

# Postgraduate Certificate

## Object Detection in Computer Vision



## Postgraduate Certificate Object Detection in Computer Vision

- » Modality: online
- » Duration: 6 weeks
- » Certificate: TECH Global University
- » Credits: 6 ECTS
- » Schedule: at your own pace
- » Exams: online

Website: [www.techtute.com/us/artificial-intelligence/postgraduate-certificate/object-detection-computer-vision](http://www.techtute.com/us/artificial-intelligence/postgraduate-certificate/object-detection-computer-vision)

# Index

01

Introduction

---

*p. 4*

02

Objectives

---

*p. 8*

03

Course Management

---

*p. 12*

04

Structure and Content

---

*p. 16*

05

Methodology

---

*p. 20*

06

Certificate

---

*p. 28*

# 01

# Introduction

One of the areas that is undergoing the greatest development, together with Machine Learning, is Computer Vision. This technology allows machines to obtain information from visual stimuli and algorithms, opening up numerous possibilities in different organizations. In this regard, a recent scientific study reveals that it will be valued in the next few years at up to 206 million dollars. Realizing the potential of this technological branch, companies are increasingly betting on it and require their employees to specialize in this field. TECH is therefore launching a university program that will delve deeper into object recognition and tracking. This program is based on a convenient 100% online format, which adapts to the agenda of all students.



“

*With this online program you will acquire programming and software development skills to apply object detection algorithms in real-world applications”*

The importance of Computer Vision Object Detection lies in its wide range of applications and benefits in various fields. An example of this is its ability to automate agricultural tasks such as planting and harvesting. With the advent of Industry 4.0, technology continues to evolve almost daily to provide experts with new tools to streamline the most complex tasks. However, it is a challenge for professionals to renew their knowledge in the face of the enormous workload to which they are exposed.

For this reason, TECH is launching a Postgraduate Certificate that will bring together the latest trends in the localization of elements in Computer Vision. The academic itinerary will delve into aspects ranging from occlusions to evaluation metrics and tracking of moving objects. Throughout the program, students will gain new skills that will allow them to effectively handle programming languages and apply them in practical object detection projects. In addition, the learning materials will include case studies focused on the detection and monitoring of individuals. In addition, the teaching staff will stimulate research and development of new approaches to encourage graduates to carry out innovation processes.

In terms of program methodology, TECH employs the revolutionary Relearning teaching system. Based on the reiteration of the essential contents during the academic course, students will reduce the hours of study and memorization so frequent in other pedagogical systems. In this way, specialists will obtain a natural and progressive learning process throughout the entire syllabus. Professionals only need a digital device with internet connection to visualize, at any time of the day, the didactic resources of this first level academic proposal.

This **Postgraduate Certificate in Object Detection in Computer Vision** contains the most complete and up-to-date program on the market. The most important features include:

- ♦ The development of case studies presented by experts in Deep Learning, 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 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



*You will develop innovative projects to automate tasks such as identifying people and ensuring security in facilities”*

“

*Get up to date on the latest techniques in Mean Average Precision with this revolutionary program"*

*Specialize in Object Detection and make the leap to industries in constant growth such as automotive or manufacturing.*

*Thanks to TECH's Relearning system, you will experience a gradual and autonomous learning.*

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.



# 02

# Objectives

This Postgraduate Certificate in Machine Vision Object Detection will provide experts with the most innovative techniques in this specialty. In this way, they will optimize their professional practice by merging the most traditional and modern evaluation metrics in their projects. Likewise, graduates will have a thorough knowledge of the deployment process, being able to implement object detection systems in a practical environment. In this sense, they will master the main Computing Platforms and will know how to correctly select aspects such as filters, the choice of framework or backbone.





“

*Object Detection in Computer Vision has a growing future. This program will allow you to stand out in this field and open the way to new opportunities”*



## General Objectives

- Generate specialized knowledge about object detection neural networks and their metrics
- Identify the different architectures
- Establish use cases
- Examine tracking algorithms and their metrics



*Specialize in the application of Object Detection in Computer Vision through the innovative multimedia formats of this Postgraduate Certificate"*

2	15	0	0	11	10	0	0	0	0	9	9	0	0
0	0	4	60	157	236	255	255	177	95	61	32	0	0
10	16	119	238	255	244	245	243	250	249	255	222	103	10
14	170	255	255	244	254	255	253	245	255	249	253	251	124
98	255	228	255	251	254	211	141	116	122	215	251	238	255
217	243	255	155	33	226	52	2	0	10	13	232	255	255
229	252	254	49	12	0	0	7	7	0	70	237	252	235
141	245	255	212	25	11	9	3	0	115	236	243	255	137
87	252	250	248	215	60	0	1	121	252	255	248	144	6
13	113	255	255	245	255	182	181	248	252	242	208	36	0
0	5	117	251	255	241	255	247	255	241	162	17	0	7
0	0	4	58	251	255	246	254	253	255	120	11	0	1
0	4	97	255	255	255	248	252	255	244	255	182	10	0
22	206	252	246	251	241	100	24	113	255	245	255	194	9
111	255	242	255	158	24	0	0	6	39	255	232	230	56
218	251	250	137	7	11	0	0	0	2	62	255	250	125
173	255	255	101	9	20	0	13	3	13	182	251	245	61
107	251	241	255	230	98	55	19	118	217	248	253	255	52
18	146	250	255	247	255	255	255	249	255	240	255	129	0
0	23	113	215	255	250	248	255	255	248	248	118	14	12
0	6	1	0	52	153	233	255	252	147	37	0	0	4



## Specific Objectives

---

- 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
- Establish object tracking algorithms
- Apply detection and tracking of people

03

# Course Management

This Postgraduate Certificate in Computer Vision Object Detection has a first class teaching staff. Specialized in this branch of Machine Learning, these professionals pour their years of work experience into the didactic contents. In addition, as they remain active, they keep abreast of all the advances that have been made in this field to provide services defined by their excellent quality. Thanks to all this, students will enjoy 180 hours of stimulating learning to develop their work with total guarantees of success. In this way, they will take full advantage of the opportunities offered by a booming discipline.



01

CA



CAR 02

CAR 01

“

*This university program is designed and taught by experts in Machine Vision, who have proposed innovative solutions in prestigious institutions"*

## Management



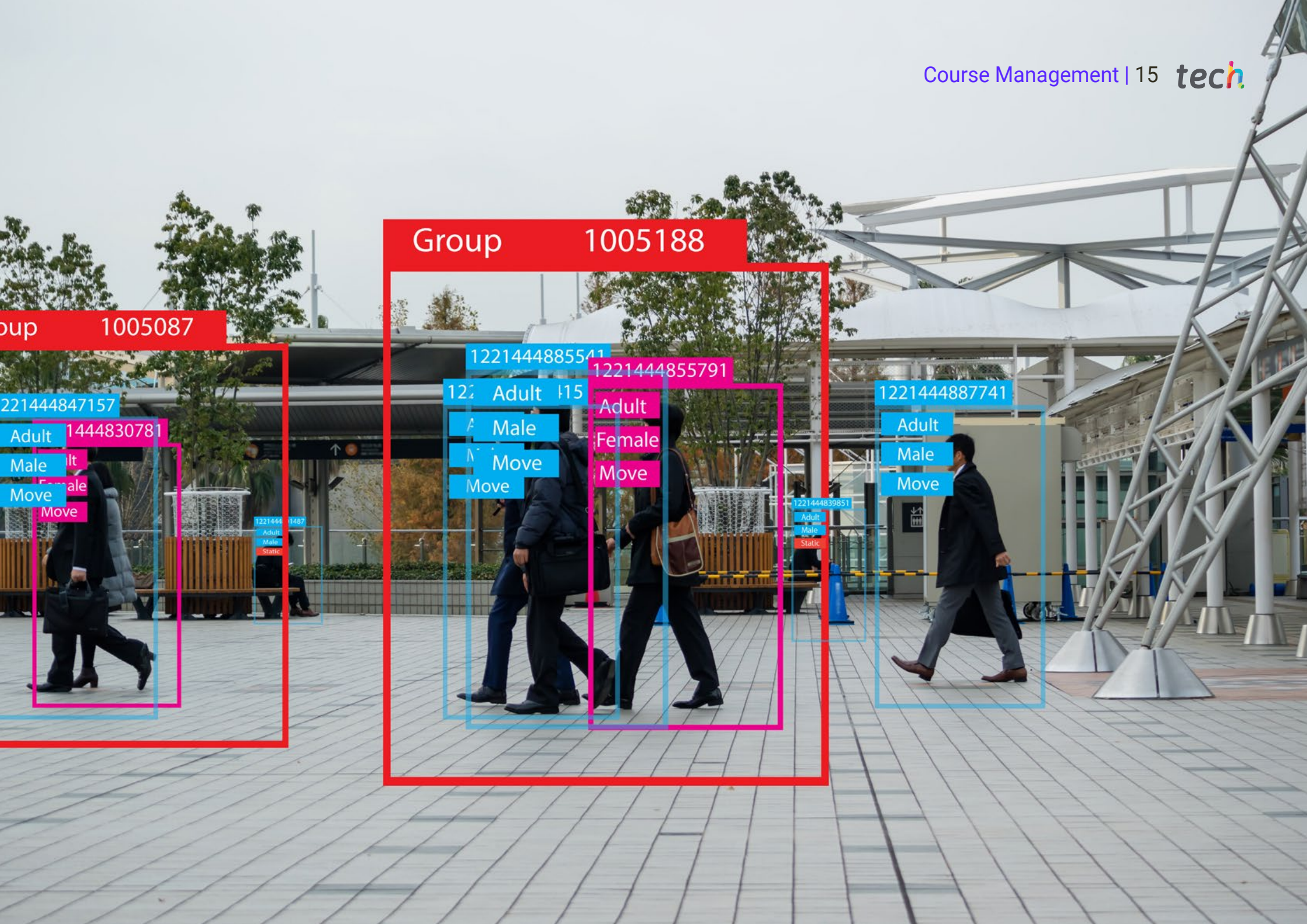
### Mr. Redondo Cabanillas, Sergio

- ♦ Machine Vision Research and Development Specialist at BCN Vision
- ♦ Development and Backoffice Team Leader at BCN Vision
- ♦ Project Manager and development of computer vision solutions
- ♦ Sound Technician at Media Arts Studio
- ♦ Specialization in Image and Sound by the Polytechnic University of Catalonia
- ♦ Graduate in Political Science and Industry from the Autonomous University of Barcelona
- ♦ Higher Level Training Cycle in Sound Villar CP

## Professors

### Mr. Delgado Gonzalo, Guillem

- ♦ Computer Vision and Artificial Intelligence Researcher at Vicomtech
- ♦ Computer Vision and Artificial Intelligence Engineer at Gestoos
- ♦ Junior Engineer at Sogeti
- ♦ Graduated in Audiovisual Systems Engineering at the Polytechnic University of Catalonia
- ♦ MSc in Computer Vision at Universitat Autònoma de Barcelona
- ♦ Graduate in Computer Science at Aalto University
- ♦ Graduate in Audiovisual Systems. UPC - ETSETB Telecom BCN



Group 1005188

Group 1005087

1221444885541

12214448855791

1221444847157

1221444885541

Adult

1221444887741

Adult 1444830781

Adult

Adult

Male

Male

Female

Male

Female

Move

Move

Move

Move

122144481487

1221444839851

Adult

Adult

Male

Male

Static

Static

# 04

## Structure and Content

Through 180 hours of studying, graduates will incorporate the most advanced techniques in Computer Vision Object Detection into their daily practice. The curriculum will provide students with multiple tools to perform evaluation metrics, including the Recall or Confidence Score. In this way, graduates will measure the effectiveness of machine learning models and computer vision systems in specific tasks. In addition, the syllabus will delve deeper into Object Tracking to track the location, size or shape of an object as it moves through a scene.





“

*A high intensity program that will update your knowledge in a real scenario, with the maximum scientific rigor of a technological reference institution"*

## Module 1. Object Detection

- 1.1. Object Detection and Tracking
  - 1.1.1. Object Detection
  - 1.1.2. Case Uses
  - 1.1.3. Object Tracking
  - 1.1.4. Case Uses
  - 1.1.5. Occlusions, Rigid and Non-Rigid Poses
- 1.2. Evaluation Metrics
  - 1.2.1. IOU-Intersection Over Union
  - 1.2.2. Confidence Score
  - 1.2.3. Recall
  - 1.2.4. Precision
  - 1.2.5. Recall Precision Curve
  - 1.2.6. Mean Average Precision (mAP)
- 1.3. Traditional Methods
  - 1.3.1. Sliding Window
  - 1.3.2. Viola Detector
  - 1.3.3. HOG
  - 1.3.4. Non Maximal Supresion (NMS)
- 1.4. Datasets
  - 1.4.1. Pascal VC
  - 1.4.2. MS Coco
  - 1.4.3. ImageNet (2014)
  - 1.4.4. MOTA Challenge
- 1.5. Two Shot Object Detector
  - 1.5.1. R-CNN
  - 1.5.2. Fast R-CNN
  - 1.5.3. Faster R-CNN
  - 1.5.4. Mask R-CNN





- 1.6. *Single Shot Object Detector*
  - 1.6.1. SSD
  - 1.6.2. YOLO
  - 1.6.3. RetinaNet
  - 1.6.4. CenterNet
  - 1.6.5. EfficientDet
- 1.7. *Backbones*
  - 1.7.1. VGG
  - 1.7.2. ResNet
  - 1.7.3. Mobilenet
  - 1.7.4. Shufflenet
  - 1.7.5. Darknet
- 1.8. *Object Tracking*
  - 1.8.1. Classical Approaches
  - 1.8.2. Particulate Filters
  - 1.8.3. Kalman
  - 1.8.4. *Sort Tracker*
  - 1.8.5. *Deep Sort*
- 1.9. *Deployment*
  - 1.9.1. Computing Platform
  - 1.9.2. Choice of *Backbone*
  - 1.9.3. Choice of *Framework*
  - 1.9.4. Model Optimization
  - 1.9.5. Model Versioning
- 1.10. *Study: People Detection and Tracking*
  - 1.10.1. Detection of People
  - 1.10.2. Monitoring of People
  - 1.10.3. Re-Identification
  - 1.10.4. Counting People in Crowds

05

# Methodology

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

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





“

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

## Case Study to contextualize all content

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

“

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



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



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

### A learning method that is different and innovative

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

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

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

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

## Relearning Methodology

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

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

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

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

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





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

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

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

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

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



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



### Study Material

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

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



### Classes

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

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



### Practising Skills and Abilities

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



### Additional Reading

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





#### Case Studies

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



#### Interactive Summaries

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

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



#### Testing & Retesting

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



06

# Certificate

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



The image features two black graduation caps (mortarboards) against a bright blue sky with light, wispy clouds. One cap is in the foreground on the left, held by a hand, and the other is slightly behind and to the right. The background is split diagonally by a white and blue geometric shape.

“

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

This program will allow you to obtain your **Postgraduate Certificate in Object Detection 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** title 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 Certificate in Object Detection in Computer Vision**

Modality: **online**

Duration: **6 weeks**

Accreditation: **6 ECTS**





**Postgraduate Certificate**  
Object Detection in  
Computer Vision

- » Modality: online
- » Duration: 6 weeks
- » Certificate: TECH Global University
- » Credits: 6 ECTS
- » Schedule: at your own pace
- » Exams: online

# Postgraduate Certificate

## Object Detection in Computer Vision