

Postgraduate Diploma Computer Vision



Postgraduate Diploma Computer Vision

- » Modality: online
- » Duration: 6 months
- » Certificate: TECH Global University
- » Accreditation: 18 ECTS
- » Schedule: at your own pace
- » Exams: online

Website: www.techtute.com/us/information-technology/postgraduate-diploma/postgraduate-diploma-computer-vision

Index

01

Introduction

p. 4

02

Objectives

p. 8

03

Course Management

p. 12

04

Structure and Content

p. 16

05

Study Methodology

p. 22

06

Certificate

p. 32

01

Introduction

Computer Vision is currently the most demanded specialty in the fields of artificial intelligence and *Machine Learning*. This area is responsible for image processing by machines and robots, and its importance lies in the large amount of information that can be gathered from it. Therefore, a machine with computer vision, with the right tools, will be able not only to relate spatially to its environment in an appropriate way, but also to systematically collect data from that environment. Because of this, major technology companies are focusing their efforts in this area and therefore this degree is perfect for the computer scientist who wishes to progress in this booming sector, enjoying the opportunity to specialize and grow professionally.



“

Computer Vision is the most demanded field within artificial intelligence and Machine Learning. Don't wait any longer and take advantage of the opportunity to access the latest knowledge in this sector”

Artificial intelligence and associated sectors such as *Machine Learning* have been the most important areas of the technology industry for only a few years. Thus, more and more programs and machines are being developed that are capable of learning to perform complex tasks in order to improve existing services. It is therefore not just a matter of automating the performance of tasks, but of being able to go further. Computer vision achieves that goal and offers great solutions to contemporary and future technological challenges.

Computer vision gives robots and machines the ability to process the spatial environment and capture images systematically, obtaining interesting data that can be used in different fields. For this reason, it is such a powerful tool that most technology companies are trying to develop projects in this direction. Thus, this Postgraduate Diploma allows the computer scientists to delve into the latest developments in this complex and promising area, so that at the end of the degree they will have delved into issues such as visible and non-visible frequencies, digital image composition and image indexing and digital processing, among many others.

In order to enjoy an optimal learning process, TECH Global University has designed a 100% online teaching methodology that guarantees the computer scientist to be able to combine, without any interruption, his professional career with his studies. All of this is accompanied by a prestigious teaching staff and high-level multimedia didactic materials such as interactive summaries, practical activities and master classes.

This **Postgraduate Diploma 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 Artificial 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 the self-assessment process can be carried out to improve learning
- ♦ Its special emphasis on innovative methodologies
- ♦ Theoretical lessons, questions to the expert, debate forums on controversial topics, and individual reflection assignments
- ♦ Content that is accessible from any fixed or portable device with an Internet connection



*Learn about the latest innovations
in Computer Vision and
Machine Learning thanks to
this Postgraduate Diploma"*

“

Computer Vision is a promising discipline and if you specialize in it, you will become a highly sought-after professional by the major technology companies of the moment”

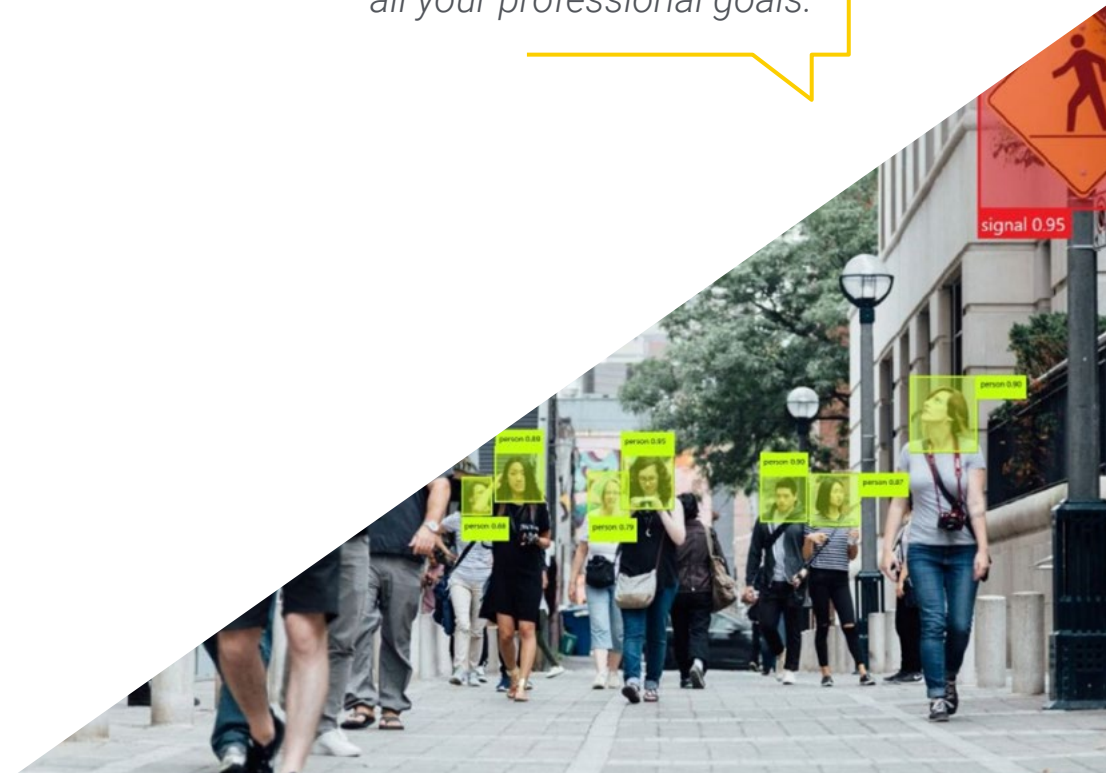
The program's teaching staff includes professionals from the industry who contribute their work experience to this program, as well as renowned specialists from leading societies and prestigious universities.

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. For this purpose, the students will be assisted by an innovative interactive video system created by renowned and experienced experts.

Apply the most innovative Computer Vision techniques to your artificial intelligence projects in a simple and effective way.

Computer Vision is the technology of the present and the future. Enroll and achieve all your professional goals.



02 Objectives

The main objective of this Postgraduate Diploma in Computer Vision is to offer the computer scientist the latest developments in this complex and exciting technological field, so that they can apply them to their daily work immediately. With this program, the professional will be able to learn about all the advances in this area, thus being able to position himself as a specialist in artificial vision in his work environment, guaranteeing him, in addition, a bright future in the industry.



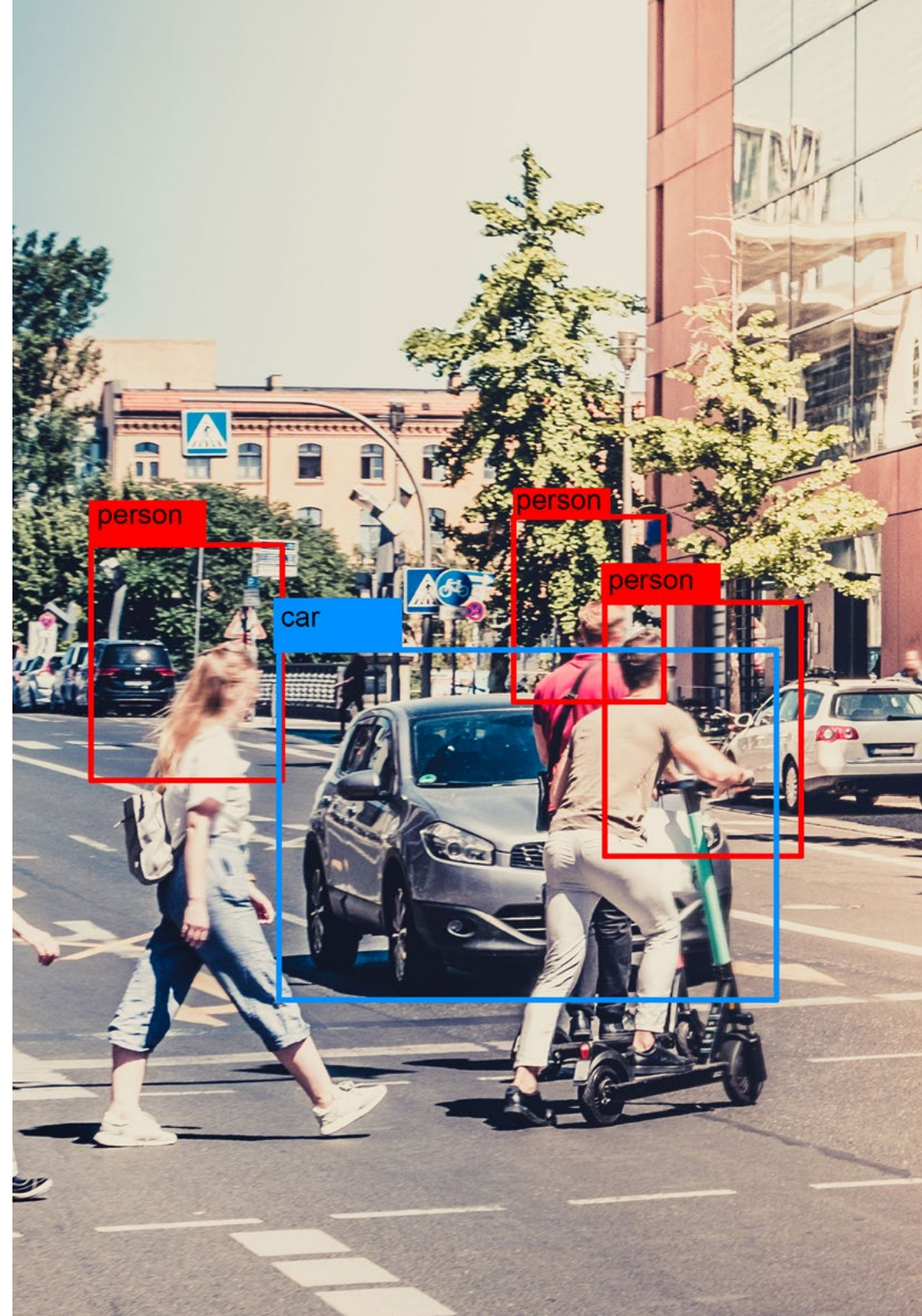
“

Computer Vision is here to stay and the computer scientist who is able to specialize and update in this field will have great professional opportunities”



General Objectives

- Analyze how the real world is digitized according to the different existing technologies
- Obtain a global vision of the devices and hardware used in the world of Computer Vision
- Develop the systems that are changing the world of vision and their functionalities
- Assess the acquisition techniques to obtain the optimal image
- Analyze the different fields in which vision is applied
- Examine use cases
- Identify where the technological advances in vision are at the moment
- Assess what is being researched and what the next few years will bring
- Examine the different digital image processing libraries available on the market
- Establish a solid foundation in the understanding of digital image processing algorithms and techniques
- Examine filtering algorithms, morphology, pixel modification, etc
- Assess fundamental computer vision techniques





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 lighting 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



*Achieve all your goals
by specializing in
Computer Vision"*

03

Course Management

Ensure that the learning process is of the highest level, TECH has assembled a specialized teaching staff in Computer Vision composed of working professionals. Thus, the computer scientist who takes this educational program will have access to the latest information in this field, all this from the hand of professors who know this discipline to perfection and who will provide all their experience to the student throughout the development of the program.



“

*You will not find better teachers
with whom to learn the keys
to Computer Vision”*

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#.

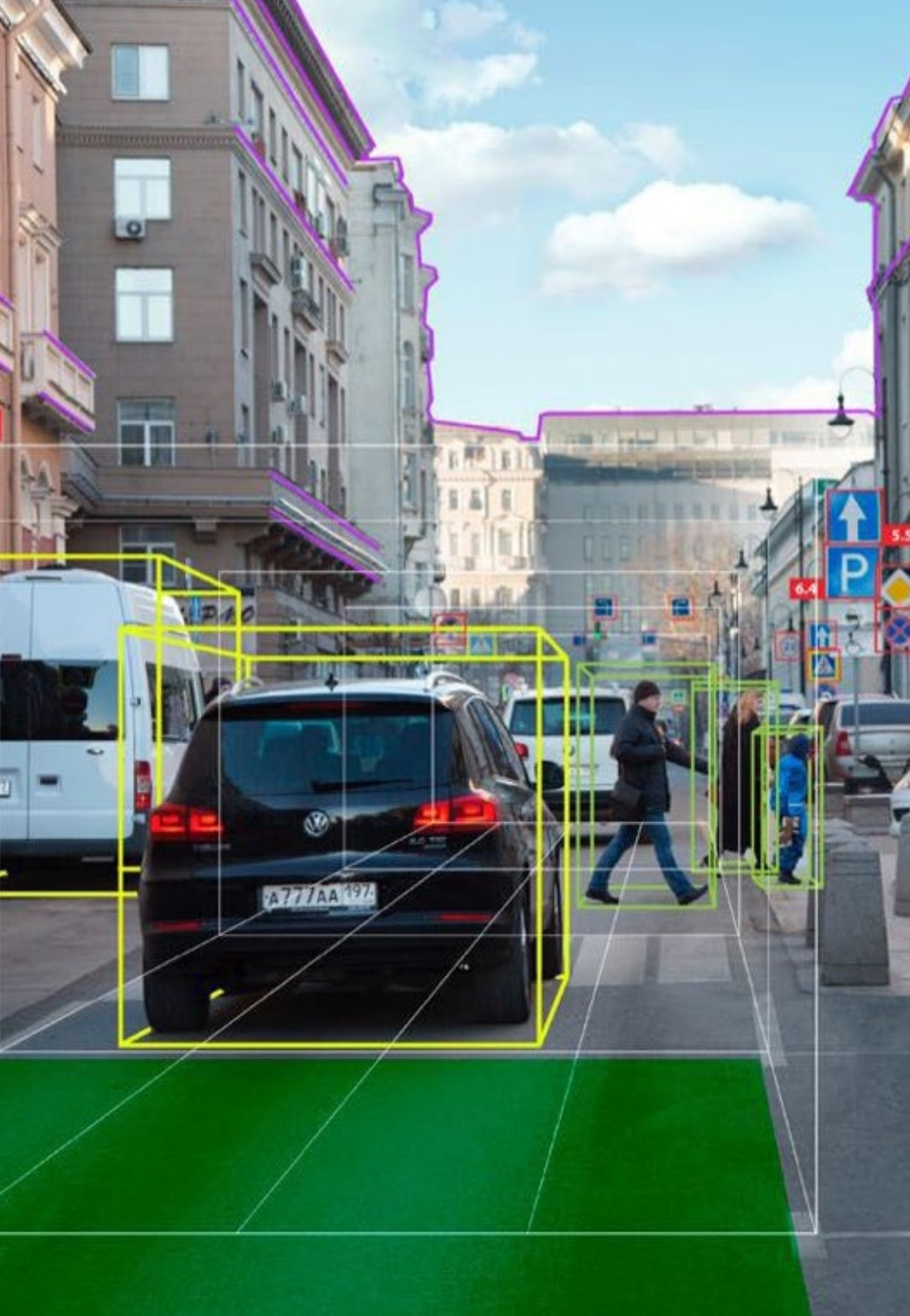
Professors

Mr. 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

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)



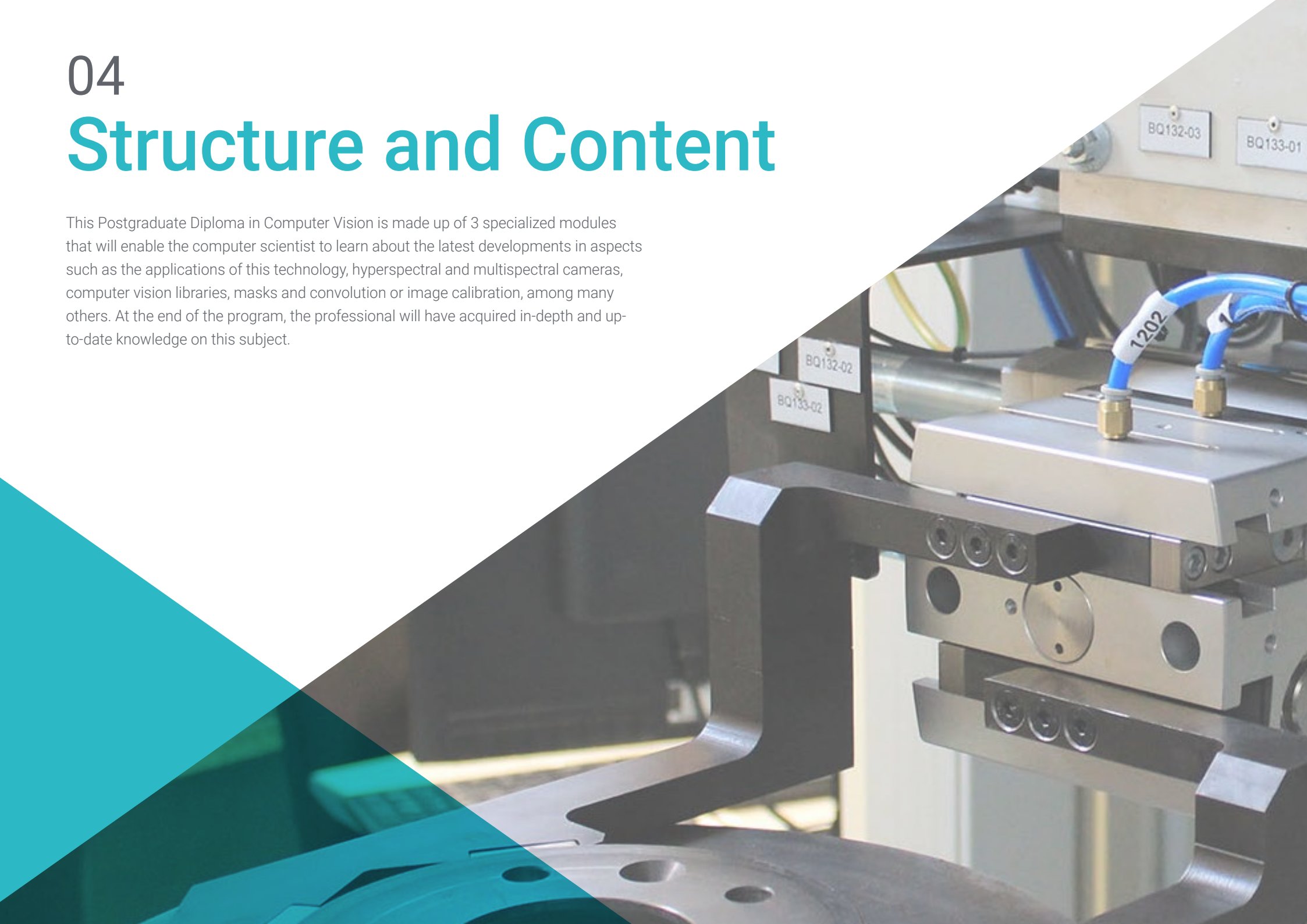
Mr. Gutiérrez Olabarria, José Ángel

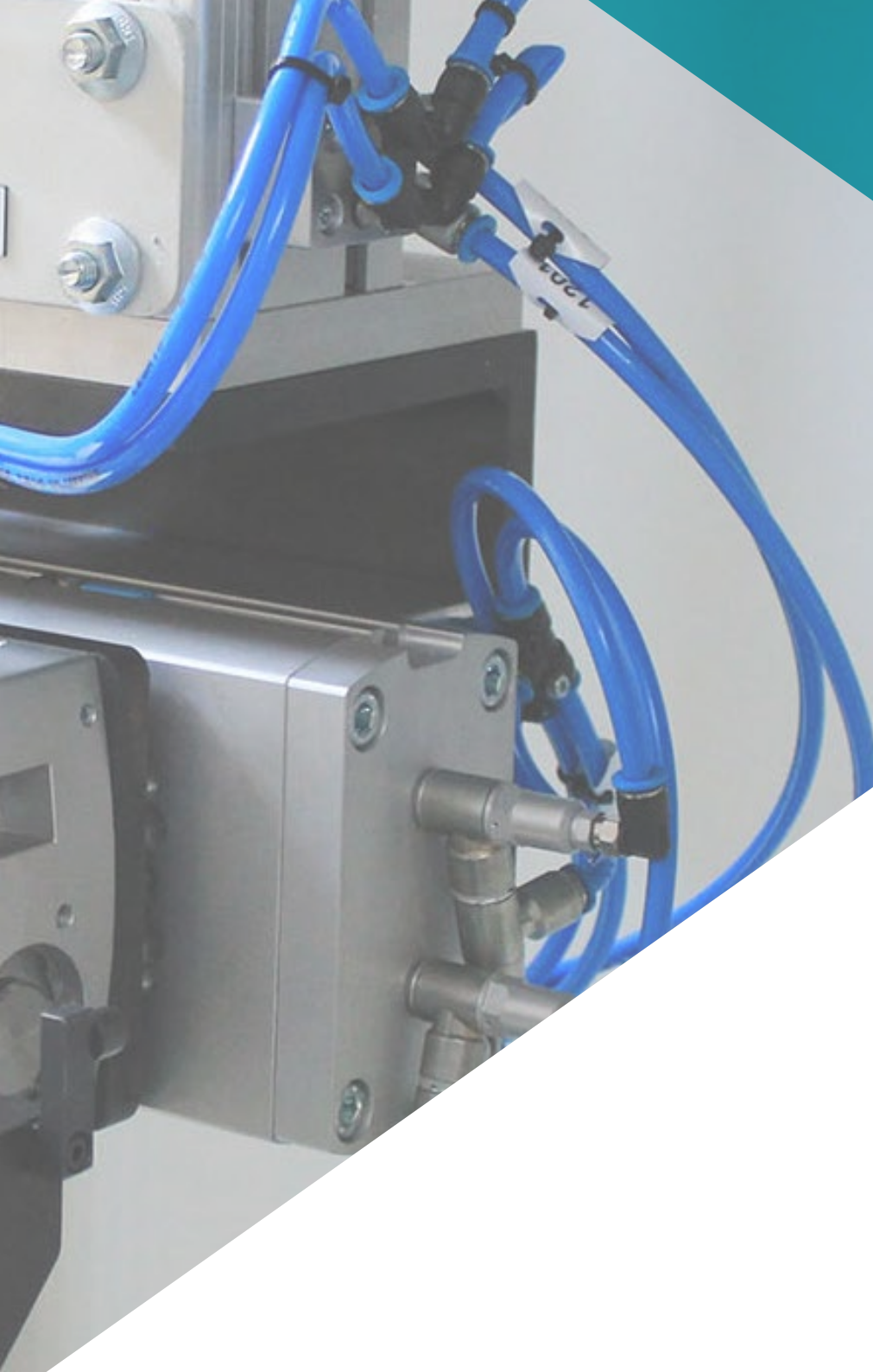
- ♦ Principal engineer specialized in artificial vision and sensors. Project management, software analysis and design and C programming of quality control and industrial computing applications, customer and supplier management. Tecnalia (formerly Robotiker)
- ♦ Market manager for the iron and steel sector, 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)

04

Structure and Content

This Postgraduate Diploma in Computer Vision is made up of 3 specialized modules that will enable the computer scientist to learn about the latest developments in aspects such as the applications of this technology, hyperspectral and multispectral cameras, computer vision libraries, masks and convolution or image calibration, among many others. At the end of the program, the professional will have acquired in-depth and up-to-date knowledge on this subject.





“

*Deepen in the applications
of Artificial Vision with this
Postgraduate Diploma”*

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. Chronicle of the 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



You will have access to the best contents in Computer Vision, from the best professors in the field”

05 Study Methodology

TECH is the world's first university to combine the **case study** methodology with **Relearning**, a 100% online learning system based on guided repetition.

This disruptive pedagogical strategy has been conceived to offer professionals the opportunity to update their knowledge and develop their skills in an intensive and rigorous way. A learning model that places students at the center of the educational process giving them the leading role, adapting to their needs and leaving aside more conventional methodologies.



“

TECH will prepare you to face new challenges in uncertain environments and achieve success in your career”

The student: the priority of all TECH programs

In TECH's study methodology, the student is the main protagonist.

The teaching tools of each program have been selected taking into account the demands of time, availability and academic rigor that, today, not only students demand but also the most competitive positions in the market.

With TECH's asynchronous educational model, it is students who choose the time they dedicate to study, how they decide to establish their routines, and all this from the comfort of the electronic device of their choice. The student will not have to participate in live classes, which in many cases they will not be able to attend. The learning activities will be done when it is convenient for them. They can always decide when and from where they want to study.

“

*At TECH you will NOT have live classes
(which you might not be able to attend)”*



The most comprehensive study plans at the international level

TECH is distinguished by offering the most complete academic itineraries on the university scene. This comprehensiveness is achieved through the creation of syllabi that not only cover the essential knowledge, but also the most recent innovations in each area.

By being constantly up to date, these programs allow students to keep up with market changes and acquire the skills most valued by employers. In this way, those who complete their studies at TECH receive a comprehensive education that provides them with a notable competitive advantage to further their careers.

And what's more, they will be able to do so from any device, pc, tablet or smartphone.

“*TECH's model is asynchronous, so it allows you to study with your pc, tablet or your smartphone wherever you want, whenever you want and for as long as you want*”

Case Studies and Case Method

The case method has been the learning system most used by the world's best business schools. Developed in 1912 so that law students would not only learn the law based on theoretical content, its function was also to present them with real complex situations. In this way, they could make informed decisions and value judgments about how to resolve them. In 1924, Harvard adopted it as a standard teaching method.

With this teaching model, it is students themselves who build their professional competence through strategies such as Learning by Doing or Design Thinking, used by other renowned institutions such as Yale or Stanford.

This action-oriented method will be applied throughout the entire academic itinerary that the student undertakes with TECH. Students will be confronted with multiple real-life situations and will have to integrate knowledge, research, discuss and defend their ideas and decisions. All this with the premise of answering the question of how they would act when facing specific events of complexity in their daily work.



Relearning Methodology

At TECH, case studies are enhanced with the best 100% online teaching method: Relearning.

This method breaks with traditional teaching techniques to put the student at the center of the equation, providing the best content in different formats. In this way, it manages to review and reiterate the key concepts of each subject and learn to apply them in a real context.

In the same line, and according to multiple scientific researches, reiteration is the best way to learn. For this reason, TECH offers between 8 and 16 repetitions of each key concept within the same lesson, presented in a different way, with the objective of ensuring that the knowledge is completely consolidated during the study process.

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



A 100% online Virtual Campus with the best teaching resources

In order to apply its methodology effectively, TECH focuses on providing graduates with teaching materials in different formats: texts, interactive videos, illustrations and knowledge maps, among others. All of them are designed by qualified teachers who focus their work on combining real cases with the resolution of complex situations through simulation, the study of contexts applied to each professional career and learning based on repetition, through audios, presentations, animations, images, etc.

The latest scientific evidence in the field of Neuroscience points to the importance of taking into account the place and context where the content is accessed before starting a new learning process. Being able to adjust these variables in a personalized way helps people to remember and store knowledge in the hippocampus to retain it in the long term. This is a model called Neurocognitive context-dependent e-learning that is consciously applied in this university qualification.

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

Likewise, this very complete Virtual Campus will allow TECH students to organize their study schedules according to their personal availability or work obligations. In this way, they will have global control of the academic content and teaching tools, based on their fast-paced professional update.



The online study mode of this program will allow you to organize your time and learning pace, adapting it to your schedule"

The effectiveness of the method is justified by four fundamental achievements:

1. Students who follow this method not only achieve the assimilation of concepts, but also a development of their mental capacity, through exercises that assess real situations and the application of knowledge.
2. Learning is solidly translated into practical skills that allow the student to better integrate into the real world.
3. Ideas and concepts are understood more efficiently, given that the example situations are based on real-life.
4. Students like to feel that the effort they put into their studies is worthwhile. This then translates into a greater interest in learning and more time dedicated to working on the course.

The university methodology top-rated by its students

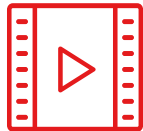
The results of this innovative teaching model can be seen in the overall satisfaction levels of TECH graduates.

The students' assessment of the teaching quality, the quality of the materials, the structure of the program and its objectives is excellent. Not surprisingly, the institution became the top-rated university by its students according to the global score index, obtaining a 4.9 out of 5.

Access the study contents from any device with an Internet connection (computer, tablet, smartphone) thanks to the fact that TECH is at the forefront of technology and teaching.

You will be able to learn with the advantages that come with having access to simulated learning environments and the learning by observation approach, that is, Learning from an expert.

As such, the best educational materials, thoroughly prepared, will be available in this program:



Study Material

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

This content is then adapted in an audiovisual format that will create our way of working online, with the latest techniques that allow us to offer you high quality in all of the material that we provide you with.



Practicing Skills and Abilities

You will carry out activities to develop specific competencies and skills in each thematic field. Exercises and activities to acquire and develop the skills and abilities that a specialist needs to develop within the framework of the globalization we live in.



Interactive Summaries

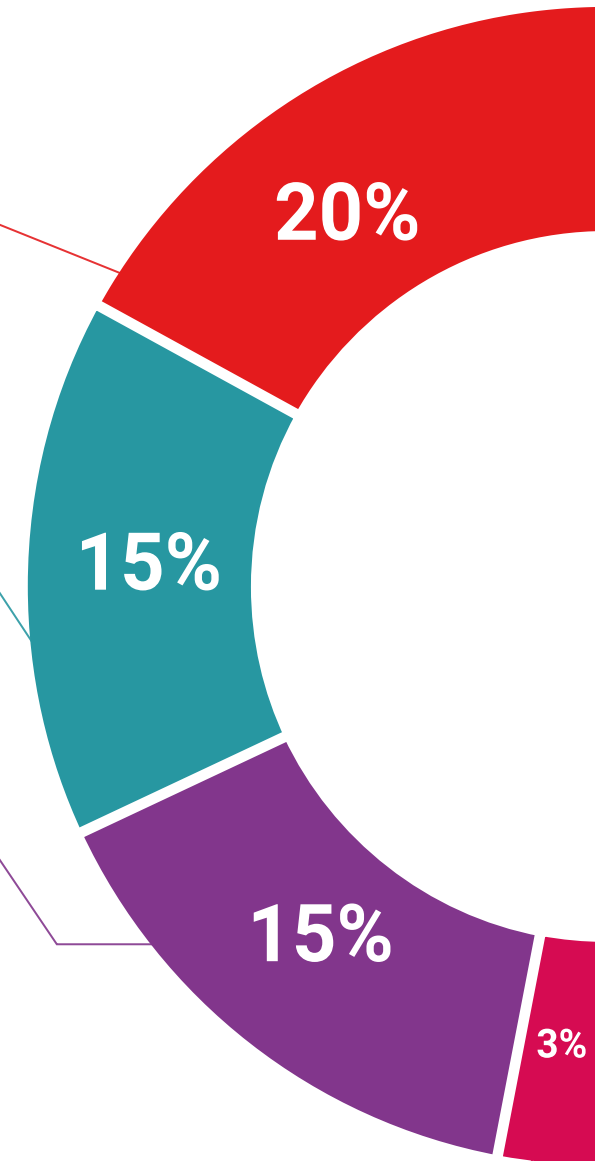
We present the contents attractively and dynamically in multimedia lessons that include audio, videos, images, diagrams, and concept maps in order to reinforce knowledge.

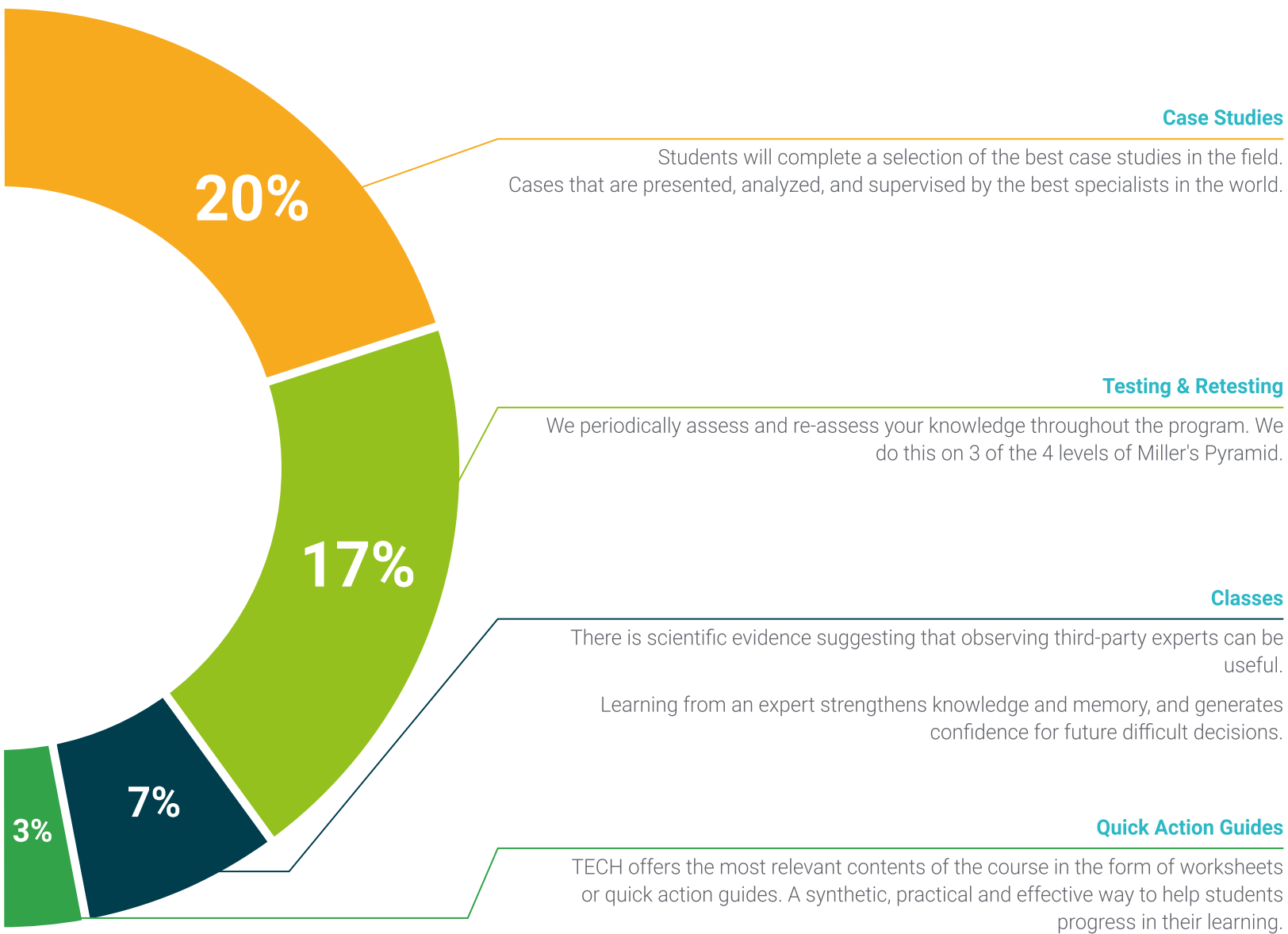
This exclusive educational system for presenting multimedia content was awarded by Microsoft as a "European Success Story".



Additional Reading

Recent articles, consensus documents, international guides... In our virtual library you will have access to everything you need to complete your education.





06 Certificate

The Postgraduate Diploma in Computer Vision guarantees students, in addition to the most rigorous and up-to-date education, access to a Postgraduate Diploma issued by TECH Global University.



“

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

This private qualification will allow you to obtain a **Postgraduate Diploma in Computer Vision** 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.

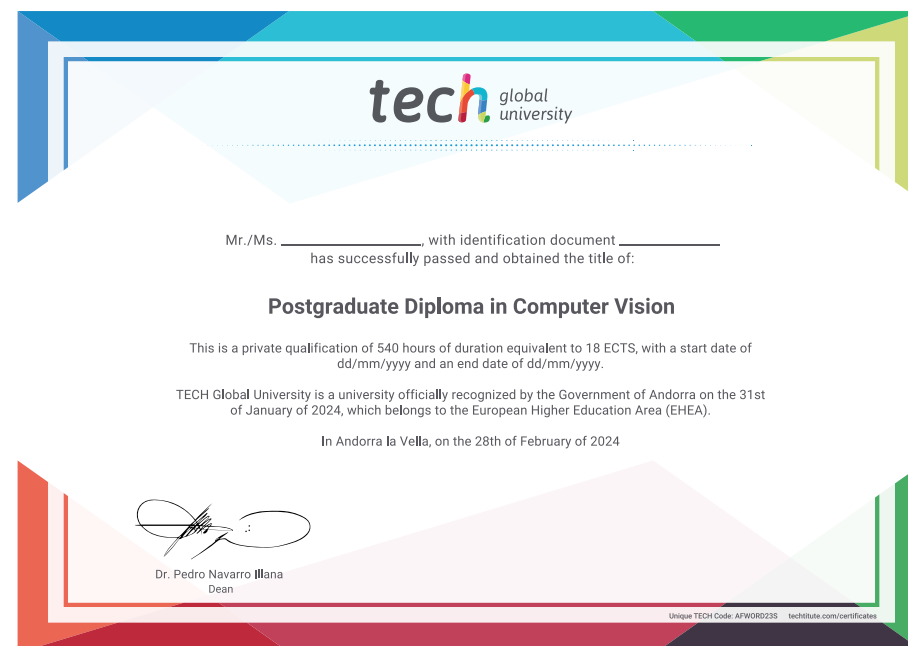
This **TECH Global University** private qualification is a European program of continuing education and professional updating that guarantees the acquisition of competencies in its area of knowledge, providing a high curricular value to the student who completes the program.

Title: **Postgraduate Diploma in Computer Vision**

Modality: **online**

Duration: **6 months**

Accreditation: **18 ECTS**





Postgraduate Diploma Computer Vision

- » Modality: online
- » Duration: 6 months
- » Certificate: TECH Global University
- » Accreditation: 18 ECTS
- » Schedule: at your own pace
- » Exams: online

Postgraduate Diploma Computer Vision

