Professional Master's Degree
Computer Vision

tech technological university

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Professional Master's Degree

Computer Vision

Modality: **Online**

Duration: **12 months**

Certificate: **TECH Technological University**

Official Nº of hours: **1,500 h.**

Website: **www.techtitute.com/pk/information-technology/professional-master-degree/master-computer-vision**

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01

Introduction

Machine Learning and artificial intelligence are the present and the future of technology. They have multiple applications, from the operation of machines and robots to scientific and medical research. Therefore, it is a growing and increasingly specialized field. Computer Vision is one of its most important branches, since it enables machines to visually process their environment, collecting and analyzing data, and allowing them to interact with it accurately. For that reason, it is one of the technological fields that has ahigh demand for specialists, and this program offers computer scientists the possibility of delving into the subject,allowing them to become a high-level professional capable of developing all types of computer vision projects.

Computer Vision is the technology of the present and the future. Specialize with this program and achieve the professional progress you are looking for"

In recent years, artificial intelligence has brought about a great revolution in the technological world. It has allowed for the development of software and machines that are capable of learning, generating new knowledge and acting according to the best available solution in each case. As such, its applications range from computational sciences, through research in areas such as healthcare, to the development of tools such as vehicles, robots or video games.

It is a field in continuous expansion and is already fundamental in most computer and technology companies. However, precisely because of its great importance and momentum in recent years, specialties have been emerging that focus on one of its specific aspects. Computer Vision is one of the most important of these. This focuses on how machines process the visual information received and how that information can be used, either to improve the machine's own relationship with its own environment by making its operations more accurate, or to collect data efficiently.

For this reason, it is a fundamental field and is closely related to Machine Learning, so more and more companies are looking for computer scientists specialized in this field who can provide the best technological solutions in the development of computer vision projects. This Professional Master's Degree offers an in-depth study of this field, bringing you closer to the most innovative knowledge and tools so that, upon completion of the program, you can make immediate professional progress thanks to your new competencies.

And all this will be achieved by following TECH Technological University's 100% online methodology, specially designed so that working computer scientists and engineers can balance this program with their jobs, since it adapts to their personal circumstances. In addition, students will be accompanied throughout the learning process by an expert teaching staff and will enjoy the best multimedia teaching resources such as case studies, technical videos, master classes or interactive summaries, among many others.

This **Professional Master's Degree in Computer Vision** contains the most complete and up-to-date educational program on the market. Its most notable features are:

- The development of case studies presented by experts in computer science and computer vision
- The graphic, schematic, and practical contents with which they are created, provide scientific and practical information on the disciplines that are essential for professional practice
- Practical exercises where self-assessment can be used to improve learning
- Its special emphasis on innovative methodologies
- Theoretical lessons, questions to the expert, debate forums on controversial topics, and individual reflection assignments
- Content that is accessible from any fixed or portable device with an Internet connection

The future is already here. Do not miss the opportunity and become a leading expert in Computer Vision thanks to this Professional Master's Degree"

Do not wait any longer and specialize in a key area of future technology that will make you advance professionally immediately"

Delve into artificial intelligence and Deep Learning and become a reference in the field of Computer Vision.

Enroll now and start developing promising computer vision projects with what you will learn in this program.

The program's teaching staff includes professionals from the sector 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 academic year. This will be done with the help of an innovative system of interactive videos made by renowned experts.

02

Objectives

The main objective of this Professional Master's Degree is to offer computer scientists the latest developments in the field of Computer Vision so that they can develop their professional work with the best tools. Accordingly, this program offers a great depth of knowledge in this field, and by the end of it the student will be in a position to develop numerous projects with great technological potential in this essential area of the present and the future of computer science and engineering.

Achieve all your career goals in the field of deep learning and Computer Vision with this high-level educational program"

General Objectives

- Obtain a global vision of the devices and hardware used in the world of computer vision
- Analyze the different fields in which vision is applied
- Identify where the technological advances in vision are at the moment
- Assess what is being researched and what the next few years hold
- Establish a solid foundation in the understanding of digital image processing algorithms and techniques
- Assess fundamental computer vision techniques
- Analyze advanced image processing techniques
- Introducing the *open* 3D library
- Analyze the advantages and difficulties of working in 3D instead of 2D
- Introduce neural networks and examine how they work
- Analyze metrics for proper learning
- Analyze existing metrics and tools
- Examine the pipeline of an image classification network
- Analyze semantic segmentation neural networks and their metrics

Specific Objectives

Module 1. Computer Vision

- Establish how the human vision system works and how an image is digitized
- Analyze the evolution of computer vision
- Evaluate image acquisition techniques
- Generate specialized knowledge about illumination systems as an important factor when processing an image
- Specify what optical systems exist and evaluate their use
- Examine the 3D vision systems and how these systems provide depth to images
- Develop the different existing systems outside the field visible to the human eye

Module 2. Applications and State-of-the-Art

- Analyze the use of computer vision in industrial applications
- Determine how vision is applied in the autonomous vehicle revolution
- Analyze images in content analysis
- Develop Deep Learning algorithms for medical analysis and Machine Learning algorithms for operating room assistance
- Analyze the use of vision in commercial applications
- Determine how robots have eyes thanks to computer vision and how it is applied in space travel
- Establish what augmented reality is and fields of use
- Analyze the Cloud Computing revolution
- Present the state of the art and what the coming years have in store for us

Module 3. Digital Image Processing

- Examine commercial and open-source digital image processing libraries
- Determine what a digital image is and evaluate the fundamental operations to be able to work with them
- Introduce image filters
- Analyze the importance and use of histograms
- Present tools to modify images pixel by pixel
- Propose image segmentation tools
- Analyze morphological operations and their applications
- Determine the methodology in image calibration
- Evaluate methods for segmenting images with conventional vision

Module 4. Advanced Digital Image Processing

- Examine advanced digital image processing filters
- Determine contour extraction and analysis tools
- Analyze object search algorithms
- Demonstrate how to work with calibrated images
- Analyze mathematical techniques for geometry analysis
- Evaluate different options in image compositing
- Develop user interface

Module 5. 3D Image Processing

- Examine a 3D image
- Analyze the software used for 3D data processing
- Develop the open 3D
- Determine the relevant data in a 3D image
- Demonstrate visualization tools
- Establish denoising filters
- Propose geometric calculation tools
- Analyze object detection methodologies
- Evaluate triangulation and scene reconstruction methods

Module 6. Deep Learning

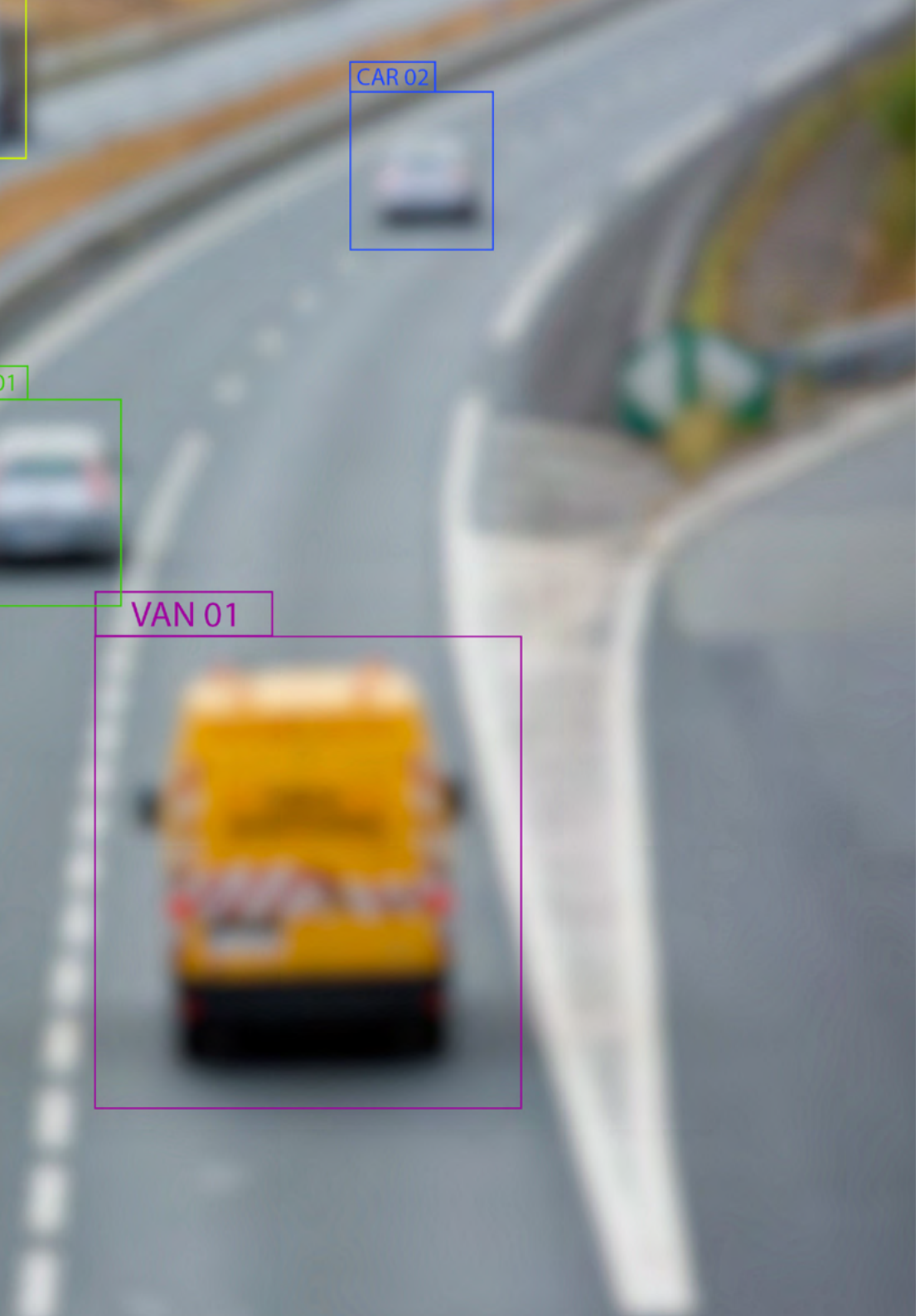
- Analyze the families that make up the artificial intelligence world
- Compile the main Frameworks of Deep Learning
- Define neural networks
- Present the learning methods of neural networks
- Fundamentals of cost functions
- Establish the most important activation functions
- Examine regularization and normalization techniques
- Develop optimization methods
- Introduce initialization methods

Module 7. Convolutional Neural Networks and Image Classification

- Generate specialized knowledge on convolutional neural networks
- Establish evaluation metrics
- Analyze the performance of CNNs for image classification
- Evaluate Data Augmentation
- Propose techniques to avoid Overfitting
- Examine different architectures
- Compile inference methods

Module 8. Object Detection

- Analyze how object detection networks work
- Examine traditional methods
- Determine evaluation metrics
- Identify the main datasets used in the marketplace
- Propose architectures of the Two Stage Object Detector type
- Analyze Fine Tuning Methods
- Examine different Single Shoot architectures
- Establish object tracking algorithms
- Apply detection and tracking of people



Module 9. Image Segmentation with Deep Learning

- Analyze how semantic segmentation networks work
- Evaluate traditional methods
- Examine evaluation metrics and different architectures
- Examine video domains and cloud points
- Apply theoretical concepts through various examples

Module 10. Advanced Image Segmentation and Advanced Computer Vision Techniques

- Generate specialized knowledge on the use of tools
- Examine semantic segmentation in medicine
- Identify the structure of a segmentation project
- Analyze Autoencoders
- Develop Adversarial Generative Networks

You will be the great expert in Computer Vision of your environment when you finish this Professional Master's Degree"

03

Skills

During the course of this Professional Master's Degree in Computer Vision, the computer scientist will be able to develop numerous skills in the fields of Machine Learning, Deep Learning and artificial intelligence. As such, they will be able to delve into digital processing libraries, image acquisition techniques, 2D and 3D image learning, as well as other aspects such as neural networks for object detection and their metrics. In this way, they will have obtained the best tools to create and successfully carry out Computer Vision projects.

With this program, you will acquire the best tools for the development of Computer Vision projects, delving into issues such as neural networks for object detection"

General Skills

- Understand how the real world is being digitized according to the different existing technologies
- Develop the systems that are changing the world of vision and their functionalities
- Master the acquisition techniques to obtain the optimal image
- Know the different digital image processing libraries available on the market
- Develop tools that combine different computer vision techniques
- Establish problem analysis rules
- Demonstrate how functional solutions can be created to address industrial, commercial, and other problems

Gain access to the latest knowledge in computer vision and become a key player in your company"

Specific Skills

- Determine how a 3D image is formed and its characteristics
- Establish methods for the processing of 3D images
- Understanding the mathematics behind neural networks
- Propose inference methods
- Generate specialized knowledge about object detection neural networks and their metrics
- Identify the different architectures
- Examine tracking algorithms and their metrics
- Identify the most common architectures
- Apply correct cost function for learning
- Analyze public data sources (Datasets)
- Examine different labeling tools
- Develop the main phases of a segmentation-based project
- Examine filtering algorithms, morphology, pixel modification, etc.
- Generate specialized knowledge about Deep Learning
- Develop convolutional neural networks

04

Course Management

This program has a high-level teaching staff made up of active professionals who develop their careers in the field of computer vision. As a result, computer scientists who enroll in this program will be able to access all the keys in this area, since the best teachers will accompany them throughout the learning process, transmitting all their knowledge. In this way, students will be able to apply everything they have learned directly in their work once they have completed the Professional Master's Degree.

Expert teachers give you all the keys about computer vision in a simple and direct way"

Management

Mr. Redondo Cabanillas, Sergio

- Head of Bcnvision's R&D Department
- Project and development manager at Bcnvision
- Machine vision applications engineer at Bcnvision
- Technical Engineering in Telecommunications. Specialization in Image and Sound at the Polytechnic University of Catalonia
- Graduate in Telecommunications. Specialization in Image and Sound by the Polytechnic University of Catalonia
- Lecturer in Cognex vision training for Bcnvision customers
- Teacher in internal courses at Bcnvision to the technical department on vision and advanced development in c #

Professors

Mr. Gutiérrez Olabarría, José Ángel

- Principal engineer specialized in computer vision and sensors. Project management, software analysis and design and C programming of quality control and industrial computing applications, customer and supplier management. Tecnalia (formerly Robotiker)
- Market manager for the iron and steel sector, performing customer contact, sourcing, market plans and strategic accounts
- Computer Engineer. Deusto University
- Master in Robotics and Automation. ETSII/IT of Bilbao
- Diploma of Advanced Studies (DEA) of the PhD program in automation and electronics. ETSII/IT of Bilbao
- Professor of the 5th year course Industrial Perception in the Automation and Electronics specialization at the School of Engineering of the University of Deusto (ESIDE)

Mr. González González, Diego Pedro

- Software Architect for Artificial Intelligence based systems
- Deep Learning and Machine Learning Application Developer
- Software architect for embedded systems for railway safety applications
- Industrial Engineer by Miguel Hernández University
- Linux driver developer
- Systems engineer for railway track equipment
- Embedded Systems Engineer
- Deep Learning Engineer
- Official Master's Degree in Artificial Intelligence from the International University of La Rioja (Spain)

Mr. Enrich Llopart, Jordi
- Technical Director Bcnvision. Computer Vision
- Project and application engineer. Bcnvision. Computer Vision
- Project and application engineer. PICVISA Machine Vision
- Graduated in Telecommunications Technical Engineering. Specialization in Image and Sound by the University School of Engineering of Terrassa (EET) / Polytechnic University of Catalonia (UPC)
- MPM - Master in Project Management. La Salle University - Ramon Llull University
- Lecturer in programming training for Cognex computer vision systems

Dr. Riera i Marín, Meritxell
- Deep Learning developer. Sycai Medical. Barcelona
- Researcher. National Center for Scientific Research (CNRS). Marseille, France
- Software engineer. Zhilabs. Barcelona
- IT Technician, Mobile World Congress
- Software engineer. Avanade. Barcelona
- Telecommunications Engineering at UPC. Barcelona
- PhD. University Pompeu Fabra (UPF) - Barcelona. Industrial PhD in collaboration with Sycai Medical
- Master of Science: Spécialité Signal, image, systèmes embarqués, automatique (SISEA) at IMT Atlantique. Pays de la Loire - Brest, France
- Master in Telecommunications Engineering at UPC. Barcelona

Mr. Delgado Gonzalo, Guillem
- Computer Vision and Artificial Intelligence Researcher at Vicomtech
- Computer Vision and Artificial Intelligence Engineer at Gestoos
- Graduate in Audiovisual Systems Engineering at Polytechnic University of Catalunya
- MSc in Computer Vision at Universitat Autónoma de Barcelona

Mr. Higón Martínez, Felipe
- More than 20 years of experience in different branches of electronics, telecommunications and IT
- Validation and prototyping engineer
- Applications Engineer
- Support Engineer
- Degree in Electronic Engineering from the University of Valencia.
- Master's Degree in Advanced and Applied Artificial Intelligence. IA3
- Technical Engineer in Telecommunications

Ms. García Moll, Clara
- Computer Vision Engineer. Satellogic
- Full Stack Developer. Catfons
- Audiovisual Systems Engineering. Pompeu Fabra University (Barcelona)
- Master's Degree in Computer Vision. Autonomous University of Barcelona

Mr. Bigata Casademunt, Antoni
- Perception Engineer at Computer Vision Center (CVC)
- Machine Learning Engineer at Visium SA, Switzerland
- Degree in Microtechnology from Ecole Polytechnique Fédérale de Lausanne (EPFL), Lausanne, Switzerland
- Master's degree in Robotics from the Ecole Polytechnique Fédérale de Lausanne (EPFL)

Mr. Solé Gómez, Àlex
- Researcher at Vicomtech in the Intelligent Security Video Analytics department.
- MSc in Telecommunications Engineering, mention in Audiovisual Systems by the Polytechnic University of Catalonia
- BSc in Telecommunications Technologies and Services Engineering, mention in Audiovisual Systems by the Polytechnic University of Catalonia

05

Structure and Content

The contents of this Professional Master's Degree in Computer Vision have been designed by leading international experts in the field, so that computer scientists will have access to highly specialized knowledge that will place him as a reference in the field. Therefore, in this program you will be able to delve into aspects such as computer vision for the study of space and for content analysis, in the search for patterns and codes, in 3D image processing libraries or in autoencoders.

The most comprehensive program on Computer Vision is waiting for you. Complete this program and access the future of the profession"

Module 1. Computer Vision

1.1. Human Perception
- 1.1.1. Human Visual System
- 1.1.2. Color
- 1.1.3. Visible and Non-Visible Frequencies

1.2. Summary of Computer Vision
- 1.2.1. Principles
- 1.2.2. Evolution
- 1.2.3. The Importance of Computer Vision

1.3. Digital Image Composition
- 1.3.1. The Digital Image
- 1.3.2. Types of Images
- 1.3.3. Color Spaces
- 1.3.4. RGB
- 1.3.5. HSV and HSL
- 1.3.6. CMY-CMYK
- 1.3.7. YCbCr
- 1.3.8. Indexed Image

1.4. Image Acquisition Systems
- 1.4.1. Operation of a Digital Camera
- 1.4.2. The Correct Exposure for Each Situation
- 1.4.3. Depth of Field
- 1.4.4. Resolution
- 1.4.5. Image Formats
- 1.4.6. HDR Mode
- 1.4.7. High Resolution Cameras
- 1.4.8. High-Speed Cameras

1.5. Optical Systems
- 1.5.1. Optical Principles
- 1.5.2. Conventional Lenses
- 1.5.3. Telecentric Lenses
- 1.5.4. Types of Autofocus Lenses
- 1.5.5. Focal Length
- 1.5.6. Depth of Field
- 1.5.7. Optical Distortion
- 1.5.8. Calibration of an Image

1.6. Illumination Systems
- 1.6.1. Importance of Illumination
- 1.6.2. Frequency Response
- 1.6.3. LED Illumination
- 1.6.4. Outdoor Lighting
- 1.6.5. Types of Lighting for Industrial Applications. Effects

1.7. 3D Acquisition Systems
- 1.7.1. Stereo Vision
- 1.7.2. Triangulation
- 1.7.3. Structured Light
- 1.7.4. Time of Flight
- 1.7.5. Lidar

1.8. Multispectrum
- 1.8.1. Multispectral Cameras
- 1.8.2. Hyperspectral Cameras

1.9. Non-Visible Near Spectrum
- 1.9.1. IR Cameras
- 1.9.2. UV Cameras
- 1.9.3. Converting From Non-Visible to Visible by Illumination

1.10. Other Band Spectrums
- 1.10.1. X-Ray
- 1.10.2. terahertz

Module 2. Applications and State-of-the-Art

2.1. Industrial Applications
- 2.1.1. Machine Vision Libraries
- 2.1.2. Compact Cameras
- 2.1.3. PC-Based Systems
- 2.1.4. Industrial Robotics
- 2.1.5. Pick and Place 2D
- 2.1.6. Bin Picking
- 2.1.7. Quality Control
- 2.1.8. Presence Absence of Components
- 2.1.9. Dimensional Control
- 2.1.10. Labeling Control
- 2.1.11. Traceability

2.2. Autonomous Vehicles
- 2.2.1. Driver Assistance
- 2.2.2. Autonomous Driving

2.3. Computer Vision for Content Analysis
- 2.3.1. Filtering by Content
- 2.3.2. Visual Content Moderation
- 2.3.3. Tracking Systems
- 2.3.4. Brand and Logo Identification
- 2.3.5. Video Labeling and Classification
- 2.3.6. Scene Change Detection
- 2.3.7. Text or Credits Extraction

2.4. Medical Application
- 2.4.1. Disease Detection and Localization
- 2.4.2. Cancer and X-Ray Analysis
- 2.4.3. Advances in Computer Vision Due to Covid-19
- 2.4.4. Assistance in the Operating Room

2.5. Spatial Applications
- 2.5.1. Satellite Image Analysis
- 2.5.2. Computer Vision for the Study of Space
- 2.5.3. Mission to Mars

2.6. Commercial Applications
- 2.6.1. Stock Control
- 2.6.2. Video Surveillance, Home Security
- 2.6.3. Parking Cameras
- 2.6.4. Population Control Cameras
- 2.6.5. Speed Cameras

2.7. Vision Applied to Robotics
- 2.7.1. Drones
- 2.7.2. AGV
- 2.7.3. Vision in Collaborative Robots
- 2.7.4. The Eyes of the Robots

2.8. Augmented Reality
- 2.8.1. Operation
- 2.8.2. Devices
- 2.8.3. Applications in the Industry
- 2.8.4. Commercial Applications

2.9. Cloud Computing
- 2.9.1. Cloud Computing Platforms
- 2.9.2. From Cloud Computing to Production

2.10. Research and State-of-the-Art
- 2.10.1. Commercial Applications
- 2.10.2. What's Cooking?
- 2.10.3. The Future of Computer Vision

Module 3. Digital Image Processing

3.1. Computer Vision Development Environment
- 3.1.1. Computer Vision Libraries
- 3.1.2. Programming Environment
- 3.1.3. Visualization Tools

3.2. Digital image Processing
- 3.2.1. Pixel Relationships
- 3.2.2. Image Operations
- 3.2.3. Geometric Transformations

3.3. Pixel Operations
- 3.3.1. Histogram
- 3.3.2. Histogram Transformations
- 3.3.3. Operations on Color Images

3.4. Logical and Arithmetic Operations
- 3.4.1. Addition and Subtraction
- 3.4.2. Product and Division
- 3.4.3. And/Nand
- 3.4.4. Or/Nor
- 3.4.5. Xor/Xnor

3.5. Filters
- 3.5.1. Masks and Convolution
- 3.5.2. Linear Filtering
- 3.5.3. Non-Linear Filtering
- 3.5.4. Fourier Analysis

3.6. Morphological Operations
- 3.6.1. Erosion and Dilation
- 3.6.2. Closing and Opening
- 3.6.3. Top Hat and Black Hat
- 3.6.4. Contour Detection
- 3.6.5. Skeleton
- 3.6.6. Hole Filling
- 3.6.7. Convex Hull

3.7. Image Analysis Tools
- 3.7.1. Edge Detection
- 3.7.2. Detection of Blobs
- 3.7.3. Dimensional Control
- 3.7.4. Color Inspection

3.8. Object Segmentation
- 3.8.1. Image Segmentation
- 3.8.2. Classical Segmentation Techniques
- 3.8.3. Real Applications

3.9. Image Calibration
- 3.9.1. Image Calibration
- 3.9.2. Methods of Calibration
- 3.9.3. Calibration Process in a 2D Camera/Robot System

3.10. Image Processing in a Real Environment
- 3.10.1. Problem Analysis
- 3.10.2. Image Processing
- 3.10.3. Feature Extraction
- 3.10.4. Final Results

Module 4. Advanced Digital Image Processing

4.1. Optical Character Recognition (OCR)
- 4.1.1. Image Pre-Processing
- 4.1.2. Text Detection
- 4.1.3. Text Recognition

4.2. Code Reading
- 4.2.1. 1D Codes
- 4.2.2. 2D Codes
- 4.2.3. Applications

4.3. Pattern Search
- 4.3.1. Pattern Search
- 4.3.2. Patterns Based on Gray Level
- 4.3.3. Patterns Based on Contours
- 4.3.4. Patterns Based on Geometric Shapes
- 4.3.5. Other Techniques

4.4. Object Tracking with Conventional Vision
- 4.4.1. Background Extraction
- 4.4.2. Meanshift
- 4.4.3. Camshift
- 4.4.4. Optical Flow

4.5. Facial Recognition
- 4.5.1. Facial Landmark Detection
- 4.5.2. Applications
- 4.5.3. Facial Recognition
- 4.5.4. Emotion Recognition

4.6. Panoramic and Alignment
- 4.6.1. Stitching
- 4.6.2. Image Composition
- 4.6.3. Photomontage

4.7. High Dynamic Range (HDR) and Photometric Stereo
- 4.7.1. Increasing the Dynamic Range
- 4.7.2. Image Compositing for Contour Enhancement
- 4.7.3. Techniques for the Use of Dynamic Applications

4.8. Image Compression
- 4.8.1. Image Compression
- 4.8.2. Types of Compressors
- 4.8.3. Image Compression Techniques

4.9. Video Processing
- 4.9.1. Image Sequences
- 4.9.2. Video Formats and Codecs
- 4.9.3. Reading a Video
- 4.9.4. Frame Processing

4.10. Real Application of Image Processing
- 4.10.1. Problem Analysis
- 4.10.2. Image Processing
- 4.10.3. Feature Extraction
- 4.10.4. Final Results

Module 5. 3D Image Processing

5.1. 3D Imaging
- 5.1.1. 3D Imaging
- 5.1.2. 3D Image Processing Software and Visualizations
- 5.1.3. Metrology Software

5.2. Open 3D
- 5.2.1. Library for 3D Data Processing
- 5.2.2. Features
- 5.2.3. Installation and Use

5.3. The Data
- 5.3.1. Depth Maps in 2D Image
- 5.3.2. Pointclouds
- 5.3.3. Normal
- 5.3.4. Surfaces

5.4. Visualization
- 5.4.1. Data Visualization
- 5.4.2. Controls
- 5.4.3. Web Display

5.5. Filters
- 5.5.1. Distance Between Points, Eliminate Outliers
- 5.5.2. High Pass Filter
- 5.5.3. Downsampling

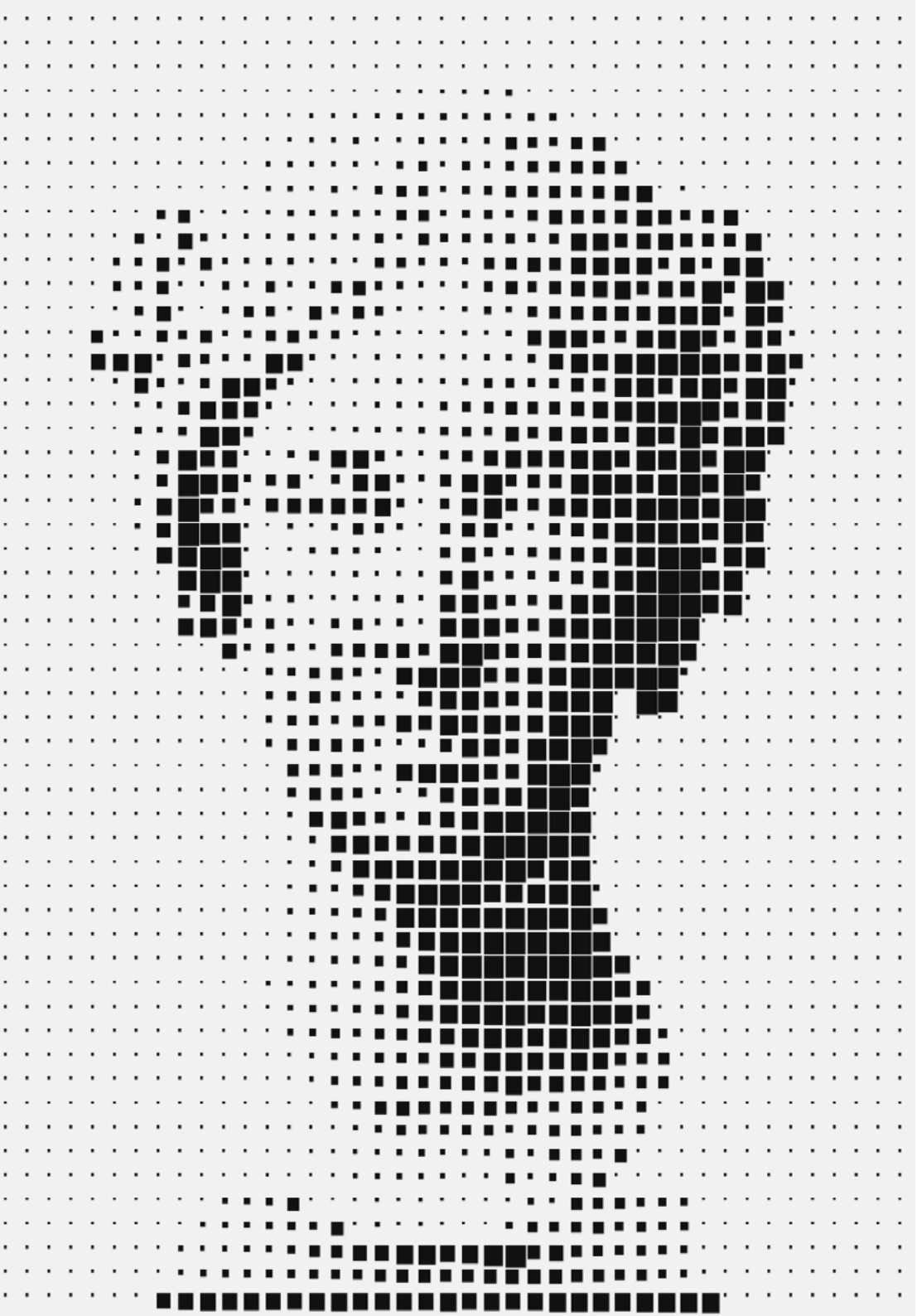
5.6. Geometry and Feature Extraction
- 5.6.1. Extraction of a Profile
- 5.6.2. Depth Measurement
- 5.6.3. Volume
- 5.6.4. 3D Geometric Shapes
- 5.6.5. Shots
- 5.6.6. Projection of a Point
- 5.6.7. Geometric Distances
- 5.6.8. Kd Tree
- 5.6.9. 3D Features

5.7. Registration and Meshing
- 5.7.1. Concatenation
- 5.7.2. ICP
- 5.7.3. Ransac 3D

5.8. 3D Object Recognition
- 5.8.1. Searching for an Object in the 3D Scene
- 5.8.2. Segmentation.
- 5.8.3. Bin Picking

5.9. Surface Analysis
- 5.9.1. Smoothing
- 5.9.2. Orientable Surfaces
- 5.9.3. Octree

5.10. Triangulation
- 5.10.1. From Mesh to Point Cloud
- 5.10.2. Depth Map Triangulation
- 5.10.3. Triangulation of Unordered Point Clouds



Module 6. Deep Learning

6.1. Artificial Intelligence
- 6.1.1. Machine Learning
- 6.1.2. Deep Learning
- 6.1.3. The Explosion of Deep Learning Why Now?

6.2. Neural Networks
- 6.2.1. The Neural Network
- 6.2.2. Uses of Neural Networks
- 6.2.3. Linear Regression and Perceptron
- 6.2.4. Forward Propagation
- 6.2.5. Backpropagation
- 6.2.6. Feature Vectors

6.3. Loss Functions
- 6.3.1. Loss Functions
- 6.3.2. Types of Loss Functions
- 6.3.3. Choice of Loss Functions

6.4. Activation Functions
- 6.4.1. Activation Function
- 6.4.2. Linear Functions
- 6.4.3. Non-Linear Functions
- 6.4.4. Output vs. Hidden Layer Activation Functions

6.5. Regularization and Normalization
- 6.5.1. Regularization and Normalization
- 6.5.2. Overfitting and Data Augmentation
- 6.5.3. Regularization Methods: L1, L2 and Dropout
- 6.5.4. Normalization Methods: Batch, Weight, Layer

6.6. Optimization
- 6.6.1. Gradient Descent
- 6.6.2. Stochastic Gradient Descent
- 6.6.3. Mini Batch Gradient Descent
- 6.6.4. Momentum
- 6.6.5. Adam

6.7. Hyperparameter Tuning and Weights
- 6.7.1. Hyperparameters
- 6.7.2. Batch Size vs. Learning Rate vs. Step Decay
- 6.7.3. Weights

6.8. Evaluation Metrics of a Neural Network
- 6.8.1. Accuracy
- 6.8.2. Dice Coefficient
- 6.8.3. Sensitivity vs. Specificity/Recall vs. Precision
- 6.8.4. ROC Curve (AUC)
- 6.8.5. F1-Score
- 6.8.6. Matrix Confusion
- 6.8.7. Cross-Validation

6.9. Frameworks and Hardware
- 6.9.1. Tensor Flow
- 6.9.2. Pytorch
- 6.9.3. Caffe
- 6.9.4. Keras
- 6.9.5. Hardware for the Learning Phase

6.10. Creation of a Neural Network-Training and Validation
- 6.10.1. Dataset
- 6.10.2. Network Construction
- 6.10.3. Training
- 6.10.4. Visualization of Results

Module 7. Convolutional Neural Networks and Image Classification

7.1. Convolutional Neural Networks
- 7.1.1. Introduction
- 7.1.2. Convolution
- 7.1.3. CNN Building Blocks

7.2. Types of CNN Layers
- 7.2.1. Convolutional
- 7.2.2. Activation
- 7.2.3. Batch Normalization
- 7.2.4. Polling
- 7.2.5. Fully Connected

7.3. Metrics
- 7.3.1. Matrix Confusion
- 7.3.2. Accuracy
- 7.3.3. Precision
- 7.3.4. Recall
- 7.3.5. F1 Score
- 7.3.6. ROC Curve
- 7.3.7. AUC

7.4. Main Architectures
- 7.4.1. AlexNet
- 7.4.2. VGG
- 7.4.3. Resnet
- 7.4.4. GoogleLeNet

7.5. Image Classification
- 7.5.1. Introduction
- 7.5.2. Analysis of Data
- 7.5.3. Data Preparation
- 7.5.4. Model Training
- 7.5.5. Model Validation

7.6. Practical Considerations for CNN Training
- 7.6.1. Optimizer Selection
- 7.6.2. Learning Rate Scheduler
- 7.6.3. Check Training Pipeline
- 7.6.4. Training with Regularization

7.7. Best Practices in Deep Learning
- 7.7.1. Transfer Learning
- 7.7.2. Fine Tuning
- 7.7.3. Data Augmentation

7.8. Statistical Data Evaluation
- 7.8.1. Number of Datasets
- 7.8.2. Number of Labels
- 7.8.3. Number of Images
- 7.8.4. Data Balancing

7.9. Deployment
- 7.9.1. Saving and Loading Models
- 7.9.2. Onnx
- 7.9.3. Inference

7.10. Case Study: Image Classification
- 7.10.1. Data Analysis and Preparation
- 7.10.2. Testing the Training Pipeline
- 7.10.3. Model Training
- 7.10.4. Model Validation

Module 8. Object Detection

8.1. Object Detection and Tracking
- 8.1.1. Object Detection
- 8.1.2. Case Uses
- 8.1.3. Object Tracking
- 8.1.4. Case Uses
- 8.1.5. Occlusions, Rigid and Non-Rigid Poses

8.2. Evaluation Metrics
- 8.2.1. IOU - Intersection Over Union
- 8.2.2. Confidence Score
- 8.2.3. Recall
- 8.2.4. Precision
- 8.2.5. Recall–Precision Curve
- 8.2.6. Mean Average Precision (mAP)

8.3. Traditional Methods
- 8.3.1. Sliding Window
- 8.3.2. Viola Detector
- 8.3.3. HOG
- 8.3.4. Non-Maximal Suppresion (NMS)

8.4. Datasets
- 8.4.1. Pascal VC
- 8.4.2. MS Coco
- 8.4.3. ImageNet (2014)
- 8.4.4. MOTA Challenge

8.5. Two Shot Object Detector
- 8.5.1. R-CNN
- 8.5.2. Fast R-CNN
- 8.5.3. Faster R-CNN
- 8.5.4. Mask R-CNN

8.6. Single Shot Object Detector
- 8.6.1. SSD
- 8.6.2. YOLO
- 8.6.3. RetinaNet
- 8.6.4. CenterNet
- 8.6.5. EfficientDet

8.7. Backbones
- 8.7.1. VGG
- 8.7.2. ResNet
- 8.7.3. Mobilenet
- 8.7.4. Shufflenet
- 8.7.5. Darknet

8.8. Object Tracking
- 8.8.1. Classical Approaches
- 8.8.2. Particulate Filters
- 8.8.3. Kalman
- 8.8.4. Sorttracker
- 8.8.5. Deep Sort

8.9. Deployment
- 8.9.1. Computing Platform
- 8.9.2. Choice of Backbone
- 8.9.3. Choice of Framework
- 8.9.4. Model Optimization
- 8.9.5. Model Versioning

8.10. Study: Detection and Tracking of Individuals
- 8.10.1. Detection of People
- 8.10.2. Monitoring of People
- 8.10.3. Re-Identification
- 8.10.4. Counting People in Crowds

Module 9. Image Segmentation with Deep Learning

9.1. Object Detection and Segmentation
- 9.1.1. Semantic Segmentation
  - 9.1.1.1. Semantic Segmentation Use Cases
- 9.1.2. Instantiated Segmentation
  - 9.1.2.1. Instantiated Segmentation Use Cases

9.2. Evaluation Metrics
- 9.2.1. Similarities with Other Methods
- 9.2.2. Pixel Accuracy
- 9.2.3. Dice Coefficient (F1 Score)

9.3. Cost Functions
- 9.3.1. Dice Loss
- 9.3.2. Focal Loss
- 9.3.3. Tversky Loss
- 9.3.4. Other Functions

9.4. Traditional Segmentation Methods
- 9.4.1. Threshold Application with Otsu and Riddlen
- 9.4.2. Self-Organized Maps
- 9.4.3. GMM-EM Algorithm

9.5. Semantic Segmentation Applying Deep Learning: FCN
- 9.5.1. FCN
- 9.5.2. Architecture
- 9.5.3. FCN Applications

9.6. Semantic Segmentation Applying Deep Learning: U-NET
- 9.6.1. U-NET
- 9.6.2. Architecture
- 9.6.3. U-NET Application

9.7. Semantic Segmentation Applying Deep Learning: Deep Lab
- 9.7.1. Deep Lab
- 9.7.2. Architecture
- 9.7.3. Deep Lab Application

9.8. Instantiated Segmentation Applying Deep Learning: Mask RCNN
- 9.8.1. Mask RCNN
- 9.8.2. Architecture
- 9.8.3. Application of a Mask RCNN

9.9. Video Segmentation
- 9.9.1. STFCN
- 9.9.2. Semantic Video CNNs
- 9.9.3. Clockwork Convnets
- 9.9.4. Low-Latency

9.10. Point Cloud Segmentation
- 9.10.1. The Point Cloud
- 9.10.2. PointNet
- 9.10.3. A-CNN

Module 10. Advanced Image Segmentation and Advanced Computer Vision Techniques

10.1. Database for General Segmentation Problems
- 10.1.1. Pascal Context
- 10.1.2. CelebAMask-HQ
- 10.1.3. Cityscapes Dataset
- 10.1.4. CCP Dataset

10.2. Semantic segmentation in medicine
- 10.2.1. Semantic segmentation in medicine
- 10.2.2. Datasets for Medical Problems
- 10.2.3. Practical Applications

10.3. Annotation Tools
- 10.3.1. Computer Vision Annotation Tool
- 10.3.2. LabelMe
- 10.3.3. Other Tools

10.4. Segmentation Tools Using Different Frameworks
- 10.4.1. Keras
- 10.4.2. Tensorflow v2
- 10.4.3. Pytorch
- 10.4.4. Others

10.5. Semantic Segmentation Project. The Data, Phase 1
- 10.5.1. Problem Analysis
- 10.5.2. Input Source for Data
- 10.5.3. Data Analysis
- 10.5.4. Data Preparation

10.6. Semantic Segmentation Project. Training, Phase 2
- 10.6.1. Algorithm Selection
- 10.6.2. Training
- 10.6.3. Assessment

10.7. Semantic Segmentation Project. Results, Phase 3
- 10.7.1. Fine Tuning
- 10.7.2. Presentation of The Solution
- 10.7.3. Conclusions

10.8. Autoencoders
- 10.8.1. Autoencoders
- 10.8.2. Architecture of an Autoencoder
- 10.8.3. Noise Removal Autoencoders
- 10.8.4. Automatic Coloring Autoencoder

10.9. Generative Adversarial Networks (GANs)
- 10.9.1. Generative Adversarial Networks (GANs)
- 10.9.2. DCGAN Architecture
- 10.9.3. Conditional GAN Architecture

10.10. Enhanced Generative Adversarial Networks
- 10.10.1. Overview of the Problem
- 10.10.2. WGAN
- 10.10.3. LSGAN
- 10.10.4. ACGAN

This Professional Master's Degree has the most in-depth and up-to-date content in Computer Vision. Do not miss the opportunity and enroll now"

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 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

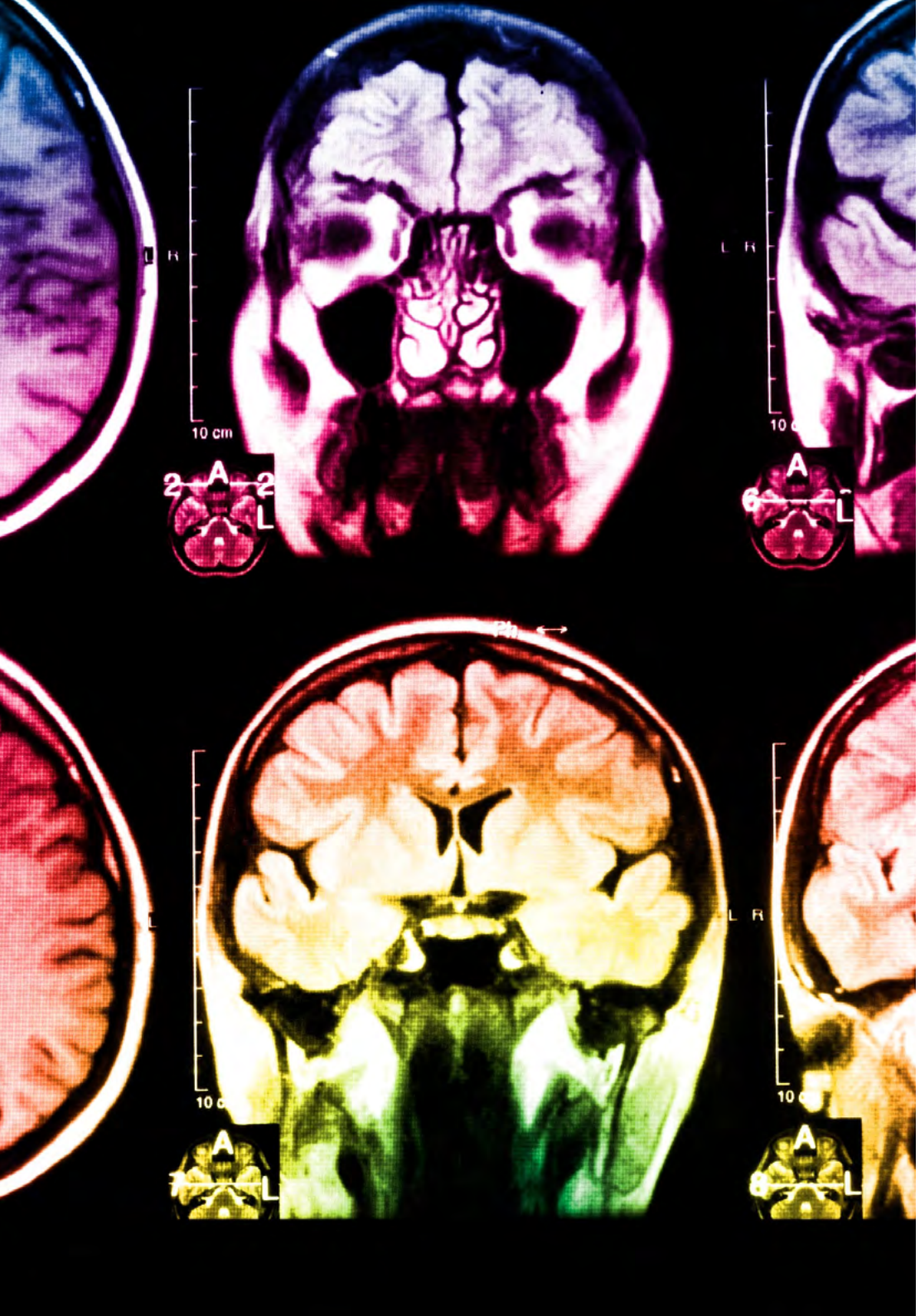
TECH effectively combines the Case Study methodology with a 100% online learning system based on repetition, which combines different teaching elements in each lesson.

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.

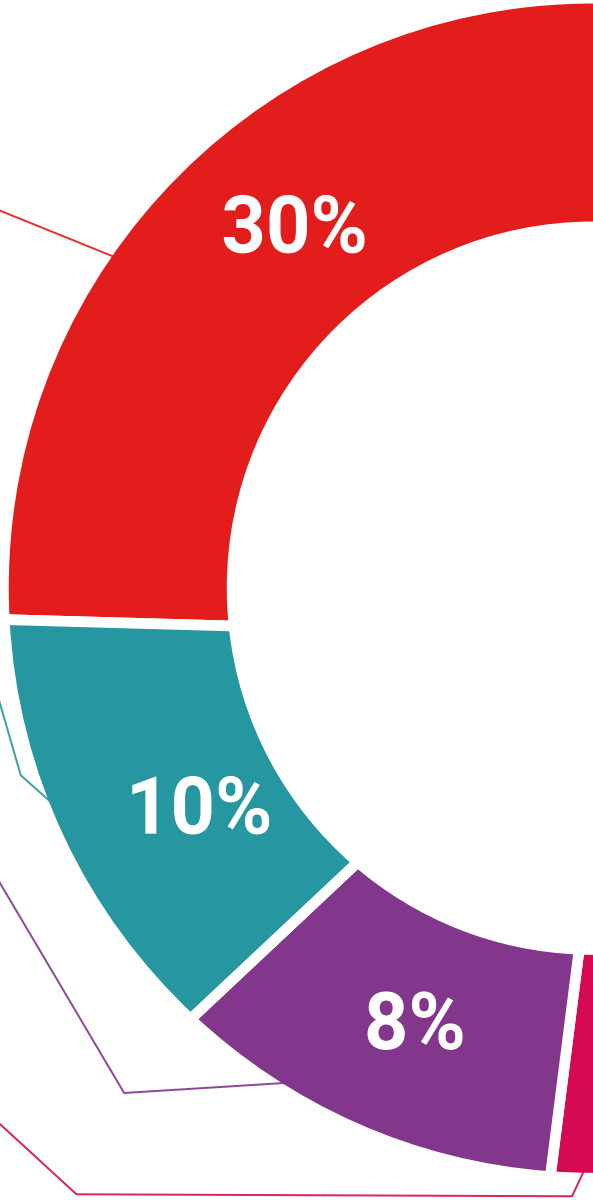
Learning from an Expert strengthens knowledge and memory, and generates confidence in future difficult decisions.

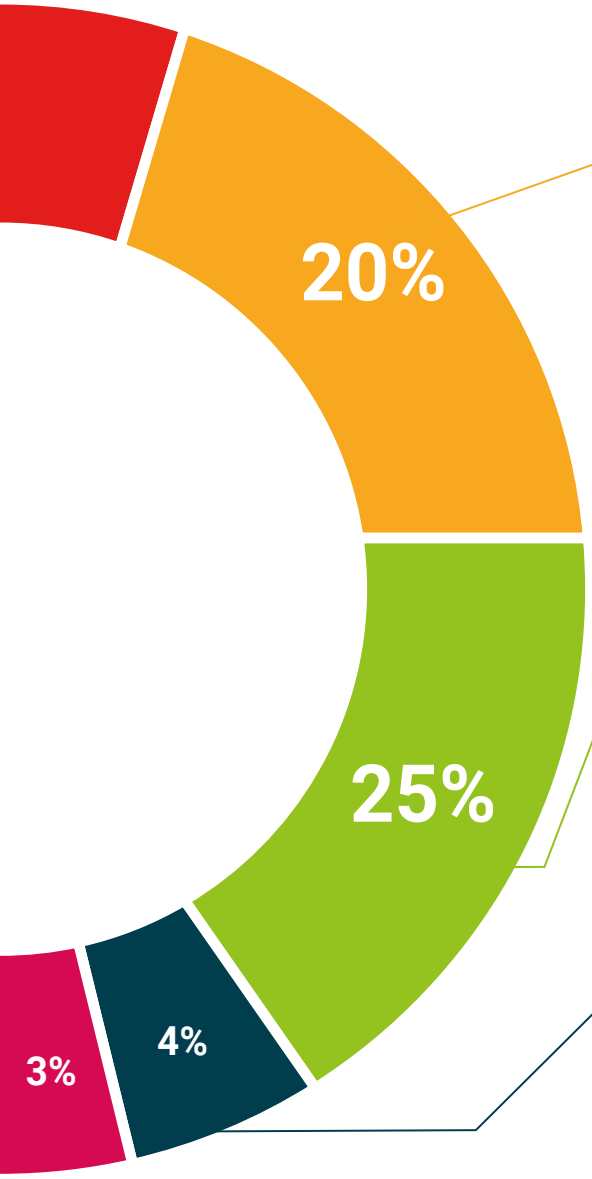
Practising Skills and Abilities

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.

07

Certificate

The Professional Master's Degree in Computer Vision guarantees students, in addition to the most rigorous and up-to-date education, access to a Professional Master's Degree issued by TECH Technological University.

Successfully complete this program and receive your university degree without travel or laborious paperwork"

This **Professional Master's Degree in Computer Vision** contains the most complete and up-to-date educational program on the market.

After the student has passed the assessments, they will receive their corresponding **Professional Master's Degree** issued by **TECH Technological University** via tracked delivery*.

The certificate issued by **TECH Technological University** will express the qualification obtained in the Professional Master's Degree, and meets the requirements commonly demanded by labor exchanges, competitive examinations, and professional career evaluation committees.

Title: **Professional Master's Degree in Computer Vision**

Official Nº of hours: **1,500 h.**

tech technological university

Awards the following

CERTIFICATE

to

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

For having successfully passed and accredited the following program

PROFESSIONAL MASTER'S DEGREE

in

Computer Vision

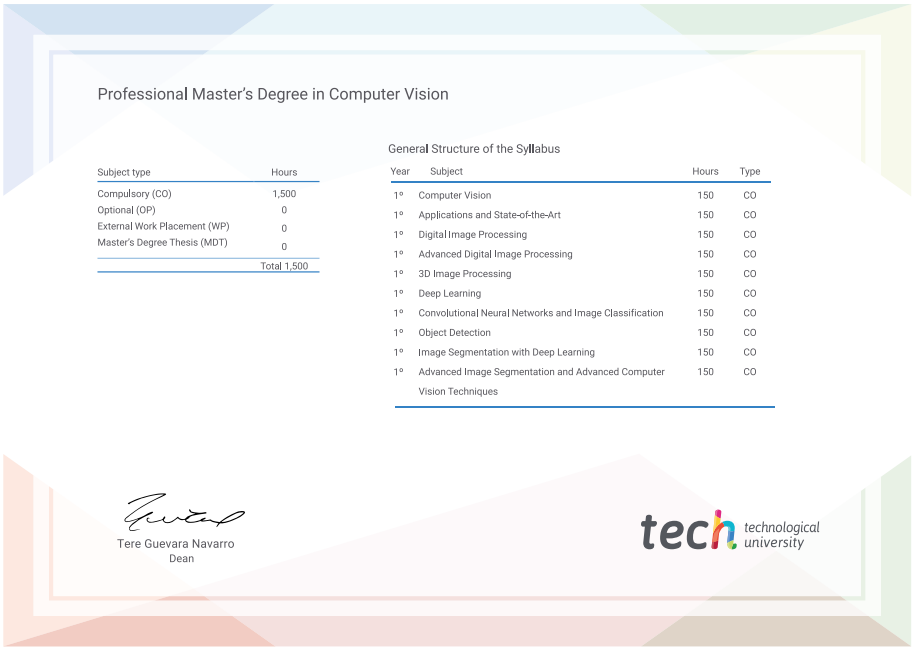
This is a qualification awarded by this University, equivalent to 1,500 hours, with a start date of dd/mm/yyyy and an end date of dd/mm/yyyy.

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

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


Professional Master's Degree in Computer Vision

Subject type	Hours
Compulsory (CO)	1,500
Optional (OP)	0
External Work Placement (WP)	0
Master's Degree Thesis (MDT)	0
	Total 1,500

General Structure of the Syllabus

Year	Subject	Hours	Type
1º	Computer Vision	150	CO
1º	Applications and State-of-the-Art	150	CO
1º	Digital Image Processing	150	CO
1º	Advanced Digital Image Processing	150	CO
1º	3D Image Processing	150	CO
1º	Deep Learning	150	CO
1º	Convolutional Neural Networks and Image Classification	150	CO
1º	Object Detection	150	CO
1º	Image Segmentation with Deep Learning	150	CO
1º	Advanced Image Segmentation and Advanced Computer Vision Techniques	150	CO

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Dean

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*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.

Professional Master's Degree

Computer Vision

Course Modality: **Online**

Duration: **12 months**

Certificate: **TECH Technological University**

Official Nº of hours: **1,500 h.**

Professional Master's Degree

Computer Vision

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