization and Training with TensorFlow

- ♦ Determine how to use the TensorFlow API to define custom functions and graphics and custom graphs
- ♦ Fundamentally use the tf.data API to load and preprocess data efficiently
- ♦ Discuss the TensorFlow Datasets project and how it can be used to facilitate access to preprocessed datasets

### Module 6. Deep Computer Vision with Convolutional Neural Networks

- ♦ Explore and understand how convolutional and clustering layers work for Visual Cortex architecture
- ♦ Develop CNN architectures with Keras
- ♦ Use pre-trained Keras models for object classification, localization, detection, and tracking, as well as semantic segmentation





### **Module 7. Processing Sequences Using RNN and CNN**

- ♦ Analyze the architecture of recurrent neurons and layers
- ♦ Examine the various training algorithms for training RNN models
- ♦ Evaluating the performance of RNN models using accuracy and sensitivity metrics

### **Module 8. NLP Natural Language Processing with RNN and Attention**

- ♦ Generating text using recurrent neural networks
- ♦ Train an encoder-decoder network to perform neural machine translation
- ♦ Developing a practical application of natural language processing with RNN and attention

### **Module 9. Autoencoders, GANs, and Diffusion Models**

- ♦ Implementing PCA techniques with an incomplete linear autoencoder
- ♦ Use convolutional and variational autoencoders to improve the performance of autoencoders
- ♦ Analyze how GANs and diffusion models can generate new and realistic images new and realistic images

### **Module 10. Reinforcement Learning**

- ♦ Use gradients to optimize an agents policy
- ♦ Evaluate the use of neural networks to improve the accuracy of an agent when making decisions
- ♦ Implement different boosting algorithms to improve the performance of an agent

# 03 Skills

This advanced university education allows students to research, develop and design Artificial Intelligence systems that automate predictive models. These technical skills and abilities will be enhanced throughout this academic course, thanks not only to the theoretical approach of this program, but also to the practical perspective that will be achieved through simulation scenarios. A unique opportunity for progression that only TECH, the world's largest digital university, can offer.





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*Hone your skills to generate chatbots that understand and respond more appropriately to users' questions”*



## General Skills

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- ◆ Implement Cortex Visual Architecture
- ◆ Use pre-trained Keras models for transfer learning and other computer vision tasks
- ◆ Master the Recurrent Neural Network (RNN)
- ◆ Train and evaluate an RNN model for time series prediction
- ◆ Improve an agent's ability to make optimal decisions in an environment
- ◆ Increase an agent's efficiency by learning with rewards

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*Gain real-world, practical insight into the application of natural language processing with RNN and attention with this university program”*







## Specific Skills

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- ◆ Solve problems with data, which involves improving existing processes and developing new processes through the use of appropriate technology tools
- ◆ Implement data-driven projects and tasks
- ◆ Use metrics such as precision, accuracy and classification error
- ◆ Optimize neural network parameters
- ◆ Build customized models using the TensorFlow API
- ◆ Implement tasks such as classification, localization, object detection and tracking, and semantic segmentation with Keras
- ◆ Generate new and realistic images
- ◆ Implement Deep Q-Learning and variants of Deep Q-Learning
- ◆ Use optimization techniques for training
- ◆ Successfully train deep neural networks

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# Course Management

This academic institution has focused all its efforts on bringing together an excellent team of specialists in Deep Learning and its application in various sectors. In this way, the engineering professional will have the guarantee of access to a quality program of great value for their progression in a growing sector. In addition, thanks to the proximity of the faculty, students will be able to resolve any questions they may have about the content of this degree throughout their academic career.



“

*Experts with extensive knowledge of Tensorflow, streaming architecture, Machine Learning or Big Data make up this excellent university education”*

## Management



### Mr. Gil Contreras, Armando

- ♦ Lead Big Data Scientist-Big Data at Jhonson Controls
- ♦ Data Scientist-Big Data at Opensistemas
- ♦ Fund Auditor at Creatividad y Tecnología and PricewaterhouseCoopers
- ♦ Professor in EAE Business School
- ♦ Degree in Economics from the Technological Institute of Santo Domingo (INTEC)
- ♦ Master's Degree in Data Science at the University Center of Technology and Art
- ♦ Master MBA in International Relations and Business at the Center for Financial Studies (CEF)
- ♦ Postgraduate degree in Corporate Finance from the Technological Institute of Santo Domingo

## Professors

### Mr. Villar Valor, Javier

- ♦ Director and founding partner Impulsa2
- ♦ Head of Operations at Summa Insurance Brokers
- ♦ Responsible for identifying opportunities for improvement at Liberty Seguros
- ♦ Director of Transformation and Professional Excellence in Johnson Controls Iberia
- ♦ Responsible for the organization of the company Groupama Seguros
- ♦ Responsible for Lean Six Sigma methodology at Honeywell
- ♦ Director of Quality and Purchasing at SP & PO
- ♦ Professor at the European Business School

### Mr. Matos, Dionis

- ♦ Data Engineer at Wide Agency Sodexo
- ♦ Data Consultant at Tokiota Site
- ♦ Data Engineer at Devoteam Testa Home
- ♦ Business Intelligence Developer at Ibermatica Daimler
- ♦ Master's Degree in Big Data and Analytics /Project Management(Minor) at EAE Business School



**Ms. Delgado Feliz, Benedit**

- ♦ Assistant and Electronic Surveillance Operator for the National Drug Control Directorate
- ♦ Social Communicator from the Catholic University of Santo Domingo
- ♦ Voiceover by the Otto Rivera School of Professional Voiceovers

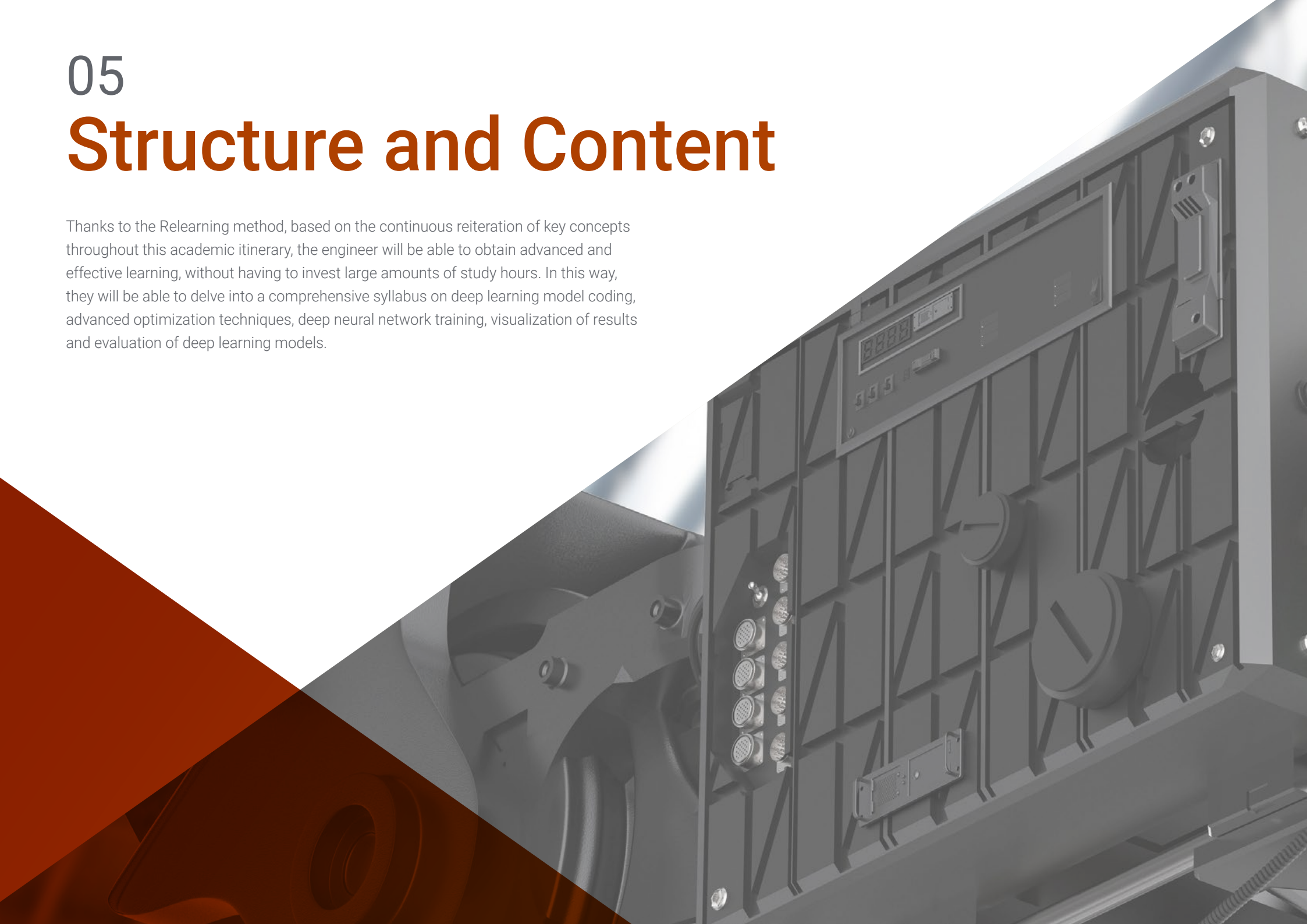
**Ms. Gil de León, María**

- ♦ Co-Director of Marketing and Secretary at RAÍZ Magazine
- ♦ Copy Editor at Gauge Magazine
- ♦ Stork Magazine reader from Emerson College
- ♦ B.A. in Writing, Literature and Publishing from Emerson College

05

# Structure and Content

Thanks to the Relearning method, based on the continuous reiteration of key concepts throughout this academic itinerary, the engineer will be able to obtain advanced and effective learning, without having to invest large amounts of study hours. In this way, they will be able to delve into a comprehensive syllabus on deep learning model coding, advanced optimization techniques, deep neural network training, visualization of results and evaluation of deep learning models.





“

*Access the most advanced and updated Deep Learning curriculum in the academic landscape from your digital device with an Internet connection”*

## Module 1. Mathematical Basis of Deep Learning

- 1.1. Functions and Derivatives
  - 1.1.1. Linear Functions
  - 1.1.2. Partial Derivative
  - 1.1.3. Higher Order Derivatives
- 1.2. Multiple Nested Functions
  - 1.2.1. Compound Functions
  - 1.2.2. Inverse Functions
  - 1.2.3. Recursive Functions
- 1.3. Chain Rule
  - 1.3.1. Derivatives of Nested Functions
  - 1.3.2. Derivatives of Compound Functions
  - 1.3.3. Derivatives of Inverse Functions
- 1.4. Functions with Multiple Inputs
  - 1.4.1. Multi-Variable Functions
  - 1.4.2. Vectorial Functions
  - 1.4.3. Matrix Functions
- 1.5. Derivatives of Functions with Multiple Inputs
  - 1.5.1. Partial Derivative
  - 1.5.2. Directional Derivatives
  - 1.5.3. Mixed Derivatives
- 1.6. Functions with Multiple Vector Inputs
  - 1.6.1. Linear Vector Functions
  - 1.6.2. Non-Linear Vector Functions
  - 1.6.3. Matrix Vector Functions
- 1.7. Creating New Functions from Existing Functions
  - 1.7.1. Addition of Functions
  - 1.7.2. Product of Functions
  - 1.7.3. Composition of Functions
- 1.8. Derivatives of Functions with Multiple Vector Entries
  - 1.8.1. Derivatives of Linear Functions
  - 1.8.2. Derivatives of Non-Linear Functions
  - 1.8.3. Derivatives of Compound Functions s

- 1.9. Vector Functions and Their Derivatives: A Step Further
  - 1.9.1. Directional Derivatives
  - 1.9.2. Mixed Derivatives
  - 1.9.3. Matrix Derivatives
- 1.10. The Backward Pass
  - 1.10.1. Error Propagation
  - 1.10.2. Applying Update Rules
  - 1.10.3. Parameter Optimization

## Module 2. Deep Learning Principles

- 2.1. Supervised Learning
  - 2.1.1. Supervised Learning Machines
  - 2.1.2. Uses of Supervised Learning
  - 2.1.3. Differences between Supervised and Unsupervised Learning
- 2.2. Supervised Learning Models
  - 2.2.1. Linear Models
  - 2.2.2. Decision Tree Models
  - 2.2.3. Neural Network Models
- 2.3. Linear Regression
  - 2.3.1. Simple Linear Regression
  - 2.3.2. Multiple Linear Regression
  - 2.3.3. Regression Analysis
- 2.4. Model Training
  - 2.4.1. *Batch Learning*
  - 2.4.2. Online Learning
  - 2.4.3. Optimization Methods
- 2.5. Model Evaluation: Training Set vs. Test Set
  - 2.5.1. Evaluation Metrics
  - 2.5.2. Cross Validation
  - 2.5.3. Comparison of Data Sets
- 2.6. Model Evaluation: The Code
  - 2.6.1. Prediction Generation
  - 2.6.2. Error Analysis
  - 2.6.3. Evaluation Metrics



- 2.7. Variables Analysis
  - 2.7.1. Identification of Relevant Variables
  - 2.7.2. Correlation Analysis
  - 2.7.3. Regression Analysis
- 2.8. Explainability of Neural Network Models
  - 2.8.1. Interpretable Models
  - 2.8.2. Visualization Methods
  - 2.8.3. Evaluation Methods
- 2.9. Optimization
  - 2.9.1. Optimization Methods
  - 2.9.2. Regularization Techniques
  - 2.9.3. The Use of Graphs
- 2.10. Hyperparameters
  - 2.10.1. Selection of Hyperparameters
  - 2.10.2. Parameter Search
  - 2.10.3. Hyperparameter Tuning

### Module 3. Neural Networks, the Basis of Deep Learning

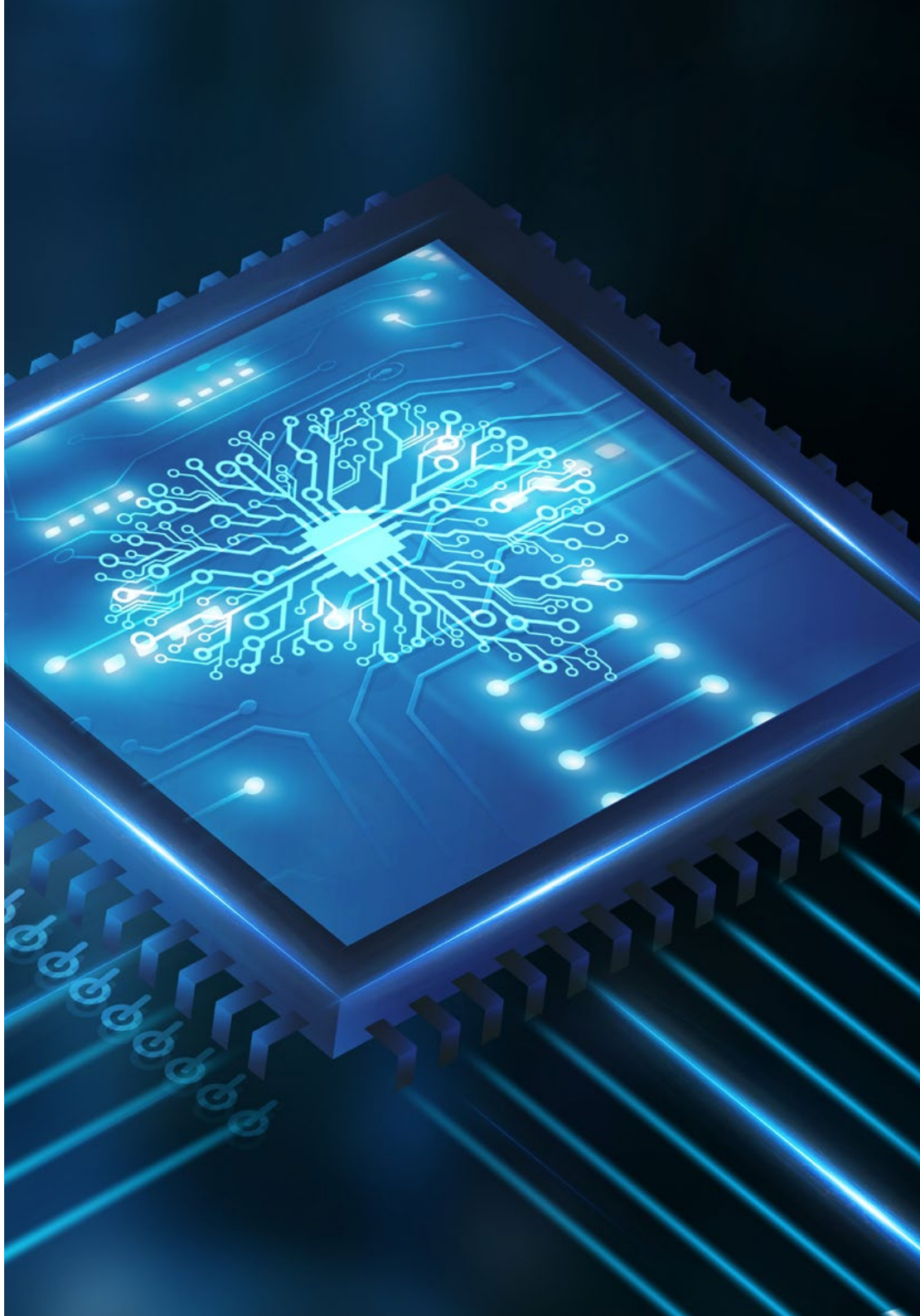
- 3.1. Deep Learning
  - 3.1.1. Types of Deep Learning
  - 3.1.2. Applications of Deep Learning
  - 3.1.3. Advantages and Disadvantages of Deep Learning
- 3.2. Surgery
  - 3.2.1. Sum
  - 3.2.2. Product
  - 3.2.3. Transfer
- 3.3. Layers
  - 3.3.1. Input Layer
  - 3.3.2. Hidden Layer
  - 3.3.3. Output Layer
- 3.4. Union of Layers and Operations
  - 3.4.1. Architecture Design
  - 3.4.2. Connection between Layers
  - 3.4.3. Forward Propagation

- 3.5. Construction of the First Neural Network
  - 3.5.1. Network Design
  - 3.5.2. Establish the Weights
  - 3.5.3. Network Training
- 3.6. Trainer and Optimizer
  - 3.6.1. Optimizer Selection
  - 3.6.2. Establishment of a Loss Function
  - 3.6.3. Establishing a Metric
- 3.7. Application of the Principles of Neural Networks
  - 3.7.1. Activation Functions
  - 3.7.2. Backward Propagation
  - 3.7.3. Parameter Adjustment
- 3.8. From Biological to Artificial Neurons
  - 3.8.1. Functioning of a Biological Neuron
  - 3.8.2. Transfer of Knowledge to Artificial Neurons
  - 3.8.3. Establish Relations Between the Two
- 3.9. Implementation of MLP (Multilayer Perceptron) with Keras
  - 3.9.1. Definition of the Network Structure
  - 3.9.2. Model Compilation
  - 3.9.3. Model Training
- 3.10. Fine Tuning Hyperparameters of Neural Networks
  - 3.10.1. Selection of the Activation Function
  - 3.10.2. Set the Learning Rate
  - 3.10.3. Adjustment of Weights

### Module 4. Deep Neural Networks Training

- 4.1. Gradient Problems
  - 4.1.1. Gradient Optimization Techniques
  - 4.1.2. Stochastic Gradients
  - 4.1.3. Weight Initialization Techniques
- 4.2. Reuse of Pre-Trained Layers
  - 4.2.1. Transfer Learning Training
  - 4.2.2. Feature Extraction
  - 4.2.3. Deep Learning

- 4.3. Optimizers
  - 4.3.1. Stochastic Gradient Descent Optimizers
  - 4.3.2. Adam and RMSprop Optimizers
  - 4.3.3. Moment Optimizers
- 4.4. Learning Rate Programming
  - 4.4.1. Automatic Learning Rate Control
  - 4.4.2. Learning Cycles
  - 4.4.3. Smoothing Terms
- 4.5. Overfitting
  - 4.5.1. Cross Validation
  - 4.5.2. Regularization
  - 4.5.3. Evaluation Metrics
- 4.6. Practical Guidelines
  - 4.6.1. Model Design
  - 4.6.2. Selection of Metrics and Evaluation Parameters
  - 4.6.3. Hypothesis Testing
- 4.7. Transfer Learning
  - 4.7.1. Transfer Learning Training
  - 4.7.2. Feature Extraction
  - 4.7.3. Deep Learning
- 4.8. Data Augmentation
  - 4.8.1. Image Transformations
  - 4.8.2. Synthetic Data Generation
  - 4.8.3. Text Transformation
- 4.9. Practical Application of Transfer Learning
  - 4.9.1. Transfer Learning Training
  - 4.9.2. Feature Extraction
  - 4.9.3. Deep Learning
- 4.10. Regularization
  - 4.10.1. L1 and L2
  - 4.10.2. Regularization by Maximum Entropy
  - 4.10.3. Dropout



## Module 5. Model Customization and Training with TensorFlow

- 5.1. TensorFlow
  - 5.1.1. Using the TensorFlow Library
  - 5.1.2. Model Education with TensorFlow
  - 5.1.3. Operations with Graphs in TensorFlow
- 5.2. TensorFlow and NumPy
  - 5.2.1. NumPy Computational Environment for TensorFlow
  - 5.2.2. Using NumPy Arrays with TensorFlow
  - 5.2.3. NumPy Operations for TensorFlow Graphs
- 5.3. Model Customization and Training Algorithms
  - 5.3.1. Building Custom Models with TensorFlow
  - 5.3.2. Management of Training Parameters
  - 5.3.3. Use of Optimization Techniques for Training
- 5.4. TensorFlow Functions and Graphs
  - 5.4.1. Functions with TensorFlow
  - 5.4.2. Use of Graphs for Model Training
  - 5.4.3. Optimization of Graphs with TensorFlow Operations
- 5.5. Data Loading and Pre-Processing with TensorFlow
  - 5.5.1. Loading Datasets with TensorFlow
  - 5.5.2. Data Pre-Processing with TensorFlow
  - 5.5.3. Using TensorFlow Tools for Data Manipulation
- 5.6. The tf.data API
  - 5.6.1. Using the tf.data API for Data Processing
  - 5.6.2. Constructing Data Streams with tf.data
  - 5.6.3. Use of the tf.data API for Training Models
- 5.7. The TFRecord Format
  - 5.7.1. Using the TFRecord API for Data Serialization
  - 5.7.2. Loading TFRecord Files with TensorFlow
  - 5.7.3. Using TFRecord Files for Training Models
- 5.8. Keras Pre-Processing Layers
  - 5.8.1. Using the Keras Pre-Processing API
  - 5.8.2. Construction of Pre-Processing Pipelined with Keras
  - 5.8.3. Using the Keras Pre-Processing API for Model Training

- 5.9. The TensorFlow Datasets Project
  - 5.9.1. Using TensorFlow Datasets for Data Loading
  - 5.9.2. Data Pre-Processing with TensorFlow Datasets
  - 5.9.3. Using TensorFlow Datasets for Model Training
- 5.10. Construction of a Deep Learning Application with TensorFlow. Practical Application
  - 5.10.1. Building a Deep Learning Application with TensorFlow.
  - 5.10.2. Training a Model with TensorFlow
  - 5.10.3. Using the Application for the Prediction of Results

## Module 6. Deep Computer Vision with Convolutional Neural Networks

- 6.1. The Cortex Visual Architecture
  - 6.1.1. Functions of the Visual Cortex
  - 6.1.2. Theories of Computational Vision
  - 6.1.3. Models of Image Processing
- 6.2. Convolutional Layers
  - 6.2.1. Reuse of Weights in Convolution
  - 6.2.2. 2D Convolution
  - 6.2.3. Activation Functions
- 6.3. Grouping Layers and Implementation of Grouping Layers with Keras
  - 6.3.1. Pooling and Striding
  - 6.3.2. Flattening
  - 6.3.3. Types of Pooling
- 6.4. CNN Architecture
  - 6.4.1. VGG Architecture
  - 6.4.2. AlexNet Architecture
  - 6.4.3. ResNet Architecture
- 6.5. Implementation of a ResNet-34 CNN Using Keras
  - 6.5.1. Weight Initialization
  - 6.5.2. Input Layer Definition
  - 6.5.3. Output Definition
- 6.6. Use of Pre-Trained Keras Models
  - 6.6.1. Characteristics of Pre-Trained Models
  - 6.6.2. Uses of Pre-Trained Models
  - 6.6.3. Advantages of Pre-Trained Models

- 6.7. Pre-Trained Models for Transfer Learning
  - 6.7.1. Transfer Learning
  - 6.7.2. Transfer Learning Process
  - 6.7.3. Advantages of Transfer Learning
- 6.8. Classification and Localization in Deep Computer Vision
  - 6.8.1. Image Classification
  - 6.8.2. Localization of Objects in Images
  - 6.8.3. Object Detection
- 6.9. Object Detection and Object Tracking
  - 6.9.1. Object Detection Methods
  - 6.9.2. Object Tracking Algorithms
  - 6.9.3. Tracking and Localization Techniques
- 6.10. Semantic Segmentation
  - 6.10.1. Deep Learning for Semantic Segmentation
  - 6.10.2. Edge Detection
  - 6.10.3. Rule-Based Segmentation Methods

## Module 7. Processing Sequences Using RNN (Recurrent Neural Networks) and CNN (Convolutional Neural Networks)

- 7.1. Recurrent Neurons and Layers
  - 7.1.1. Types of Neurons Recurring
  - 7.1.2. Architecture of a Recurrent Layer
  - 7.1.3. Applications of Recurrent Layers
- 7.2. Recurrent Neural Network (RNN) Training
  - 7.2.1. Backpropagation over Time (BPTT)
  - 7.2.2. Stochastic Downward Gradient
  - 7.2.3. Regularization in RNN Training
- 7.3. Evaluation of RNN Models
  - 7.3.1. Evaluation Metrics
  - 7.3.2. Cross Validation
  - 7.3.3. Hyperparameter Tuning

- 7.4. Prerenal RNNs
  - 7.4.1. Prenetrated Networks
  - 7.4.2. Transfer of Learning
  - 7.4.3. Fine Tuning
- 7.5. Forecasting a Time Series
  - 7.5.1. Statistical Models for Forecasting
  - 7.5.2. Time Series Models
  - 7.5.3. Models Based on Neural Networks
- 7.6. Interpretation of Time Series Analysis Results
  - 7.6.1. Main Component Analysis
  - 7.6.2. Cluster Analysis
  - 7.6.3. Correlation Analysis
- 7.7. Handling of Long Sequences
  - 7.7.1. Long Short-Term Memory (LSTM)
  - 7.7.2. Gated Recurrent Units (GRU)
  - 7.7.3. 1D Convolutional
- 7.8. Partial Sequence Learning
  - 7.8.1. Deep Learning Methods
  - 7.8.2. Generative Models
  - 7.8.3. Reinforcement Learning
- 7.9. Practical Application of RNN and CNN
  - 7.9.1. Natural Language Processing
  - 7.9.2. Pattern Recognition
  - 7.9.3. Computer Vision
- 7.10. Differences in Classical Results
  - 7.10.1. Classical vs. RNN Methods
  - 7.10.2. Classical vs. CNN Methods
  - 7.10.3. Difference in Training Time

## Module 8. Natural Language Processing (NLP) with Recurrent Neural Networks (RNN) and Attention

- 8.1. Text Generation Using RNN
  - 8.1.1. Training an RNN for Text Generation
  - 8.1.2. Natural Language Generation with RNN
  - 8.1.3. Text Generation Applications with RNN
- 8.2. Training Data Set Creation
  - 8.2.1. Preparation of the Data for Training an RNN
  - 8.2.2. Storage of the Training Dataset
  - 8.2.3. Data Cleaning and Transformation
- 8.3. Sentiment Analysis
  - 8.3.1. Classification of Opinions with RNN
  - 8.3.2. Detection of Themes in Comments
  - 8.3.3. Sentiment Analysis with Deep Learning Algorithms
- 8.4. Encoder-Decoder Network for Neural Machine Translation
  - 8.4.1. Training an RNN for Machine Translation
  - 8.4.2. Use of an Encoder-Decoder Network for Machine Translation
  - 8.4.3. Improving the Accuracy of Machine Translation with RNNs
- 8.5. Attention Mechanisms
  - 8.5.1. Application of Attention Mechanisms in RNN
  - 8.5.2. Use of Attention Mechanisms to Improve the Accuracy of the Models
  - 8.5.3. Advantages of Attention Mechanisms in Neural Networks
- 8.6. Transformer Models
  - 8.6.1. Using Transformers Models for Natural Language Processing
  - 8.6.2. Application of Transformers Models for Vision
  - 8.6.3. Advantages of Transformers Models
- 8.7. Transformers for Vision
  - 8.7.1. Use of Transformers Models for Vision
  - 8.7.2. Image Data Pre-Processing
  - 8.7.3. Training a Transformer Model for Vision

- 8.8. Hugging Face Transformer Library
  - 8.8.1. Using the Hugging Face Transformers Library
  - 8.8.2. Application of the Hugging Face Transformers Library
  - 8.8.3. Advantages of the Hugging Face Transformers Library
- 8.9. Other Transformers Libraries. Comparison
  - 8.9.1. Comparison Between Different Transformers Libraries
  - 8.9.2. Use of the Other Transformers Libraries
  - 8.9.3. Advantages of the Other Transformers Libraries
- 8.10. Development of an NLP Application with RNN and Attention. Practical Application
  - 8.10.1. Development of a Natural Language Processing Application with RNN and Attention
  - 8.10.2. Use of RNN, Attention Mechanisms and Transformers Models in the Application.
  - 8.10.3. Evaluation of the Practical Application

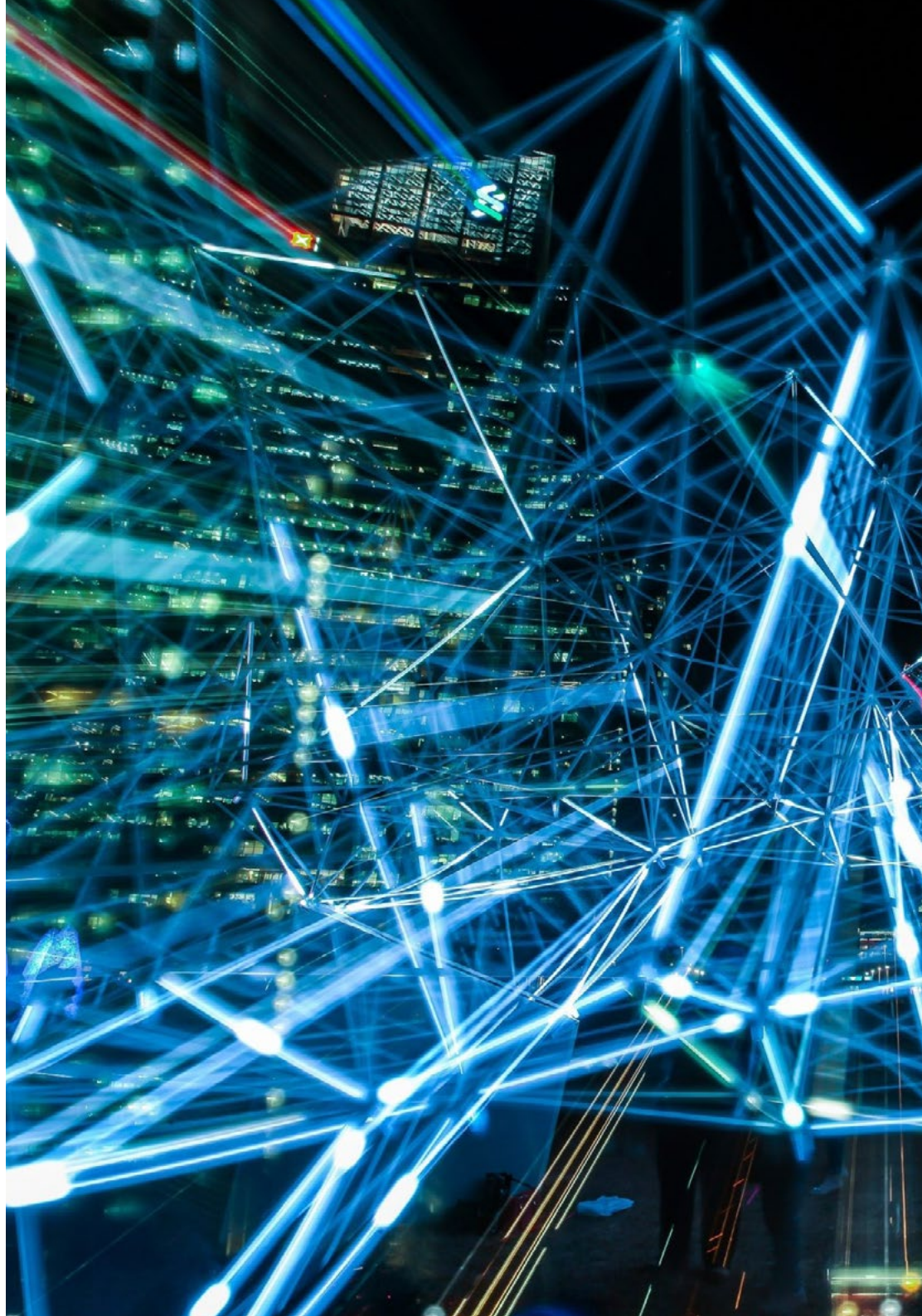
## Module 9. Autoencoders, GANs and Diffusion Models

- 9.1. Representation of Efficient Data
  - 9.1.1. Dimensionality Reduction
  - 9.1.2. Deep Learning
  - 9.1.3. Compact Representations
- 9.2. PCA Realization with an Incomplete Linear Automatic Encoder
  - 9.2.1. Training Process
  - 9.2.2. Implementation in Python
  - 9.2.3. Use of Test Data
- 9.3. Stacked Automatic Encoders
  - 9.3.1. Deep Neural Networks
  - 9.3.2. Construction of Coding Architectures
  - 9.3.3. Use of Regularization
- 9.4. Convolutional Autoencoders
  - 9.4.1. Design of Convolutional Models
  - 9.4.2. Convolutional Model Training
  - 9.4.3. Results Evaluation

- 9.5. Noise Suppression of Automatic Encoders
  - 9.5.1. Filter Application
  - 9.5.2. Design of Coding Models
  - 9.5.3. Use of Regularization Techniques
- 9.6. Sparse Automatic Encoders
  - 9.6.1. Increasing Coding Efficiency
  - 9.6.2. Minimizing the Number of Parameters
  - 9.6.3. Using Regularization Techniques
- 9.7. Variational Automatic Encoders
  - 9.7.1. Use of Variational Optimization
  - 9.7.2. Unsupervised Deep Learning
  - 9.7.3. Deep Latent Representations
- 9.8. Generation of Fashion MNIST Images
  - 9.8.1. Pattern Recognition
  - 9.8.2. Image Generation
  - 9.8.3. Deep Neural Networks Training
- 9.9. Generative Adversarial Networks and Diffusion Models
  - 9.9.1. Content Generation from Images
  - 9.9.2. Modeling of Data Distributions
  - 9.9.3. Use of Adversarial Networks
- 9.10. Implementation of the Models. Practical Application
  - 9.10.1. Implementation of the Models
  - 9.10.2. Use of Real Data
  - 9.10.3. Results Evaluation

## Module 10. Reinforcement Learning

- 10.1. Optimization of Rewards and Policy Search
  - 10.1.1. Reward Optimization Algorithms
  - 10.1.2. Policy Search Processes
  - 10.1.3. Reinforcement Learning for Reward Optimization
- 10.2. OpenAI
  - 10.2.1. OpenAI Gym Environment
  - 10.2.2. Creation of OpenAI Environments
  - 10.2.3. Reinforcement Learning Algorithms in OpenAI





- 10.3. Neural Network Policies
  - 10.3.1. Convolutional Neural Networks for Policy Search
  - 10.3.2. Deep Learning Policies
  - 10.3.3. Extending Neural Network Policies
- 10.4. Stock Evaluation: the Credit Allocation Problem
  - 10.4.1. Risk Analysis for Credit Allocation
  - 10.4.2. Estimating the Profitability of Loans
  - 10.4.3. Credit Evaluation Models Based on Neural Networks
- 10.5. Policy Gradients
  - 10.5.1. Reinforcement Learning with Policy Gradients
  - 10.5.2. Optimization of Policy Gradients
  - 10.5.3. Policy Gradient Algorithms
- 10.6. Markov Decision Processes
  - 10.6.1. Optimization of Markov Decision Processes
  - 10.6.2. Reinforcement Learning for Markov Decision Processes
  - 10.6.3. Models of Markov Decision Processes
- 10.7. Temporal Difference Learning and Q-Learning
  - 10.7.1. Application of Temporal Differences in Learning
  - 10.7.2. Application of Q-Learning in Learning
  - 10.7.3. Optimization of Q-Learning Parameters
- 10.8. Implementation of Deep Q-Learning and Deep Q-Learning Variants
  - 10.8.1. Construction of Deep Neural Networks for Deep Q-Learning
  - 10.8.2. Implementation of Deep Q-Learning
  - 10.8.3. Variations of Deep Q-Learning
- 10.9. Reinforcement Learning Algorithms
  - 10.9.1. Reinforcement Learning Algorithms
  - 10.9.2. Reward Learning Algorithms
  - 10.9.3. Punishment Learning Algorithms
- 10.10. Design of a Reinforcement Learning Environment. Practical Application
  - 10.10.1. Design of a Reinforcement Learning Environment
  - 10.10.2. Implementation of a Reinforcement Learning Algorithm
  - 10.10.3. Evaluation of a Reinforcement Learning Algorithm

06

# Methodology

This academic program offers students a different way of learning. Our methodology uses a cyclical learning approach: **Relearning**.

This teaching system is used, for example, in the most prestigious medical schools in the world, and major publications such as the **New England Journal of Medicine** have considered it to be one of the most effective.







“

*Discover Relearning, a system that abandons conventional linear learning, to take you through cyclical teaching systems: a way of learning that has proven to be extremely effective, especially in subjects that require memorization"*

## Case Study to contextualize all content

Our program offers a revolutionary approach to developing skills and knowledge. Our goal is to strengthen skills in a changing, competitive, and highly demanding environment.

“

*At TECH, you will experience a learning methodology that is shaking the foundations of traditional universities around the world”*



*You will have access to a learning system based on repetition, with natural and progressive teaching throughout the entire syllabus.*



*The student will learn to solve complex situations in real business environments through collaborative activities and real cases.*

### A learning method that is different and innovative

This TECH program is an intensive educational program, created from scratch, which presents the most demanding challenges and decisions in this field, both nationally and internationally. This methodology promotes personal and professional growth, representing a significant step towards success. The case method, a technique that lays the foundation for this content, ensures that the most current economic, social and professional reality is taken into account.

“*Our program prepares you to face new challenges in uncertain environments and achieve success in your career”*

The case method is the most widely used learning system in the best faculties in the world. The case method was developed in 1912 so that law students would not only learn the law based on theoretical content. It consisted of presenting students with real-life, complex situations for them to make informed decisions and value judgments on how to resolve them. In 1924, Harvard adopted it as a standard teaching method.

What should a professional do in a given situation? This is the question that you are presented with in the case method, an action-oriented learning method. Throughout the program, the studies will be presented with multiple real cases. They will have to combine all their knowledge and research, and argue and defend their ideas and decisions.

## Relearning Methodology

TECH effectively combines the Case Study methodology with a 100% online learning system based on repetition, which combines 8 different teaching elements in each lesson.

We enhance the Case Study with the best 100% online teaching method: Relearning.

*In 2019, we obtained the best learning results of all online universities in the world.*



At TECH, you will learn using a cutting-edge methodology designed to train the executives of the future. This method, at the forefront of international teaching, is called Relearning.

Our university is the only one in the world authorized to employ this successful method. In 2019, we managed to improve our students' overall satisfaction levels (teaching quality, quality of materials, course structure, objectives...) based on the best online university indicators.

In our program, learning is not a linear process, but rather a spiral (learn, unlearn, forget, and re-learn). Therefore, we combine each of these elements concentrically.

This methodology has trained more than 650,000 university graduates with unprecedented success in fields as diverse as biochemistry, genetics, surgery, international law, management skills, sports science, philosophy, law, engineering, journalism, history, and financial markets and instruments. All this in a highly demanding environment, where the students have a strong socio-economic profile and an average age of 43.5 years.

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

From the latest scientific evidence in the field of neuroscience, not only do we know how to organize information, ideas, images and memories, but we know that the place and context where we have learned something is fundamental for us to be able to remember it and store it in the hippocampus, to retain it in our long-term memory.

In this way, and in what is called neurocognitive context-dependent e-learning, the different elements in our program are connected to the context where the individual carries out their professional activity.



This program offers the best educational material, prepared with professionals in mind:



### Study Material

All teaching material is produced by the specialists who teach the course, specifically for the course, so that the teaching content is highly specific and precise.

These contents are then applied to the audiovisual format, to create the TECH online working method. All this, with the latest techniques that offer high quality pieces in each and every one of the materials that are made available to the student.



### Classes

There is scientific evidence suggesting that observing third-party experts can be useful.

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



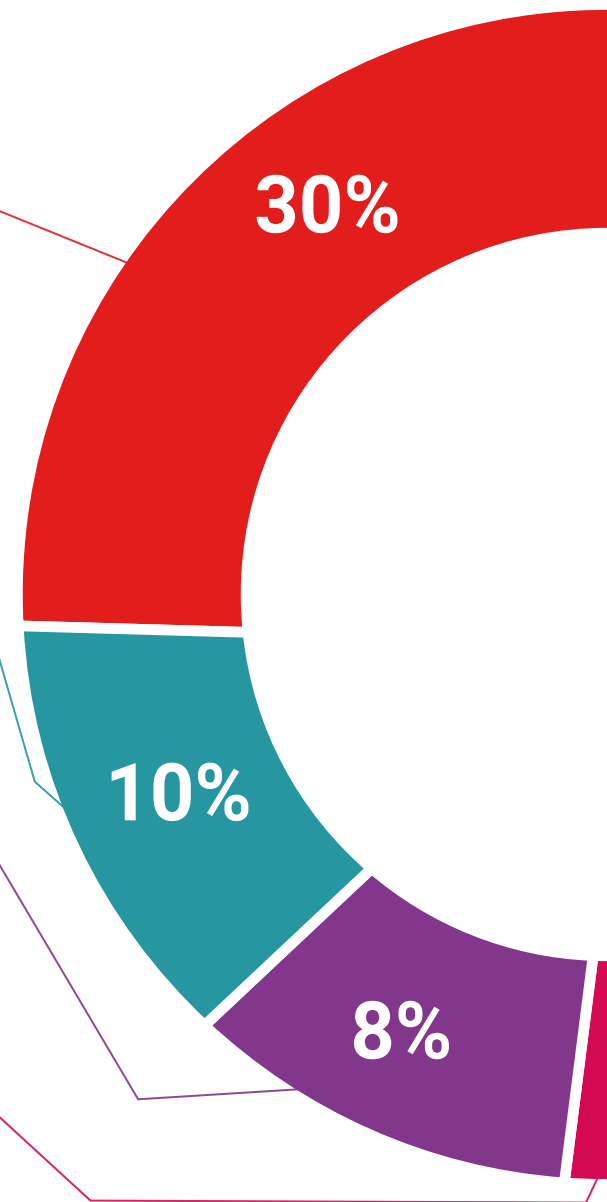
### Practising Skills and Abilities

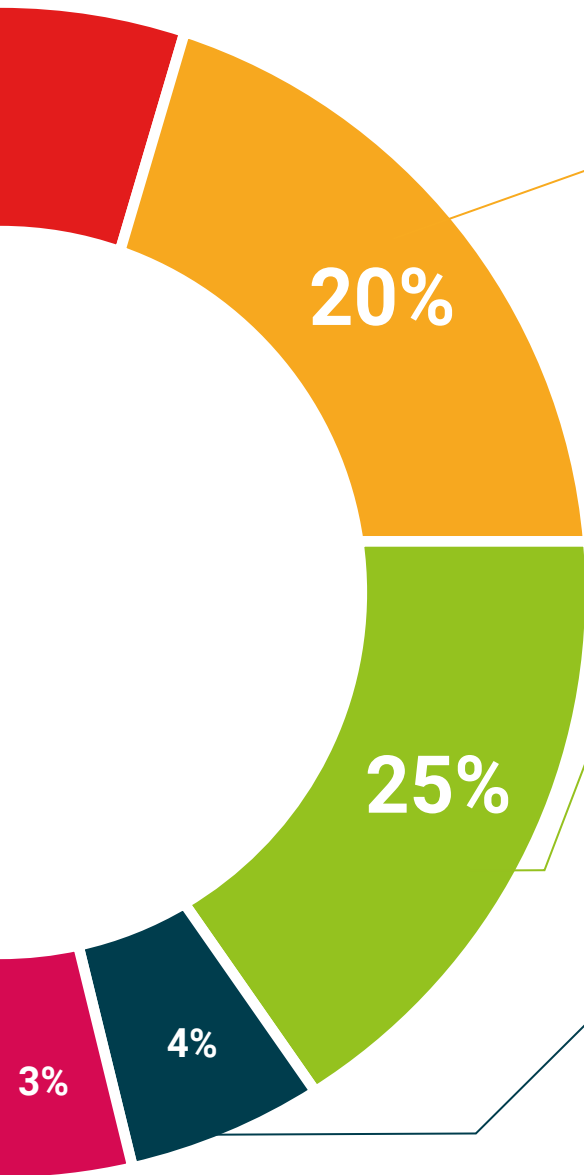
They will carry out activities to develop specific skills and abilities in each subject area. Exercises and activities to acquire and develop the skills and abilities that a specialist needs to develop in the context of the globalization that we are experiencing.



### Additional Reading

Recent articles, consensus documents and international guidelines, among others. In TECH's virtual library, students will have access to everything they need to complete their course.





**Case Studies**

Students will complete a selection of the best case studies chosen specifically for this program. Cases that are presented, analyzed, and supervised by the best specialists in the world.



**Interactive Summaries**

The TECH team presents the contents attractively and dynamically in multimedia lessons that include audio, videos, images, diagrams, and concept maps in order to reinforce knowledge.

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



**Testing & Retesting**

We periodically evaluate and re-evaluate students' knowledge throughout the program, through assessment and self-assessment activities and exercises, so that they can see how they are achieving their goals.



07

# Certificate

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





“

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

This private qualification will allow you to obtain a **Master's Degree in Deep Learning** endorsed by **TECH Global University**, the world's largest online university.

**TECH Global University** is an official European University publicly recognized by the Government of Andorra (*official bulletin*). Andorra is part of the European Higher Education Area (EHEA) since 2003. The EHEA is an initiative promoted by the European Union that aims to organize the international training framework and harmonize the higher education systems of the member countries of this space. The project promotes common values, the implementation of collaborative tools and strengthening its quality assurance mechanisms to enhance collaboration and mobility among students, researchers and academics.

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

Title: **Master's Degree in Deep Learning**

Modality: **online**

Duration: **12 months**

Accreditation: **60 ECTS**



\*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.

future  
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guarantee accreditation teaching  
institutions technology learning  
community commitment  
personalized service innovation  
knowledge present quality  
online training  
development language  
classroom

**tech** global  
university

## Master's Degree Deep Learning

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

# Master's Degree Deep Learning

