Postgraduate Certificate
Mathematical Basis of Deep Learning

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Postgraduate Certificate
Mathematical Basis of Deep Learning

- Modality: **online**
- Duration: **12 weeks**
- Certificate: **TECH Technological University**
- Dedication: **16h/ week**
- Schedule: **at your own pace**
- Exams: **online**

Website: www.techtitute.com/in/information-technology/postgraduate-certificate/mathematical-basis-deep-learning

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01

Introduction

Deep Learning has proven to be extremely powerful in a wide variety of applications, from object detection in images to Natural Language Processing and autonomous vehicle driving. In fact, advances in this area are becoming more and more vertiginous and a specialization in its mathematical foundations is of great interest. And this will be achieved by the student with this degree, essential to master the mathematical foundations behind the operation of these Deep Learning models. Through this program, students will be able to go through topics such as derivatives, multivariable calculus and probability theory, all of which are essential for the operation of neural networks. In addition, the degree is offered 100% online, which means that students can tailor their studies to their schedules.

Get up to speed on the mathematical foundations of Deep Learning to create the most advanced neural networks"

Today, Deep Learning has become one of the most widely used techniques in Artificial Intelligence due to its ability to train deep neural networks and perform complex tasks accurately in a wide variety of fields. In Robotics, for example, Deep Learning is used for autonomous navigation and object recognition. In the case of Natural Language Processing, it is valuable for machine translation and the creation of intelligent Chatbots.

However, in order to effectively use these neural networks, it is necessary to have a solid grasp of the underlying mathematical foundations. This is precisely the focus of the Postgraduate Certificate in Mathematical Foundations of Deep Learning, which is designed to provide students with a foundation in Advanced Mathematics and Statistics necessary for deep learning.

The program is structured around topics dealing with Linear Algebra, Multivariable Calculus, Optimization and Probability. In this sense, students will go through key concepts such as matrices, vectors, partial derivatives, Downward Gradient, probability distributions or Inferential Statistics. In addition, the degree also includes several examples and practical exercises to help students apply the theoretical concepts in a real context.

The best part is that this Postgraduate Certificate is 100% online, which means that enrollees can access the program materials from anywhere in the world and at any time that is convenient for them.

This **Postgraduate Certificate in Mathematical Basis of Deep Learning** contains the most complete and up-to-date program on the market. The most important features include:

- The development of practical cases presented by experts in Mathematical Foundations of Deep Learning
- The graphic, schematic and eminently practical contents with which it is conceived gather technological and practical information on those disciplines that are essential for professional practice
- Practical exercises where self-assessment can be used to improve learning
- Its special emphasis on innovative methodologies
- Theoretical lessons, questions to the expert, debate forums on controversial topics, and individual reflection assignments
- Content that is accessible from any fixed or portable device with an Internet connection

You will be an expert in operations with vector functions and their derivatives"

Compare data sets with mastery thanks to the innovative teaching resources of the Virtual Campus.

Get all the keys to master the operation of the models that operate under Supervised Learning"

You will specialize in adjusting hyperparameters or handling regularization techniques in only 300 hours.

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

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

The design of this program focuses on Problem-Based Learning, by means of which the professional must try to solve the different professional practice situations that are presented throughout the academic course. This will be done with the help of an innovative system of interactive videos made by renowned experts.

02

Objectives

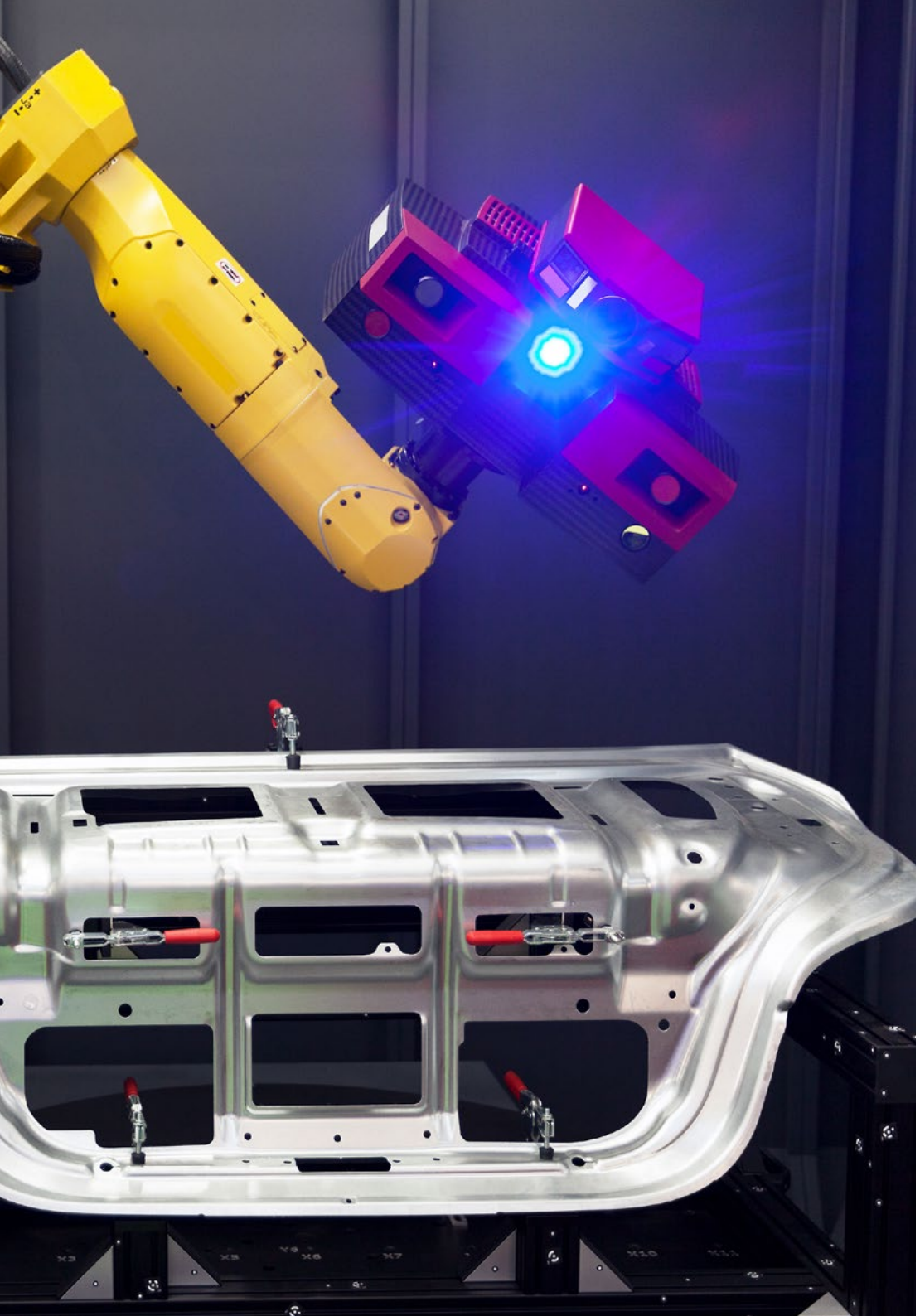
Students enrolled in this program will have the opportunity to develop advanced knowledge that will enable them to enhance their career prospects in the technology sector, especially in the development of Artificial Intelligence. To help students achieve their goals, this academic institution offers innovative and easily accessible pedagogical tools, as well as top-notch faculty with extensive backgrounds in the field of AI.

Achieves the objectives of the title and develops the Chain Rule for calculating derivatives of nested functions"

General Objectives

- 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

Enroll now and take your career in IT to the next level by exploring the functionality of Transformers libraries"



Specific Objectives

- 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
- 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

03

Course Management

Always with the goal of providing an education of the highest educational standards, TECH follows a rigorous selection process for each of the professors who teach its programs. As a result, students can be assured that they are receiving instruction from the best experts in each field. In the case of this Postgraduate Certificate, students will have access to a curriculum designed by Deep Learning eminences with extensive experience in the advanced creation of algorithms for artificial neural networks.

Deep Learning eminences will launch your career by providing you with all the keys to the mathematical basis of artificial neural networks"

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
- Lecturer at EAE Business School
- Degree in Economics from the Technological Institute of Santo Domingo INTEC
- Professional Master's Degree in Data Science at Centro Universitario de Tecnología y Arte
- Master MBA in International Relations and Business at CEF (Centro de Estudios Financieros)
- Postgraduate Certificate in Corporate Finance from the Santo Domingo Institute of Technology

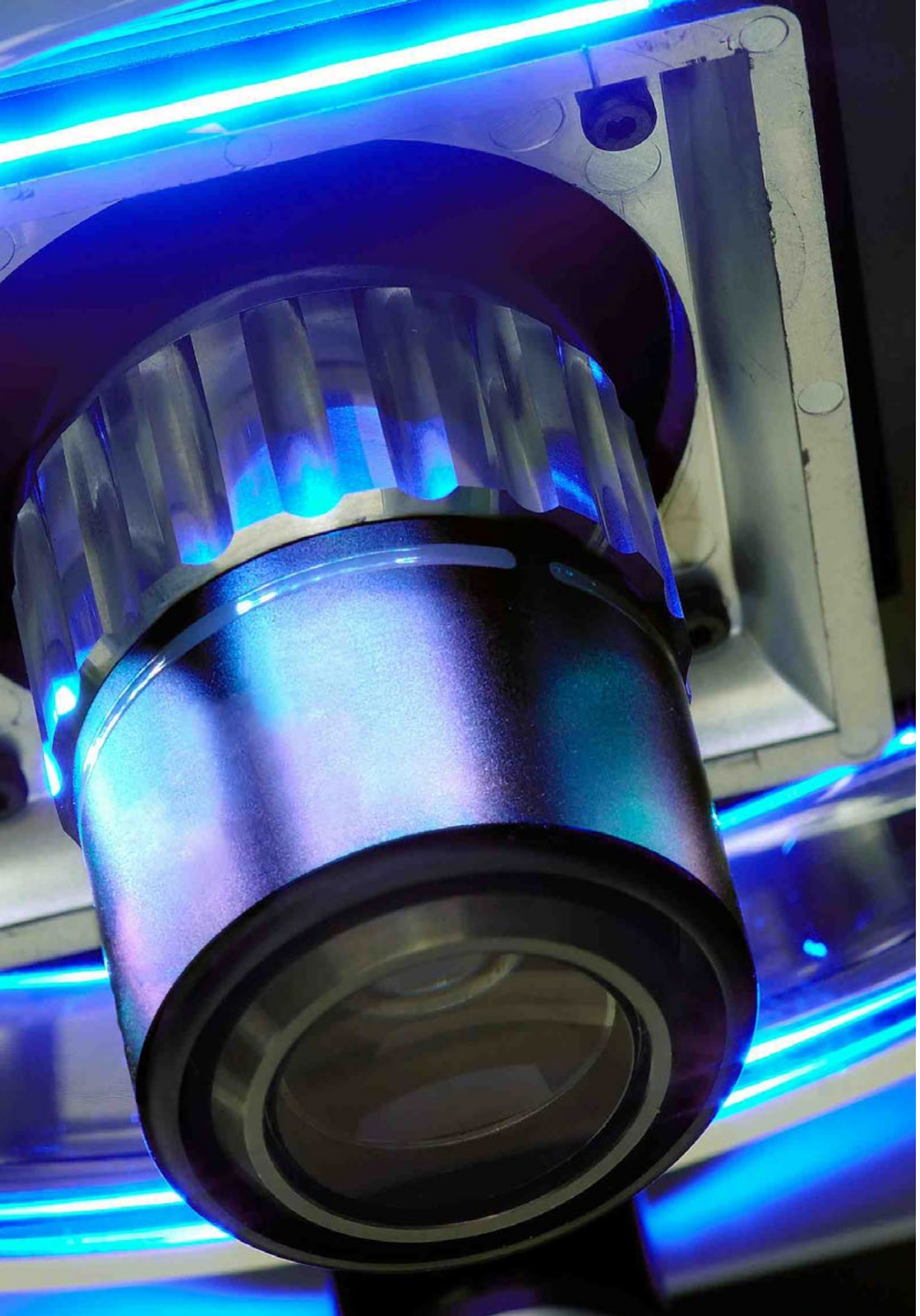
Professors

Mr. Delgado Panadero, Ángel

- ML Engenieer at Paradigma Digital
- Computer Vision Engineer at NTT Disruption
- Data Scientist at Singular People
- Data Analyst at Parclick
- Tutor at Master in Big Data and Analytics at EAE Business School
- Degree in Physics at the University of Salamanca

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 Big Data and Analytics /Project Management(Minor) at EAE Business



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 at 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
- Lecturer at the European Business School

Take the opportunity to learn about the latest advances in this field in order to apply it to your daily practice"

04

Structure and Content

The curriculum of this Postgraduate Certificate will guide students through a comprehensive exploration of the mathematical foundations of Deep Learning in an academic journey condensed into 300 hours. Students will also have access to a wide range of innovative teaching resources available on the program's Virtual Campus, which will complement and enrich their learning experience. Some of them are self-assessment exercises, case studies or interactive summaries.

A curriculum that captures each and every one of the principles of Deep Learning"

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 nonlinear functions
- 1.8.3. Derivatives of Compound Functions

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

Take the opportunity to enroll in the perfect degree to delve into the explainability of artificial neural network models"

05

Methodology

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

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

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

Case Study to contextualize all content

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

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

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

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

A learning method that is different and innovative

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

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

The case method has been the most widely used learning system among the world's leading Information Technology schools for as long as they have existed. The case method was developed in 1912 so that law students would not only learn the law based on theoretical content. It consisted of presenting students with real-life, complex situations for them to make informed decisions and value judgments on how to resolve them. In 1924, Harvard adopted it as a standard teaching method.

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

Relearning Methodology

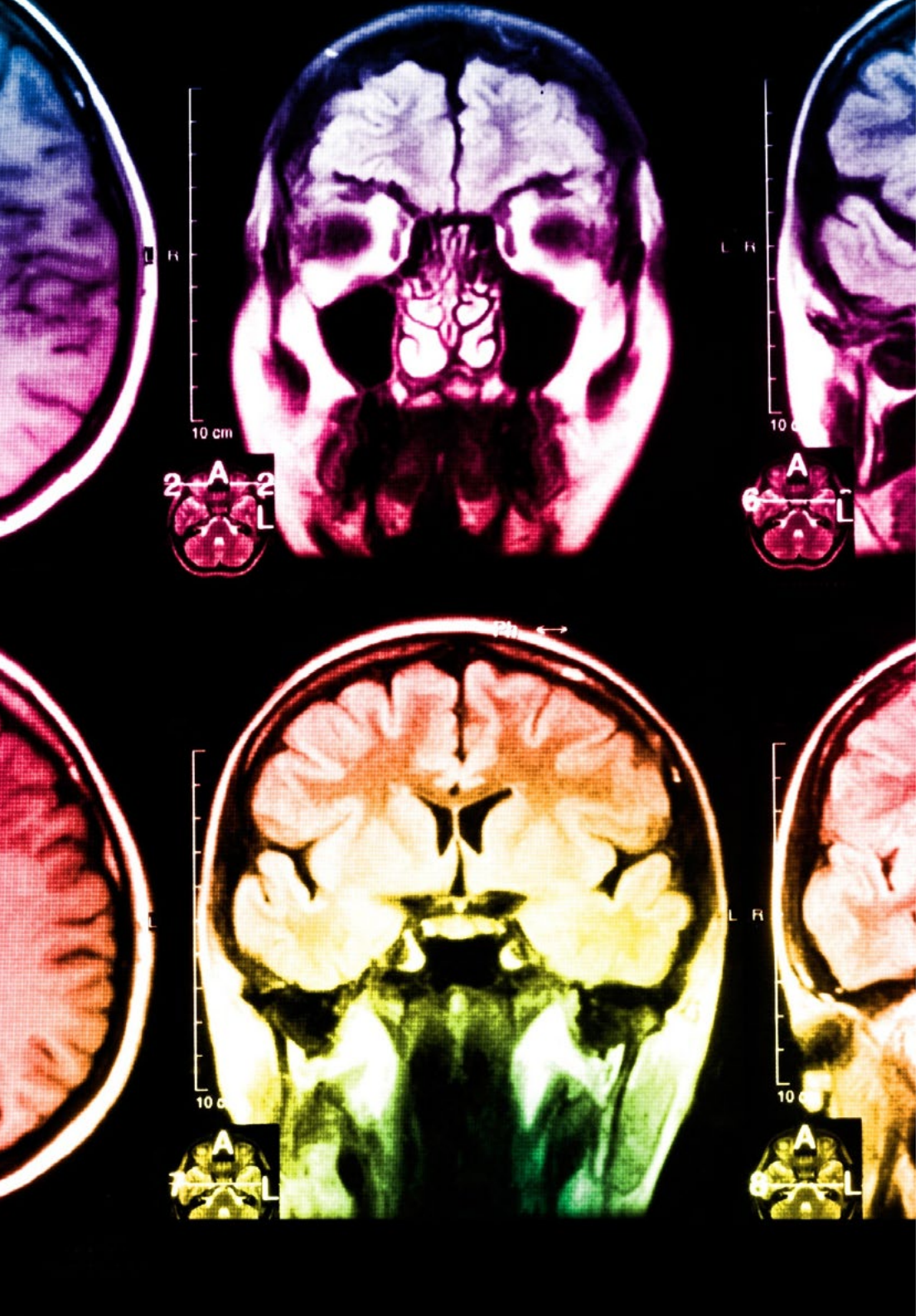
TECH effectively combines the Case Study methodology with a 100% online learning system based on repetition, which combines different teaching elements in each lesson.

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

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

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

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



In our program, learning is not a linear process, but rather a spiral (learn, unlearn, forget, and re-learn). Therefore, we combine each of these elements concentrically. This methodology has trained more than 650,000 university graduates with unprecedented success in fields as diverse as biochemistry, genetics, surgery, international law, management skills, sports science, philosophy, law, engineering, journalism, history, and financial markets and instruments. All this in a highly demanding environment, where the students have a strong socio-economic profile and an average age of 43.5 years.

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

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

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

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

Study Material

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

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

Classes

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

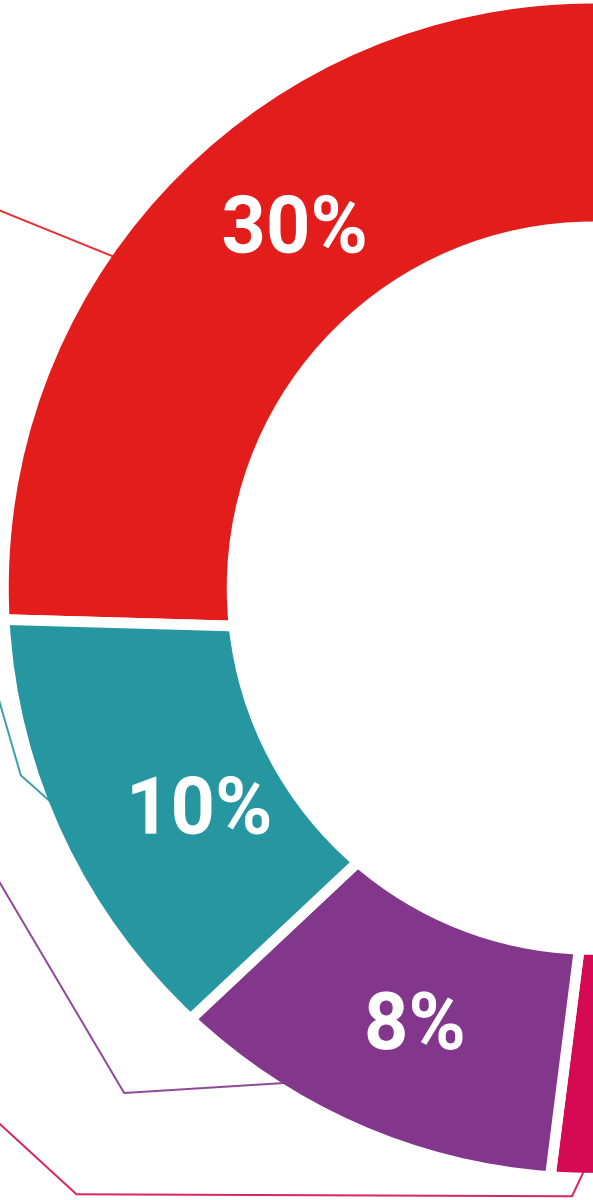
Learning from an Expert strengthens knowledge and memory, and generates confidence in future difficult decisions.

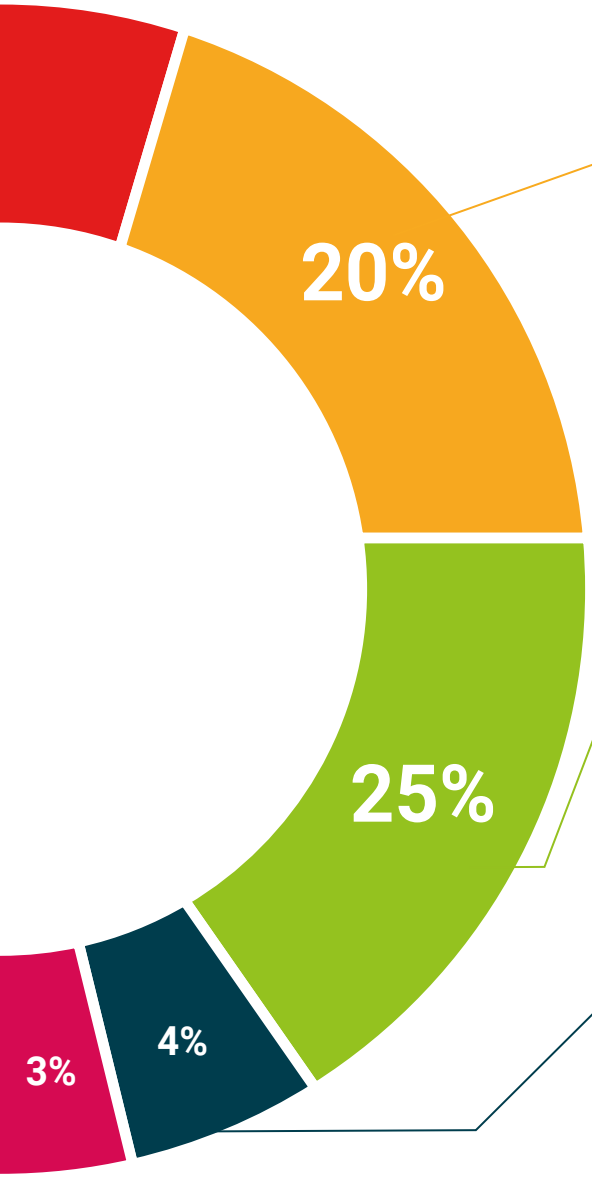
Practising Skills and Abilities

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

Additional Reading

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





Case Studies

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

Interactive Summaries

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

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

Testing & Retesting

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

06

Certificate

The Postgraduate Certificate in Mathematical Basis of Deep Learning guarantees students, in addition to the most rigorous and up-to-date education, access to a Postgraduate Certificate issued by TECH Technological University.

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

This **Postgraduate Certificate in Mathematical Basis of Deep Learning** contains the most complete and up-to-date scientific on the market.

After the student has passed the assessments, they will receive their corresponding **Postgraduate Certificate** issued by **TECH Technological University** via tracked delivery*.

The certificate issued by **TECH Technological University** will reflect the qualification obtained in the Postgraduate Certificate, and meets the requirements commonly demanded by labor exchanges, competitive examinations, and professional career evaluation committees.

Title: **Postgraduate Certificate in Mathematical Basis of Deep Learning**

Official Nº of Hours: **300h.**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Awards the following

CERTIFICATE

to

Mr./Ms. _____, with identification number _____.

For having passed and accredited the following program

POSTGRADUATE CERTIFICATE

in

Mathematical Basis of Deep Learning

This is a qualification awarded by this University, equivalent to 300 hours, with a start date of dd/mm/yyyy and an end date of dd/mm/yyyy.

TECH is a Private Institution of Higher Education recognized by the Ministry of Public Education as of June 28, 2018.

June 17, 2020

Tere Guevara Navarro

Dean

Unique TECH Code: AFWORD23S techtitute.com/certificates

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

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