

# Postgraduate Certificate

## Computer Vision, Applications and the State of the Art





## Postgraduate Certificate Computer Vision, Applications and the State of the Art

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

Website: [www.techtitute.com/us/information-technology/postgraduate-certificate/computer-vision-application-state-art](http://www.techtitute.com/us/information-technology/postgraduate-certificate/computer-vision-application-state-art)

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# 01

# Introduction

Computer vision is a branch of artificial intelligence that is responsible for processing visual information, extracting ordered data from this process. Therefore, it is a field with enormous potential that has uses in different fields such as healthcare, where it helps to improve diagnoses and treatments. This program delves into its current situation and its applications, delving into machine vision libraries, its use in autonomous vehicles or cloud computing, among many other issues. All this, through an innovative teaching methodology 100% online that allows students to combine their professional career with their studies.





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*Learn about the current state of computer vision as a discipline and delve into its applications with this Postgraduate Certificate”*

Artificial intelligence and other associated areas such as Machine Learning are the present and the future of technology. They have provided numerous solutions to complex fields such as healthcare, facilitating all kinds of medical processes. Within the field of AI, computer vision emerges as its optical branch, as it is responsible for processing, in an automated way, the visual information it receives. It is, therefore, an area with enormous prospects for the future.

This Postgraduate Certificate in Computer Vision, Applications and the State of the Art focuses on the current state of this technological discipline and delves into its numerous applications. Therefore, throughout this program the computer scientist will be able to learn about the latest developments in aspects such as image indexing, illumination systems, satellite image analysis or its commercial applications.

And it will do so with a highly qualified teaching staff, an online teaching system that adapts to the circumstances of each student and content presented in multimedia format, such as practical exercises, video lessons, master classes or interactive summaries.

This **Postgraduate Certificate in Computer Vision, Applications and the State of the Art** contains the most complete and up-to-date educational program on the market. Its most important 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



*Successfully apply computer vision to your projects thanks to what you will learn in this program”*

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*Artificial intelligence is the future:  
specialize in one of its most important  
branches and progress professionally”*

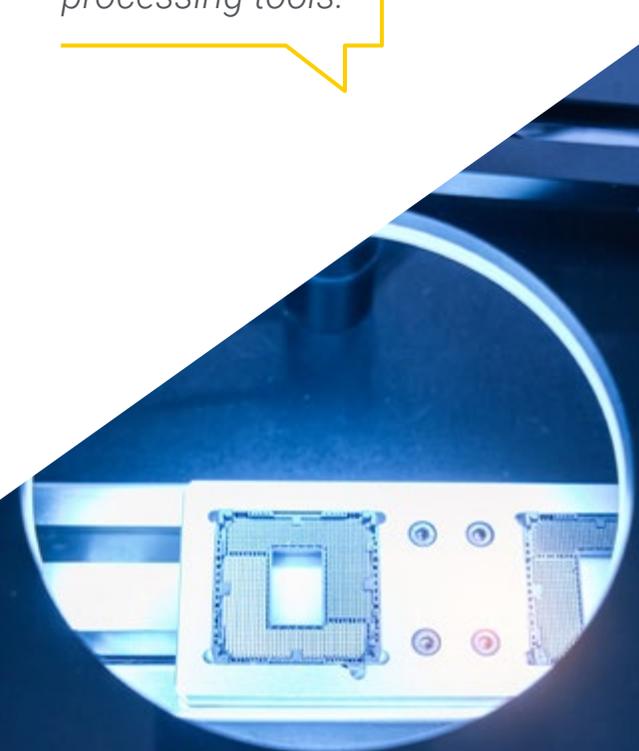
The program's teaching staff includes professionals from the sector who contribute their work experience to this educational program, as well as renowned specialists from leading societies and prestigious universities.

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

*This Postgraduate Certificate is  
what you were looking for. Don't  
wait any longer and enroll.*

*With this program, you will combine  
Machine Learning with computer  
vision to create powerful image  
processing tools.*



# 02 Objectives

The main objective of this Postgraduate Certificate in Computer Vision, Applications and the State of the Art is to offer the computer scientist or engineer all the keys to know in depth this important area of AI so that they can apply its principles to their own work. Therefore, at the end of the program, students will be able to incorporate its tools to your Machine Learning and artificial intelligence projects with simplicity.





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*Computer vision experts are needed. Complete this Postgraduate Certificate and become a professional highly sought after by technology companies”*



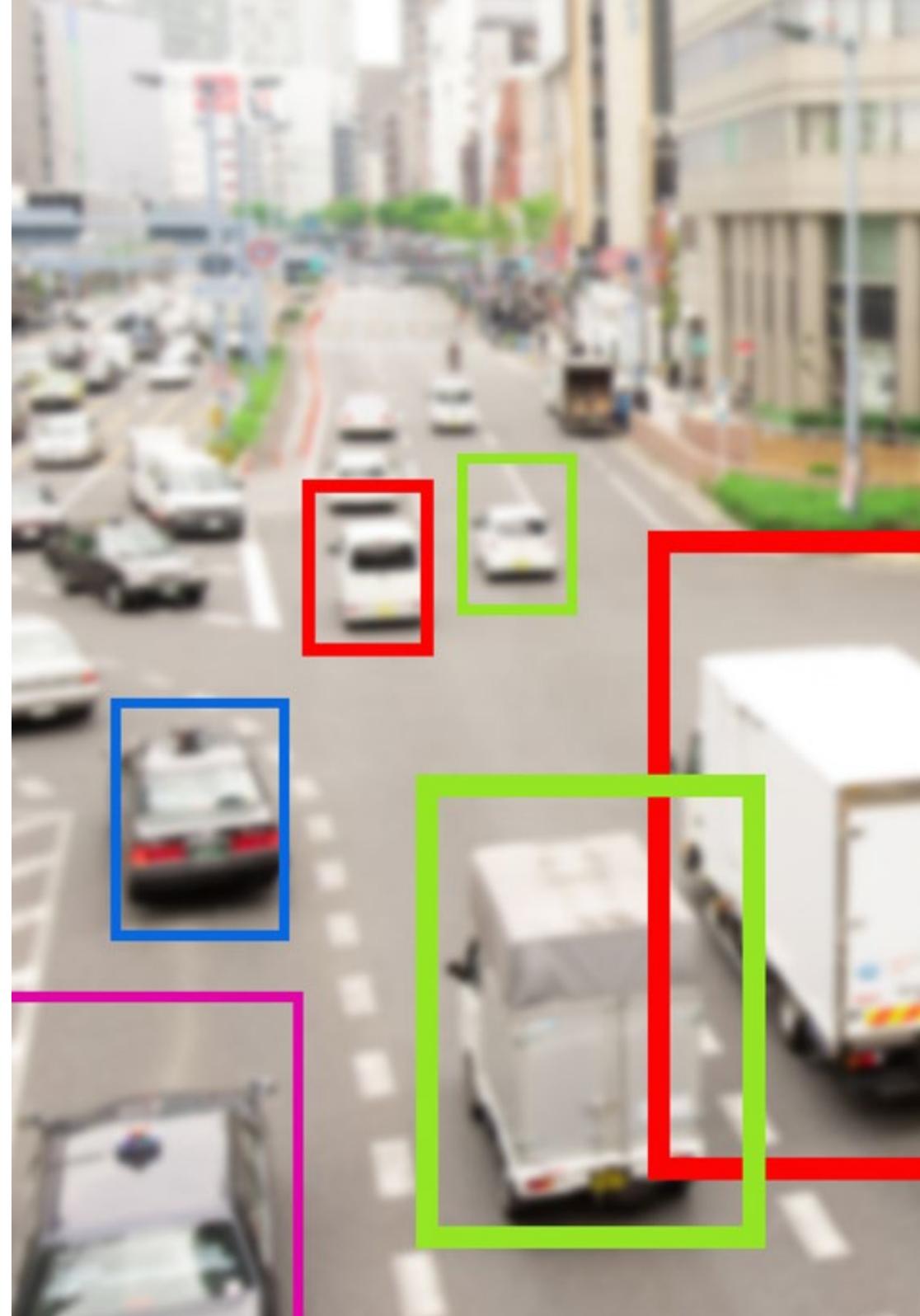
## General Objectives

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- ◆ Analyze how the real world is digitized according to the different existing technologies
- ◆ Obtain an overview of the devices and hardware used in the computer vision world
- ◆ Develop the systems that are changing the world of vision and their functionalities
- ◆ Assessing 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



*All your professional goals will be within your reach: enroll now*

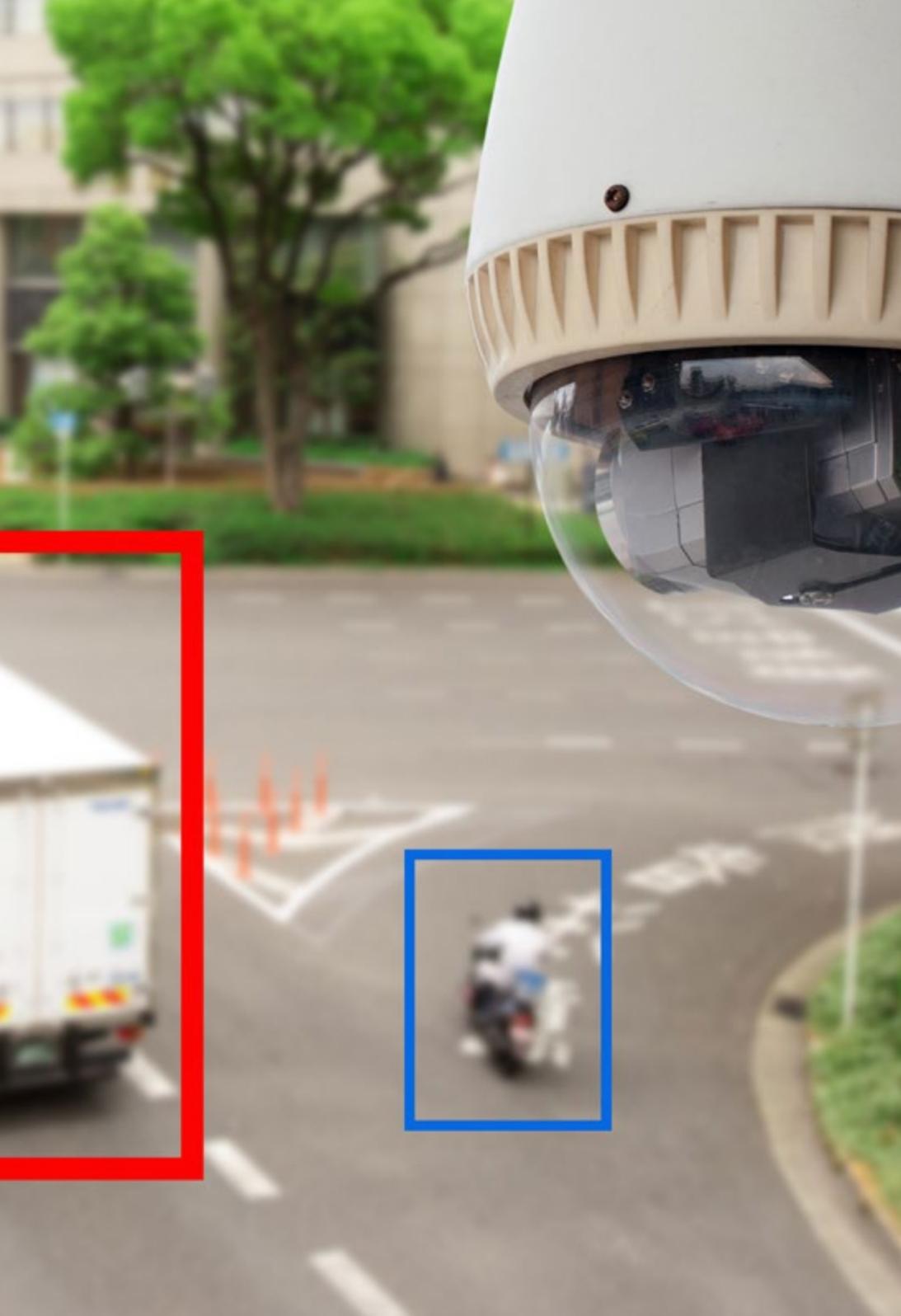




## Specific Objectives

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- ◆ Establishing 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
- ◆ 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



# 03

# Course Management

The faculty of this Postgraduate Certificate in Computer Vision, Applications and the State of the Art is composed of active professionals who know the latest developments in this area. As a result, they will be able to transfer to the student all the keys of computer vision and its current state. This way, students will be able to incorporate them into their work with ease and experience a great professional advancement thanks to all that they have learned.





“

*This faculty will make you a expert in computer vision. Enroll now and check it out"*

## 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. Tecnalía (formerly Robotiker)
- ♦ Market manager for the iron and steel sector, performing customer contact, contracting, market plans and strategic accounts functions
- ♦ 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. Bigata Casademunt, Antoni

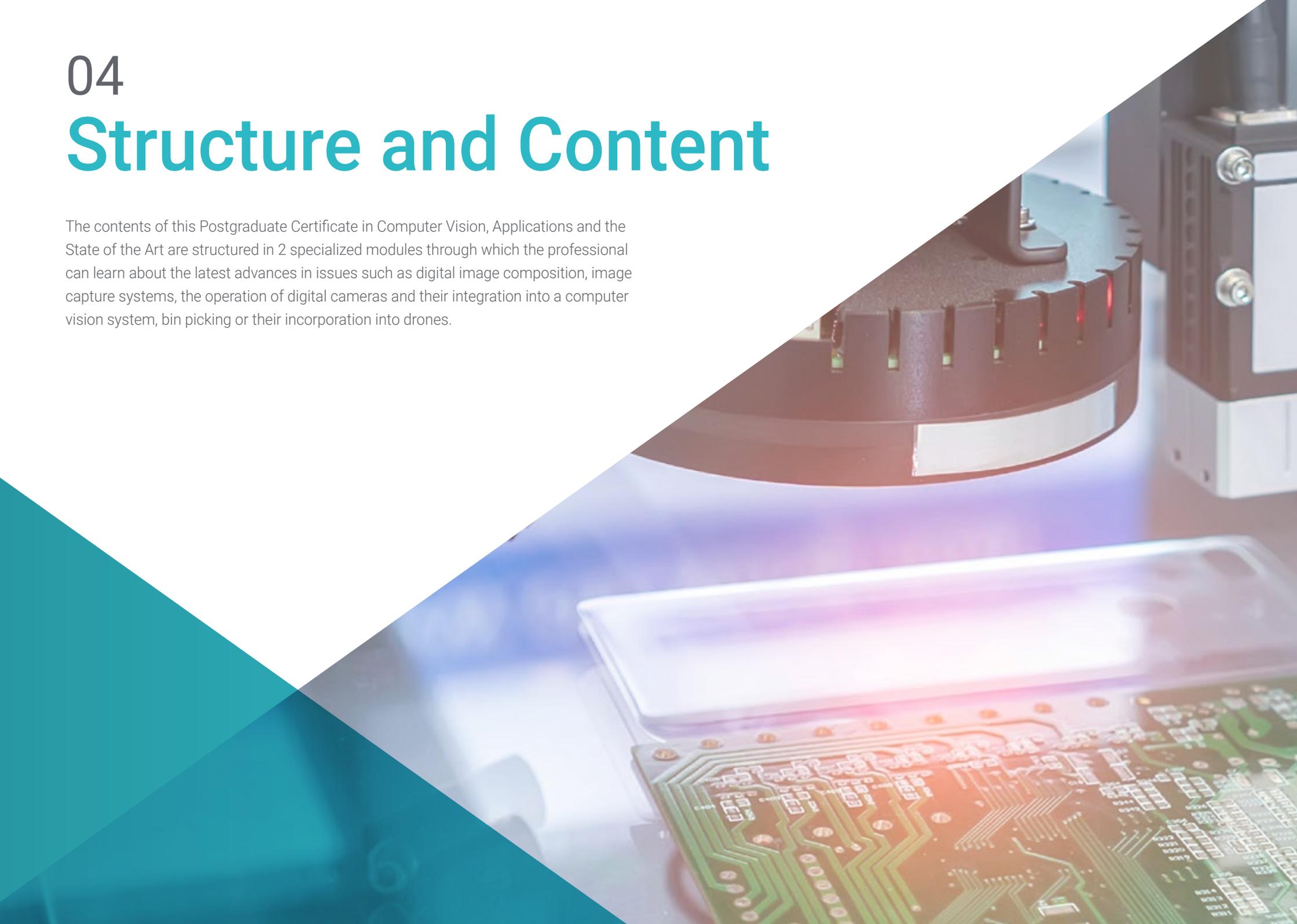
- ♦ Perception Engineer at Computer Vision Center (CVC)
- ♦ Machine Learning Engineer at Visium SA, Switzerland
- ♦ Degree in Microtechnology from Ecole Polytechnique Fédérale de Lausanne (EPFL), Lausanne, Switzerland
- ♦ Master's degree in Robotics from the Ecole Polytechnique Fédérale de Lausanne (EPFL)



# 04

# Structure and Content

The contents of this Postgraduate Certificate in Computer Vision, Applications and the State of the Art are structured in 2 specialized modules through which the professional can learn about the latest advances in issues such as digital image composition, image capture systems, the operation of digital cameras and their integration into a computer vision system, bin picking or their incorporation into drones.



“

*Learn about the many applications of computer vision and develop innovative AI projects with this program”*

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



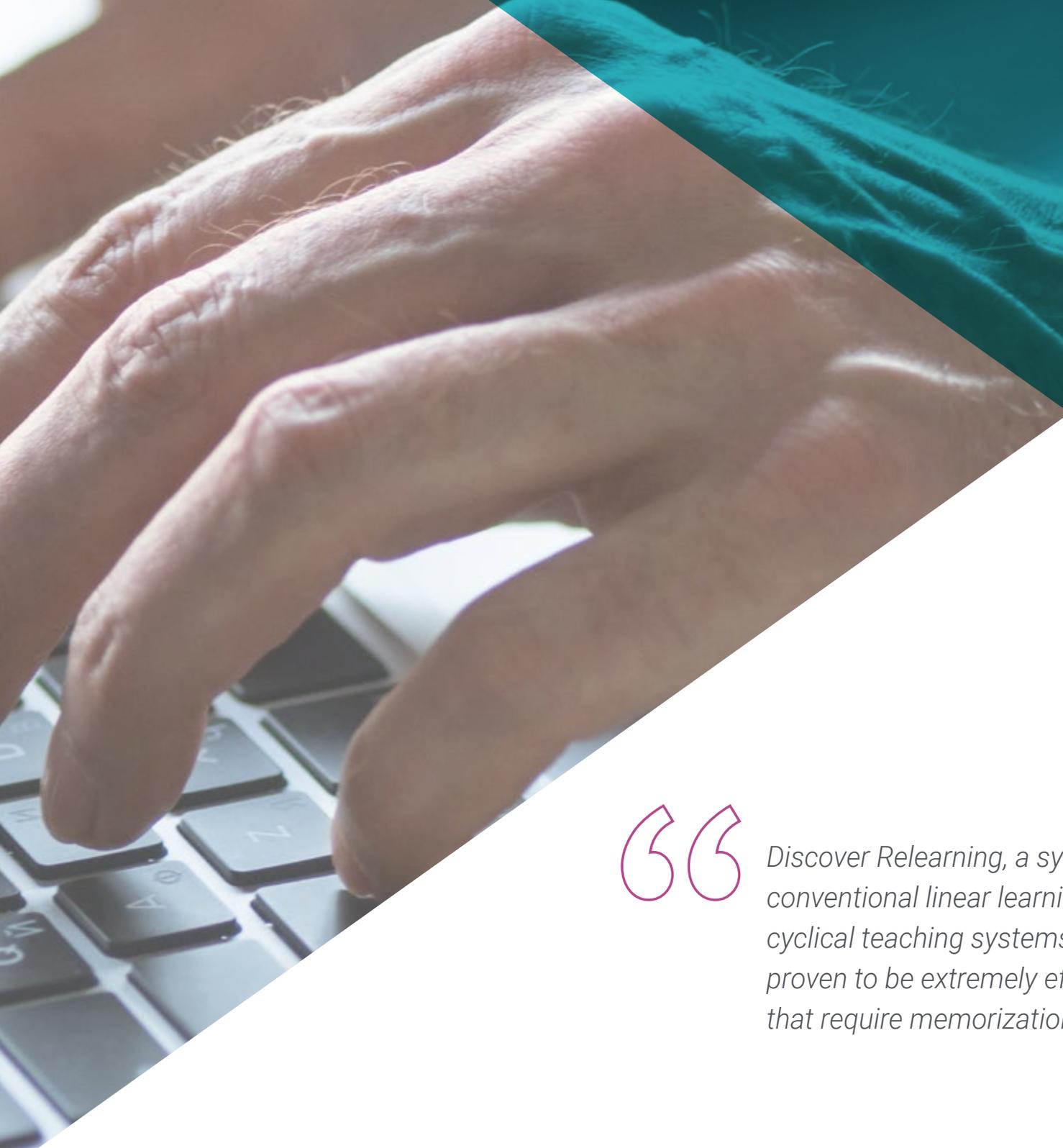
*This program offers you the specialization you are looking for and need. Enroll now and access the career advancement you deserve”*

# 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.



A close-up photograph of a person's hands typing on a laptop keyboard. The image is partially obscured by a teal diagonal graphic element that covers the top right and bottom right portions of the page.

“

*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.

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*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

This Postgraduate Certificate in Computer Vision, Applications and the State of the Art 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 Computer Vision, Applications and the State of the Art** contains the most complete and up-to-date program 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 diploma 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 Computer Vision, Applications and the State of the Art**  
Official N° of Hours: **300 h.**



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

future  
health confidence people  
education information tutors  
guarantee accreditation teaching  
institutions technology learning  
community commitment  
personalized service innovation  
knowledge present  
online  
development language  
classroom



## Postgraduate Certificate Computer Vision, Applications and the State of the Art

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# Postgraduate Certificate

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