# Advanced Master's Degree
Virtual Reality and
Computer Vision


tech global university

# Advanced Master's Degree
## Virtual Reality and Computer Vision

- Modality: **online**
- Duration: **2 years**
- Certificate: **TECH Global University**
- Accreditation: **120 ECTS**
- Schedule: **at your own pace**
- Exams: **online**

Website: **www.techtitute.com/us/artificial-intelligence/advanced-master-degree/advanced-master-degree-virtual-reality-computer-vision**

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# Introduction to the Program

The Advanced Master's Degree at TECH University offers state-of-the-art education in two of today's most ground-breaking technologies. With a practical focus, this program allows students to develop skills in areas such as digital image processing, deep learning and convolutional networks, applying them in sectors such as entertainment, industry and healthcare. Over the course of 20 modules, students will learn to design immersive environments, create 3D characters, and develop video games and interactive applications using tools such as Unity 3D and Zbrush. This Advanced Master's Degree prepares professionals to lead technological projects, generate innovative solutions and excel in a constantly evolving field.

*Master Virtual Reality and Computer Vision to stand out as a leader in this innovative field"*

Virtual Reality and Computer Vision are revolutionizing key sectors such as entertainment, healthcare, industry, and research. Their impact on society, with innovative applications such as medical diagnostics, immersive video game creation, and industrial process automation, reinforces the need for highly trained experts. This Advanced Master's Degree, designed by TECH Global University, responds to this demand by developing professionals in the use of advanced technologies such as Digital Image Processing, Deep Learning, and Convolutional Networks, which are essential for leading innovation projects.

The program comprehensively covers the technical fundamentals, from the creation of 3D environments and character design to the implementation of advanced algorithms. In addition, students acquire skills in leading tools such as Unity 3D, ZBrush, and 3D Max, mastering the design and programming of immersive solutions applicable in various sectors.

One of the main advantages of this program is its 100% online format, which allows students to balance their studies with work and personal responsibilities. Thanks to access to the Virtual Campus, participants have the flexibility to manage their learning independently and access updated content from any device connected to the Internet.

This **Advanced Master's Degree in Virtual Reality and Computer Vision** contains the most complete and up-to-date program on the market. The most important features include:

- Development of practical cases presented by experts in Virtual Reality 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
- Special emphasis on innovative methodologies in the management of Virtual Reality and Computer Vision industries
- 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

*"Drive success by applying Virtual Reality and Computer Vision in key sectors of the economy"*

*Consolidate your skills through practical case studies and interactive resources designed to apply advanced concepts in Virtual Reality and Computer Vision"*

*Access the most innovative techniques thanks to a practical and up-to-date approach that integrates tools such as Deep Learning, image processing, and 3D modeling.*

*Study without restrictions with a 100% online program that allows you to learn from anywhere and adapt your pace to your daily needs.*

The teaching staff includes professionals from the field of Virtual Reality and Computer Vision, who bring their work experience to this program, as well as renowned specialists from leading companies 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 an immersive learning experience designed to prepare for real-life situations.

This program is designed around Problem-Based Learning, whereby the student must try to solve the different professional practice situations that arise throughout the program. For this purpose, the professional will be assisted by an innovative interactive video system created by renowned and experienced experts.

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# Why Study at TECH?

TECH is the world's largest online university. With an impressive catalog of more than 14,000 university programs, available in 11 languages, it is positioned as a leader in employability, with a 99% job placement rate. In addition, it has a huge faculty of more than 6,000 professors of the highest international prestige.

*Study at the largest online university in the world and ensure your professional success. The future begins at TECH"*

### The world's best online university, according to FORBES

The prestigious Forbes magazine, specialized in business and finance, has highlighted TECH as "the best online university in the world" This is what they have recently stated in an article in their digital edition in which they echo the success story of this institution, "thanks to the academic offer it provides, the selection of its teaching staff, and an innovative learning method oriented to form the professionals of the future".

### The best top international faculty

TECH's faculty is made up of more than 6,000 professors of the highest international prestige. Professors, researchers and top executives of multinational companies, including Isaiah Covington, performance coach of the Boston Celtics; Magda Romanska, principal investigator at Harvard MetaLAB; Ignacio Wistumba, chairman of the department of translational molecular pathology at MD Anderson Cancer Center; and D.W. Pine, creative director of TIME magazine, among others.

### The world's largest online university

TECH is the world's largest online university. We are the largest educational institution, with the best and widest digital educational catalog, one hundred percent online and covering most areas of knowledge. We offer the largest selection of our own degrees and accredited online undergraduate and postgraduate degrees. In total, more than 14,000 university programs, in ten different languages, making us the largest educational institution in the world.


### The most complete syllabuses on the university scene

TECH offers the most complete syllabuses on the university scene, with programs that cover fundamental concepts and, at the same time, the main scientific advances in their specific scientific areas. In addition, these programs are continuously updated to guarantee students the academic vanguard and the most demanded professional skills. and the most in-demand professional competencies. In this way, the university's qualifications provide its graduates with a significant advantage to propel their careers to success.

### A unique learning method

TECH is the first university to use Relearning in all its programs. This is the best online learning methodology, accredited with international teaching quality certifications, provided by prestigious educational agencies. In addition, this innovative academic model is complemented by the "Case Method", thereby configuring a unique online teaching strategy. Innovative teaching resources are also implemented, including detailed videos, infographics and interactive summaries.

### The official online university of the NBA

TECH is the official online university of the NBA. Thanks to our agreement with the biggest league in basketball, we offer our students exclusive university programs, as well as a wide variety of educational resources focused on the business of the league and other areas of the sports industry. Each program is made up of a uniquely designed syllabus and features exceptional guest hosts: professionals with a distinguished sports background who will offer their expertise on the most relevant topics.

### Leaders in employability

TECH has become the leading university in employability. Ninety-nine percent of its students obtain jobs in the academic field they have studied within one year of completing any of the university's programs. A similar number achieve immediate career enhancement. All this thanks to a study methodology that bases its effectiveness on the acquisition of practical skills, which are absolutely necessary for professional development.

Google Partner
PREMIER 2025

The Official Online University of the **NBA**

4.9/5
global score

99%
maximun employability guaranteed

### Google Premier Partner

The American technology giant has awarded TECH the Google Premier Partner badge. This award, which is only available to 3% of the world's companies, highlights the efficient, flexible and tailored experience that this university provides to students. The recognition not only accredits the maximum rigor, performance and investment in TECH's digital infrastructures, but also places this university as one of the world's leading technology companies.

### The top-rated university by its students

Students have positioned TECH as the world's top-rated university on the main review websites, with a highest rating of 4.9 out of 5, obtained from more than 1,000 reviews. These results consolidate TECH as the benchmark university institution at an international level, reflecting the excellence and positive impact of its educational model.

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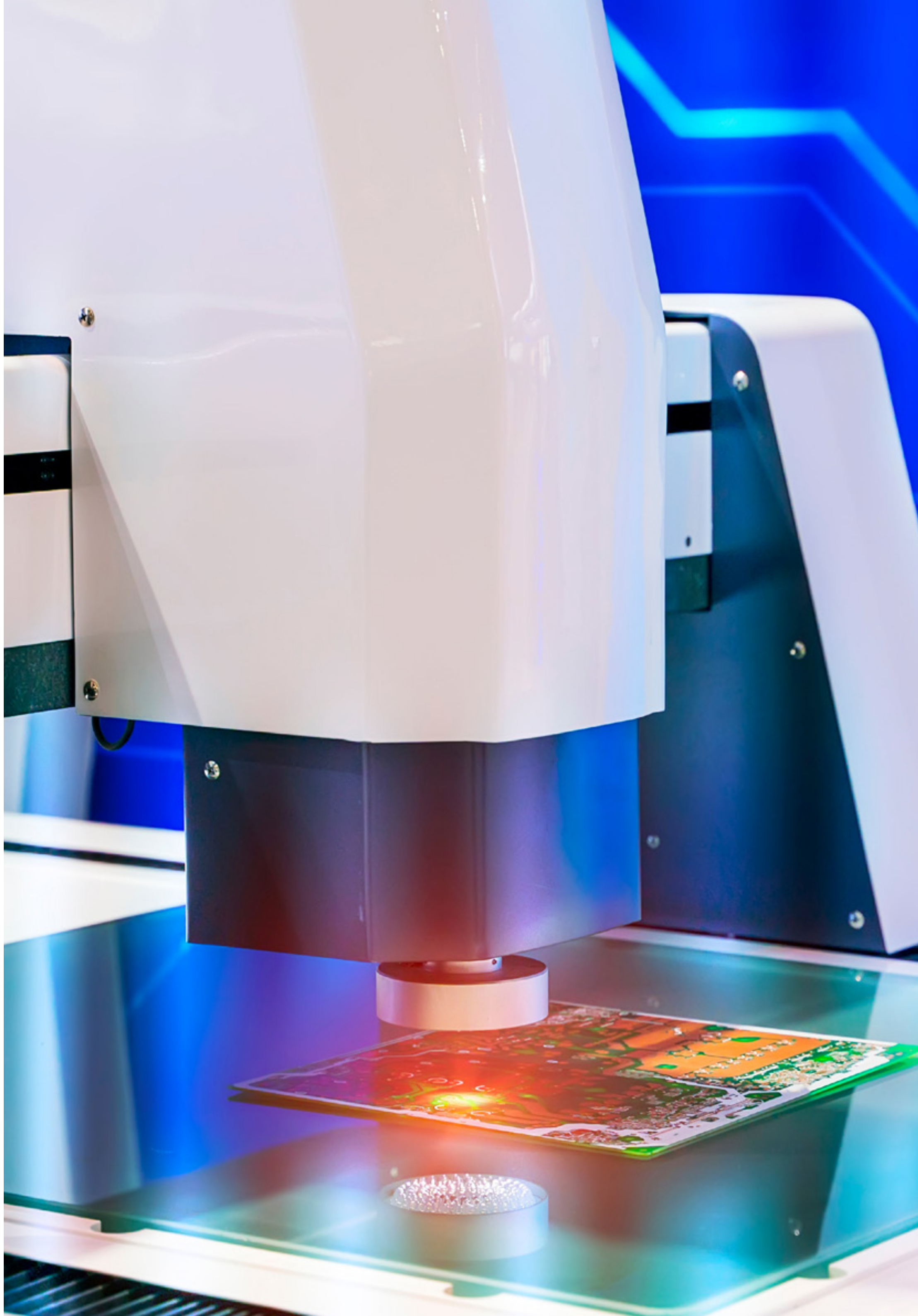
# Syllabus

The materials for this university program have been developed by experts in Artificial Intelligence and advanced technologies. The syllabus delves into areas such as Digital Image Processing, Deep Learning, and Convolutional Networks, offering a comprehensive approach to tackling the most complex challenges in these fields. In addition, the program includes specific modules on 3D design and modeling, video game creation, and immersive environment development.

*You will learn to implement innovative solutions and develop high-impact interactive experiences, preparing you to lead technology projects in emerging industries"*

## **Module 1.** Computer Vision

- 1.1. Human Perception
    - 1.1.1. Human Visual System
    - 1.1.2. The 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 Capture 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 given 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. How It Works
- 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.** 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. Open3D
- 5.2.1. Library for 3D Data Processing
- 5.2.2. Characteristics
- 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 PointClouds

## **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 Perception
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 Training Phase

6.10. Creation of a Neural Network – Training and Validation
- 6.10.1. Dataset
- 6.10.2. Network Construction
- 6.10.3. Education
- 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 Studies
- 8.1.3. Object Tracking
- 8.1.4. Case Studies
- 8.1.5. *Occlusions, Rigid and Non-Rigid Poses*

8.2. Assessment 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. *Sort Tracker*
- 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: People Detection and Tracking
- 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-organizing 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: RCNN Mask
  9.8.1. RCNN Mask
  9.8.2. Architecture
  9.8.3. Application of a RCNN Mask
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. Education
- 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. Autoencoder Architecture
- 10.8.3. Noise Elimination 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

## **Module 11.** The 3D Industry

11.1. 3D Industry in Animation and Video Games
- 11.1.1. 3D Animation
- 11.1.2. 3D Industry in Animation and Video Games
- 11.1.3. 3D Animation Future

11.2. 3D in Video Games
- 11.2.1. Video Games. Limitations
- 11.2.2. 3D Video Game Development. Difficulties
- 11.2.3. Solutions to Video Game Development Difficulties

11.3. 3D Software for Video Games
- 11.3.1. Maya. Pros and Cons
- 11.3.2. 3Ds Max. Pros and Cons
- 11.3.3. Blender. Pros and Cons

11.4. Pipeline in 3D Asset Generation for Video Games
- 11.4.1. Idea and Assembly from a Modelsheet
- 11.4.2. Modeling with Low Geometry and High Detailing
- 11.4.3. Projection of Textured Details

11.5. Key Artistic 3D Styles for Video Games
- 11.5.1. Cartoon Style
- 11.5.2. Realistic Style
- 11.5.3. Cel Shading
- 11.5.4. *Motion Capture*

11.6. 3D Integration
- 11.6.1. 2D Digital World Integration
- 11.6.2. 3D Digital World Integration
- 11.6.3. Real-World Integration (AR, MR/XR)

11.7. Key 3D Factors for Different Industries
- 11.7.1. 3D in Film and Series
- 11.7.2. 3D in Video Games
- 11.7.3. 3D in Marketing

11.8. Render: Real-time rendering and pre-rendering
- 11.8.1. Lighting
- 11.8.2. Shadow Definition
- 11.8.3. Quality vs. Speed

11.9. 3D Asset Generation in 3D Max
- 11.9.1. 3D Max Software
- 11.9.2. Interface, Menus, Toolbars
- 11.9.3. Controls
- 11.9.4. Scene
- 11.9.5. *Viewports*
- 11.9.6. *Basic Shapes*
- 11.9.7. Object Generation, Modification and Transformation
- 11.9.8. 3D Scene Creation
- 11.9.9. 3D Professional Asset Modeling for Video Games
- 11.9.10. Material Editors
  - 11.9.10.1. Creating and Editing Materials
  - 11.9.10.2. Applying Light to Materials
  - 11.9.10.3. UVW Map Modifier. Mapping Coordinates
  - 11.9.10.4. Texture Creation

11.10. Workspace Organization and Best Practices
- 11.10.1. Creation of a Project
- 11.10.2. Folder Structure
- 11.10.3. Custom Functionality

## **Module 12.** Art and 3D in the Video Game Industry

12.1. 3D VR Projects
- 12.1.1. 3D Mesh Creation Software
- 12.1.2. Image Editing Software
- 12.1.3. Virtual Reality

12.2. Typical Problems, Solutions and Project Needs
- 12.2.1. Project Needs
- 12.2.2. Possible Problems
- 12.2.3. Solutions

12.3. Aesthetic Line Study for the Artistic Style Generation in Video Games: From Game Design to 3D Art Generation
- 12.3.1. Choice of Video Game Recipient. Who We Want to Reach
- 12.3.2. Developer's Artistic Possibilities
- 12.3.3. Final Definition of the Aesthetic Line

12.4. Aesthetic Benchmarking and Competitor Analysis
- 12.4.1. Pinterest and Similar Sites
- 12.4.2. Modelsheet Creation
- 12.4.3. Competitor Search

12.5. Bible Creation and Briefing
- 12.5.1. Bible Creation
- 12.5.2. Bible Development
- 12.5.3. Briefing Development

12.6. Scenarios and Assets
- 12.6.1. Production Asset Planning at Production Levels
- 12.6.2. Scenario Design
- 12.6.3. Asset Design

12.7. Asset Integration in Levels and Tests
- 12.7.1. Integration Process at All Levels
- 12.7.2. Texture
- 12.7.3. Final Touches

12.8. Characters
- 12.8.1. Character Production Planning
- 12.8.2. Character Design
- 12.8.3. Character Asset Design

12.9. Character Integration in Scenarios and Tests
- 12.9.1. Character Integration Process in Levels
- 12.9.2. Project Needs
- 12.9.3. Animations

12.10. 3D Video Game Audio
- 12.10.1. Project Dossier Interpretation for Sound Identity Generation of Video Games
- 12.10.2. Composition and Production Processes
- 12.10.3. Soundtrack Design
- 12.10.4. Sound Effect Design
- 12.10.5. Voice Design

## **Module 13.** Advanced 3D

13.1. Advanced 3D Modeling Techniques
- 13.1.1. Interface Configuration
- 13.1.2. Modeling Observation
- 13.1.3. Modeling in High
- 13.1.4. Organic Modeling for Videogames
- 13.1.5. Advanced 3D Object Mapping

13.2. Advanced 3D Texturing
- 13.2.1. Substance Painter Interfaces
- 13.2.2. Materials, Alphas and Brush Use
- 13.2.3. Particle Use

13.3. 3D Software and Unreal Engine Export
- 13.3.1. Unreal Engine Integration in Designs
- 13.3.2. 3D Model Integration
- 13.3.3. Unreal Engine Texture Application

13.4. Digital Sculpting
- 13.4.1. Digital Sculpting with ZBrush
- 13.4.2. First Steps in ZBrush
- 13.4.3. Interface, Menus and Navigation
- 13.4.4. Reference Images
- 13.4.5. Full 3D Modeling of Objects in ZBrush
- 13.4.6. Base Mesh Use
- 13.4.7. Part Modeling
- 13.4.8. 3D Model Export in ZBrush

13.5. Polypaint Use
- 13.5.1. Advanced Brushes
- 13.5.2. Texture
- 13.5.3. Default Materials

13.6. Rheopology
- 13.6.1. Rheopology. Use in the Video Game Industry
- 13.6.2. Low-Poly Mesh Creation
- 13.6.3. Software Use for Rhetopology

13.7. 3D Model Positions
- 13.7.1. Reference Image Viewers
- 13.7.2. Transpose Use
- 13.7.3. Transpose Use for Models Composed of Different Pieces

13.8. 3D Model Export
- 13.8.1. 3D Model Export
- 13.8.2. Texture Generation for Exportation
- 13.8.3. 3D Model Configuration with the Different Materials and Textures
- 13.8.4. Preview of the 3D Model

13.9. Advanced Working Techniques
- 13.9.1. 3D Modeling Workflow
- 13.9.2. 3D Modeling Work Process Organization
- 13.9.3. Production Effort Estimates

13.10. Model Finalization and Export for Other Programs
- 13.10.1. Workflow for Model Finalization
- 13.10.2. Zpluging Exportation
- 13.10.3. Possible Files. Advantages and Disadvantages

## **Module 14.** 3D Animation

14.1. Software Operation
- 14.1.1. Information Management and Work Methodology
- 14.1.2. Animation
- 14.1.3. Timing and Weight
- 14.1.4. Animation With Basic Objects
- 14.1.5. Direct and Inverse Cinematics
- 14.1.6. Inverse Kinematics
- 14.1.7. Kinematic Chain

14.2. Anatomy. Biped Vs. Quadruped
- 14.2.1. Biped
- 14.2.2. Quadruped
- 14.2.3. Walking Cycle
- 14.2.4. Running Cycle

14.3. Facial Rig and Morpher
- 14.3.1. Facial Language. Lip-Sync, Eyes and Focal Points
- 14.3.2. Sequence Editing
- 14.3.3. Phonetics. Importance

14.4. Applied Animation
- 14.4.1. 3D Animation for Film and Television
- 14.4.2. Animation for Video Games
- 14.4.3. Animation for Other Applications

14.5. Motion Capture with Kinect
- 14.5.1. Motion Capture for Animation
- 14.5.2. Sequence of Movements
- 14.5.3. Blender Integration

14.6. Skeleton, Skinning and Setup
- 14.6.1. Interaction Between Skeleton and Geometry
- 14.6.2. Mesh Interpolation
- 14.6.3. Animation Weights

14.7. *Acting*
- 14.7.1. Body Language
- 14.7.2. Poses
- 14.7.3. Sequence Editing

14.8. Cameras and Plans
- 14.8.1. The Camera and the Environment
- 14.8.2. Composition of the Shot and the Characters
- 14.8.3. Finishes

14.9. Visual Special Effects
- 14.9.1. Visual Effects and Animation
- 14.9.2. Types of Optical Effects
- 14.9.3. 3D VFX L

14.10. The Animator as an Actor
- 14.10.1. Expressions
- 14.10.2. Actors' References
- 14.10.3. From Camera to Program

## **Module 15.** Unity 3D and Artificial Intelligence Proficiency

15.1. Video Games. 3D Unity
- 15.1.1. Video Games
- 15.1.2. Video Games. Errors and Hits
- 15.1.3. Video Game Applications in Other Areas and Industries

15.2. Video Game Development. 3D Unity
- 15.2.1. Production Plan and Development Phases
- 15.2.2. Development Methodology
- 15.2.3. Patches and Additional Content

15.3. 3D Unity
- 15.3.1. Unity 3D. Applications
- 15.3.2. Scripting in Unity 3D
- 15.3.3. Asset Store and Third-Party Plugins

15.4. Physics, Inputs
- 15.4.1. InputSystem
- 15.4.2. Physics in Unity 3D
- 15.4.3. Animation and Animator

15.5. Unity Prototyping
- 15.5.1. Blocking and Colliders
- 15.5.2. Pre-Fabs
- 15.5.3. Scriptable Objects

15.6. Specific Programming Techniques
- 15.6.1. Singleton Model
- 15.6.2. Loading of Resources in the Execution of Windows Games
- 15.6.3. Performance and Profiler

15.7. Video Games for Mobile Devices
- 15.7.1. Games for Android Devices
- 15.7.2. Games for IOS Devices
- 15.7.3. Multiplatform Developments

15.8. Augmented Reality
- 15.8.1. Types of Augmented Reality Games
- 15.8.2. ARkit and ARcore
- 15.8.3. Vuforia Development

15.9. Artificial Intelligence Programming
 15.9.1. Artificial Intelligence Algorithms
 15.9.2. Finite State Machines
 15.9.3. Neural Networks
15.10. Distribution and Marketing
 15.10.1. The art of Publishing and Promoting a Video Game
 15.10.2. The Responsible for Success
 15.10.3. Strategies

## **Module 16.** 2D and 3D Video Game Development

16.1. Raster Graphic Resources
 16.1.1. Sprites
 16.1.2. Atlas
 16.1.3. Texture
16.2. Interface and Menu Development
 16.2.1. Unity GUI
 16.2.2. Unity UI
 16.2.3. UI Toolkit
16.3. Animation System
 16.3.1. Animation Curves and Keys
 16.3.2. Applied Animation Events
 16.3.3. Modifiers
16.4. Materials and Shaders
 16.4.1. Material Components
 16.4.2. RenderPass Types
 16.4.3. *Shaders*
16.5. Particles
 16.5.1. Particle Systems
 16.5.2. Transmitters and Sub-Transmitters
 16.5.3. Scripting
16.6. Lighting
 16.6.1. Lighting Modes
 16.6.2. Light Baking
 16.6.3. Light Probes
16.7. Mecanim
 16.7.1. State Machines, SubState Machines and Transitions between Animations
 16.7.2. *Blend Trees*
 16.7.3. Animation Layers and IK
16.8. Cinematic Finish
 16.8.1. Timeline
 16.8.2. Post-Processing Effects
 16.8.3. Universal Render and High-Definition Render Pipeline
16.9. Advanced VFX
 16.9.1. VFX Graph
 16.9.2. Shader Graph
 16.9.3. Pipeline Tools
16.10. Audio Components
 16.10.1. Audio Source and Audio Listener
 16.10.2. Audio Mixer
 16.10.3. Audio Spatializer

## **Module 17.** Programming, Mechanics Generation and Video Game Prototyping Techniques

17.1. Technical Process
 17.1.1. Low-Poly and High-Poly Unity Models
 17.1.2. Material Settings
 17.1.3. High-Definition Render Pipeline
17.2. Character Design
 17.2.1. Movement
 17.2.2. Collider Design
 17.2.3. Creation and Behavior
17.3. Importing Skeletal Meshes into Unity
 17.3.1. Exporting Skeletal Meshes from the 3D Software
 17.3.2. Skeletal Meshes in Unity
 17.3.3. Anchor Points for Accessories
17.4. Importing Animations
 17.4.1. Animation Preparation
 17.4.2. Importing Animations
 17.4.3. Animator and Transitions

17.5. Animation Editor
 17.5.1. Creating Blend Spaces
 17.5.2. Creating Animation Montage
 17.5.3. Editing Read-Only Animations
17.6. Ragdoll Creation and Simulation
 17.6.1. Configuration of a Ragdoll
 17.6.2. Ragdoll to Animation Graphics
 17.6.3. Simulation of a Ragdoll
17.7. Resources for Character Creation
 17.7.1. Libraries
 17.7.2. Importing and Exporting Library Materials
 17.7.3. Handling of Materials
17.8. Work Teams
 17.8.1. Hierarchy and Work Roles
 17.8.2. Version Control Systems
 17.8.3. Conflict Resolution
17.9. Requirements for Successful Development
 17.9.1. Production for Success
 17.9.2. Optimal Development
 17.9.3. Essential Requirements
17.10. Publication Packaging
 17.10.1. *Player Settings*
 17.10.2. *Build*
 17.10.3. Installer Creation

## **Module 18.** VR Immersive Game Development

18.1. Uniqueness of VR
 18.1.1. Traditional Video Games and VR. Differences
 18.1.2. Motion Sickness: Smoothness vs. Effects
 18.1.3. Unique VR Interactions
18.2. Interaction
 18.2.1. Events
 18.2.2. Physical Triggers
 18.2.3. Virtual vs. Real World
18.3. Immersive Locomotion
 18.3.1. Teletransportation
 18.3.2. Arm Swinging
 18.3.3. Forward Movement with and without Facing
18.4. VR Physics
 18.4.1. Grippable and Throwable Objects
 18.4.2. Weight and Mass in VR
 18.4.3. Gravity in VR
18.5. UI in VR
 18.5.1. Positioning and Curvature of UI Elements
 18.5.2. VR Menu Interaction Modes
 18.5.3. Best Practices for Comfortable Experiences
18.6. VR Animation
 18.6.1. Animated Model Integration in VR
 18.6.2. Animated Objects and Characters vs. Physical Objects
 18.6.3. Animated vs. Procedural Transitions
18.7. Avatars
 18.7.1. Avatar Representation from Your Own Eyes
 18.7.2. External Representation of Avatars
 18.7.3. Inverse Cinematic and Procedural Avatar Animation
18.8. Audio
 18.8.1. Configuring Audio Sources and Audio Listeners for VR
 18.8.2. Effects Available for More Immersive Experiences
 18.8.3. VR Audio Spatializer
18.9. VR and AR Project Optimization
 18.9.1. *Occlusion Culling*
 18.9.2. *Static Batching*
 18.9.3. Quality Settings and Render Pass Types
18.10. Practice: VR Escape Room
 18.10.1. Experience Design
 18.10.2. Scenario Layout
 18.10.3. Mechanic Development

## Module 19. Professional Audio for 3d VR Video Games

19.1. Professional 3D Video Games Audio
- 19.1.1. Video Game Audio
- 19.1.2. Audio Style Types in Current Video Games
- 19.1.3. Spatial Audio Models

19.2. Preliminary Material Study
- 19.2.1. Game Design Documentation Study
- 19.2.2. Level Design Documentation Study
- 19.2.3. Complexity and Typology Evaluation to Create Audio Projects

19.3. Sound Reference Studio
- 19.3.1. Main References List by Similarity with the Project
- 19.3.2. Auditory References from Other Media to Give Video Games Identity
- 19.3.3. Reference Study and Drawing of Conclusions

19.4. Sound Identity Design for Video Games
- 19.4.1. Main Factors Influencing the Project
- 19.4.2. Relevant Aspects in Audio Composition: Instrumentation, Tempo, etc
- 19.4.3. Voice Definition

19.5. Soundtrack Creation
- 19.5.1. Environment and Audio Lists
- 19.5.2. Definition of Motif, Themes and Instrumentation
- 19.5.3. Composition and Audio Testing of Functional Prototypes

19.6. Sound Effect Creation (FX)
- 19.6.1. Sound Effects: FX Types and Complete Lists According to Project Needs
- 19.6.2. Definition of Motif, Themes and Creation
- 19.6.3. Sound FX Evaluation and Functional Prototype Testing

19.7. Voice Creation
- 19.7.1. Voice Types and Phrase Listing
- 19.7.2. Search and Evaluation of Voice Actors and Actresses
- 19.7.3. Recording Evaluation and Testing of Voices on Functional Prototypes

19.8. Audio Quality Evaluation
- 19.8.1. Elaboration of Listening Sessions with the Development Team
- 19.8.2. All Audio Integration into Working Prototypes
- 19.8.3. Testing and Evaluation of the Results Obtained

19.9. Project Exporting, Formatting and Importing Audio
- 19.9.1. Video Game Audio Formats and Compression
- 19.9.2. Exporting Audio
- 19.9.3. Importing Project Audio

19.10. Preparing Audio Libraries for Marketing
- 19.10.1. Versatile Sound Library Design for Video Game Professionals
- 19.10.2. Audio Selection by Type: Soundtrack, FX and Voices
- 19.10.3. Commercialization of Audio Asset Libraries

## Module 20. Video Game Production and Financing

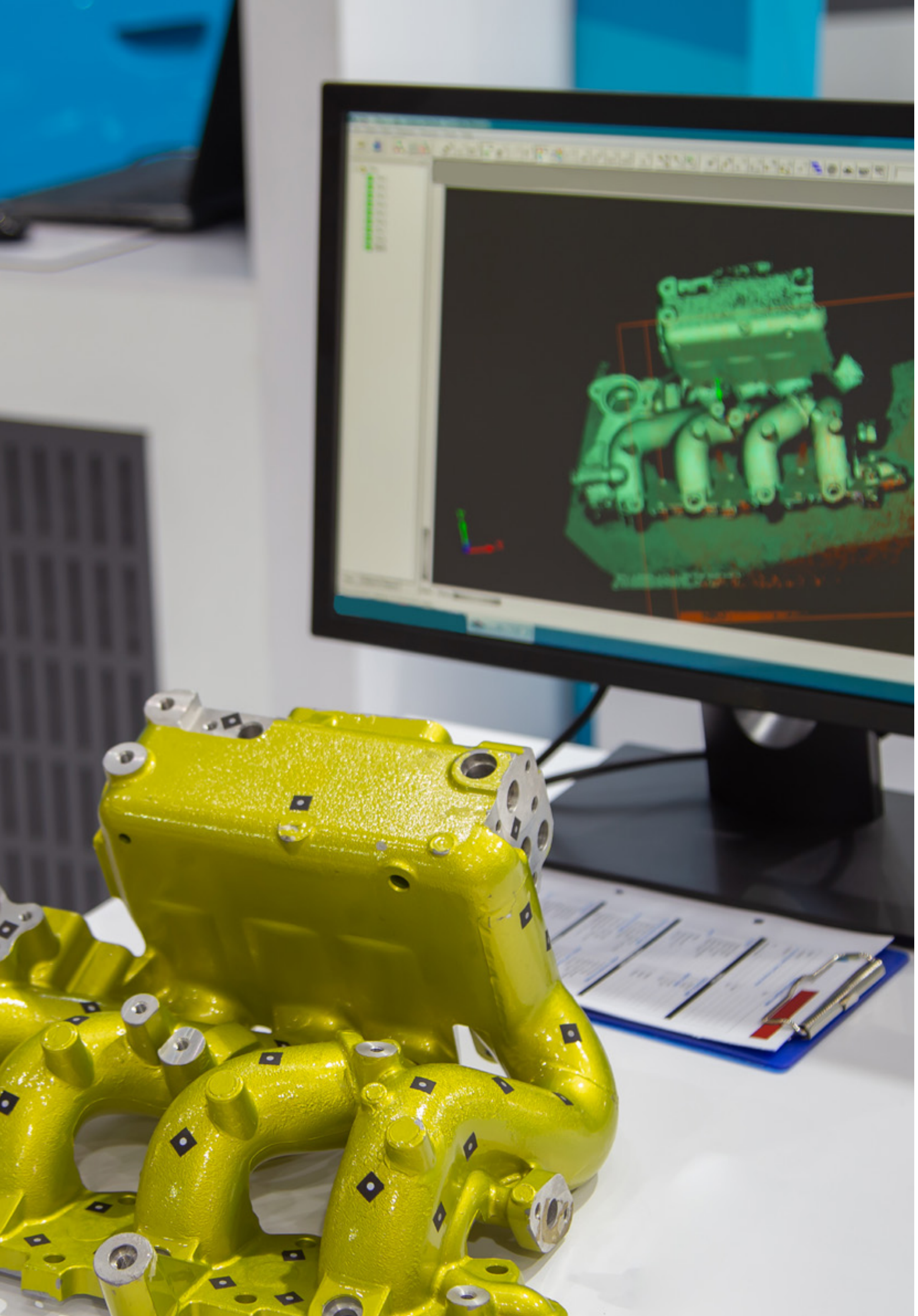
20.1. Video Game Production
- 20.1.1. Cascading Methodologies
- 20.1.2. Case Studies on Lack of Project Management and Work Plan
- 20.1.3. Consequences of the Lack of a Production Department in the Video Game Industry

20.2. Development Teams
- 20.2.1. Key Departments in Project Development
- 20.2.2. Key Profiles in Micromanagement: LEAD and SENIOR
- 20.2.3. Problems of Lack of Experience in JUNIOR Profiles
- 20.2.4. Establishment of Training Plan for Low-Experience Profiles

20.3. Agile Methodologies in Video Game Development
- 20.3.1. SCRUM
- 20.3.2. AGILE
- 20.3.3. Hybrid Methodologies

20.4. Effort, Time and Cost Estimates
- 20.4.1. Video Game Development Costs: Main Concepts and Expenses
- 20.4.2. Task Scheduling: Critical Points, Keys and Aspects to Consider
- 20.4.3. Estimates based on VS Stress Points Calculated in Hours

20.5. Prototype Planning Prioritization
- 20.5.1. Establishment of General Project Objectives
- 20.5.2. Prioritization of Key Functionalities and Contents: Order and Needs by Department
- 20.5.3. Grouping of Functionalities and Contents in Production to Constitute Deliverables (Functional Prototypes)





20.6. Best Practices in Video Game Production
- 20.6.1. Meetings, Dailies, Weekly Meetings, End of Sprint Meetings, and ALPHA, BETA and RELEASE Milestone Review Meetings
- 20.6.2. Sprint Speed Measurement
- 20.6.3. Lack of Motivation and Low Productivity Detection and Anticipation of Potential Production Problems

20.7. Production Analysis
- 20.7.1. Preliminary Analysis I: Market Status Review
- 20.7.2. Preliminary Analysis 2: Establishment of Main Project References (Direct Competitors)
- 20.7.3. Previous Analyses Conclusions

20.8. Development Cost Calculation
- 20.8.1. Human Resources
- 20.8.2. Technology and Licensing
- 20.8.3. External Development Expenses

20.9. Investment Search
- 20.9.1. Types of Investors
- 20.9.2. Executive Summary
- 20.9.3. Pitch Deck
- 20.9.4. Publishers
- 20.9.5. Self-Financing

20.10. Project Post-Mortem Elaboration
- 20.10.1. Post-Mortem Elaboration Process in the Company
- 20.10.2. Positive Aspect Analysis of the Project
- 20.10.3. Negative Aspect Analysis of the Project
- 20.10.4. Improvement Proposal on the Project's Negative Points and Conclusions

04

# Teaching Objectives

This TECH Advanced Master's Degree has been designed with the aim of providing professionals with the technical and creative tools necessary to lead innovative projects in key sectors such as entertainment, health, and industry. An academic experience that will enable graduates to excel in a rapidly growing field, enhancing their professional profile and career prospects.

*A revolutionary postgraduate degree that will transform your professional future in advanced technology. What are you waiting for? Enroll now and become part of the world's largest online university, according to Forbes!"*

## General Objectives

- Design immersive environments using virtual reality technologies
- Apply computer vision techniques in automated processes
- Integrate virtual reality systems into engineering and design projects
- Develop interactive solutions using immersive technologies
- Implement image detection and recognition algorithms
- Optimize industrial processes using computer vision
- Create realistic simulations for professional training and education
- Analyze visual data using neural networks and deep learning
- Program virtual reality applications with real-time interaction
- Evaluate the performance of computer vision systems in different environments
- Use advanced sensors and cameras to capture visual information
- Innovate user experiences using immersive technologies
- Manage technology projects that integrate VR and computer vision
- Automate tasks through intelligent image processing
- Apply computer vision in sectors such as healthcare, security, and industry
- Develop immersive interfaces adapted to different devices
- Model 3D environments for augmented and virtual reality experiences
- Research new applications of computer vision in everyday life
- Implement collaborative virtual reality environments for remote work
- Lead digital transformation processes with advanced visual technologies

## Specific Objectives

### Module 1. Computer Vision

- Establishing how the human vision system works and how an image is digitized
- Analyze the evolution of computer vision

### 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

### Module 3. Digital Image Processing

- Examine commercial and open-source digital image processing libraries.
- Introduce image filters

### Module 4. Advanced Digital Image Processing

- Examine advanced digital image processing filters
- Determine contour extraction and analysis tools

### Module 5. 3D Image Processing

- Analyze the software used for 3D data processing
- Determine the relevant data in a 3D image

### Module 6. *Deep Learning*

- Analyze the families that make up the artificial intelligence world.
- Compile the main Frameworks of Deep Learning

### Module 7. Convolutional Neural Networks and Image Classification

- Generate specialized knowledge on convolutional neural networks
- Analyze the performance of CNNs for image classification

### Module 8. Object Detection

- Analyze how object detection networks work
- Examine traditional methods

### Module 9. Image Segmentation with Deep Learning

- Analyze how semantic segmentation networks work
- Examine evaluation metrics and different architectures

### Module 10. Advanced Image Segmentation and Advanced Computer Vision Techniques

- Generate specialized knowledge on the handling of tools
- Identify the structure of a segmentation project

### Module 11. The 3D Industry

- Examine the current state of the 3D industry, as well as its evolution over the last few years
- Generate specialized knowledge about the software commonly used within the industry to generate professional 3D content

### Module 12. Art and 3D in the Video Game Industry
- Examine 3D mesh creation and image editing software
- Analyze the possible problems and resolution in 3D VR projects

### Module 13. Advanced 3D
- Master the most advanced 3D modeling techniques
- Develop the necessary knowledge for 3D texturing

### Module 14. 3D Animation
- Develop specialized knowledge in the use of 3D animation software
- Determine the similarities and differences between a biped and a quadruped

### Module 15. Unity 3D and Artificial Intelligence Proficiency
- Analyze decision history from the technological point of view of video game evolution
- Generate specialized knowledge on Scripting and use of third party Plugins in the development of our content

### Module 16. 2D and 3D Video Game Development
- Learn how to use raster graphic resources to integrate into 3D video games
- Implement interfaces and menus for 3D video games, easy to apply to VR environments



### Module 17. Programming, Mechanics Generation and Video Game Prototyping Techniques

- Work with low-poly and high-poly models in professional developments under Unity 3D environment
- Implement advanced functionalities and behaviors in characters for video games

### Module 18. VR Immersive Game Development

- Determine the main differences between traditional video games and video games based on VR environments
- Modify interaction systems to adapt to Virtual Reality

### Module 19. Professional Audio for 3d VR Video Games

- Analyze the different types of audio styles in video games and industry trends
- Examine methods for studying project documentation to build audio

### Module 20. Video Game Production and Financing

- Determine the differences between production methodologies prior to SCRUM and their evolution to the present day
- Apply Agile thinking to any development without losing project management

05

# Career Opportunities

Upon completion of this Advanced Master's Degree, graduates will have advanced knowledge of cutting-edge technologies such as Digital Image Processing, Deep Learning, and 3D Modeling. This will enable them to implement innovative solutions in sectors such as entertainment, healthcare, and industry. In addition, they will be trained to develop technological projects that transform markets and improve processes, standing out as leaders in a constantly evolving field.

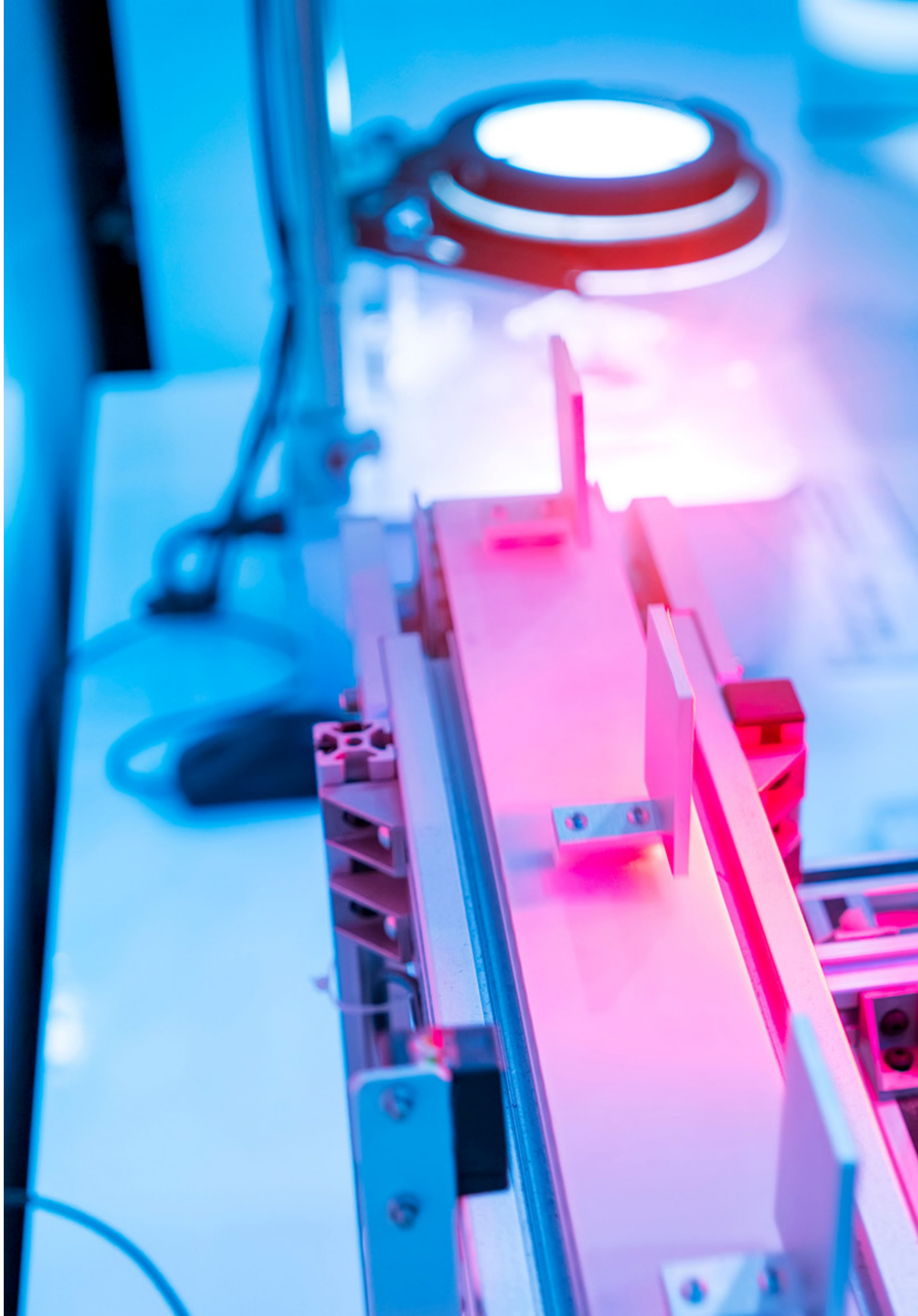

*You will apply innovative technological approaches to create immersive experiences and solve complex challenges in different industries"*

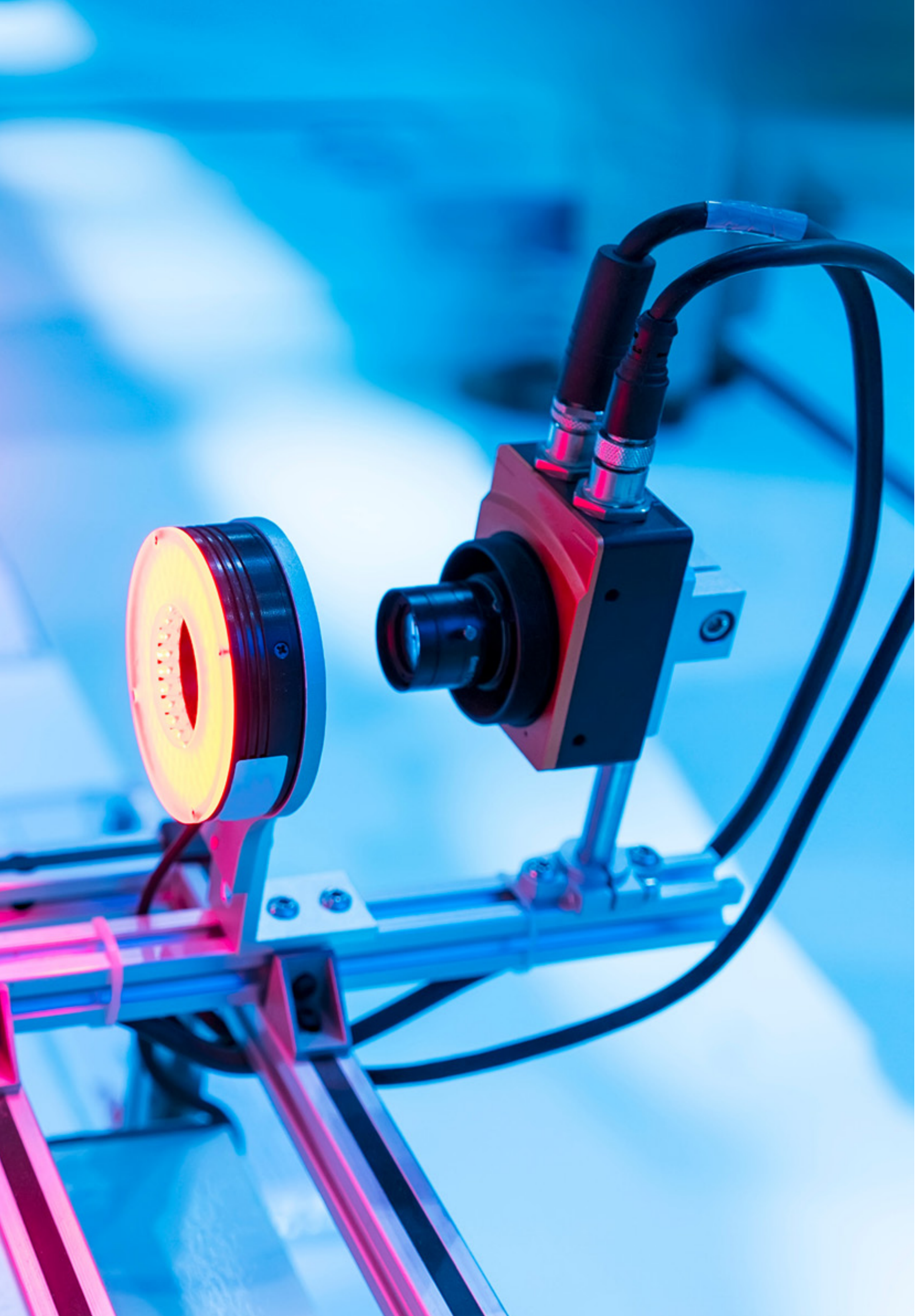
### Graduate Profile

Graduates will be highly skilled professionals capable of leading technological development projects in areas such as artificial intelligence, video game creation, and 3D content generation. They will have in-depth knowledge of advanced tools such as Unity 3D, ZBrush, and 3D Max, along with skills in designing, programming, and implementing immersive solutions. In addition, they will be able to analyze and apply complex algorithms in industrial, medical, and commercial applications.

*You will combine advanced technical knowledge with practical skills to develop innovative projects that transform key sectors such as healthcare, entertainment, and industry.*

- **Immersive Experience Development:** Ability to design virtual reality environments and increase interaction between users and systems
- **3D Modeling and Animation:** Mastery of tools for creating complex characters and scenarios
- **Implementation of Artificial Intelligence:** Application of Deep Learning and Convolutional Network algorithms in various contexts
- **Technological Leadership:** Ability to coordinate multidisciplinary teams in high-tech projects





After completing the university program, you will be able to apply your knowledge and skills in the following positions:

1. **Virtual and Augmented Reality Developer:** Designer of interactive immersive experiences.
2. **Computer Vision Engineer:** Responsible for applying image analysis techniques in industrial and commercial environments.
3. **3D Modeler and Animator:** Designer of characters and settings for video games, film, and virtual reality.
4. **Technology Project Leader:** Coordinator and supervisor of technological innovation initiatives.
5. **Artificial Intelligence Researcher:** Responsible for developing deep learning algorithms and applications.
6. **Digital Transformation Consultant:** Advisor for the integration of immersive technologies in companies from various industries.

*Complete this Advanced Master's Degree and stand out in a global job market as a leader in Virtual Reality and Computer Vision”*

06

# 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.

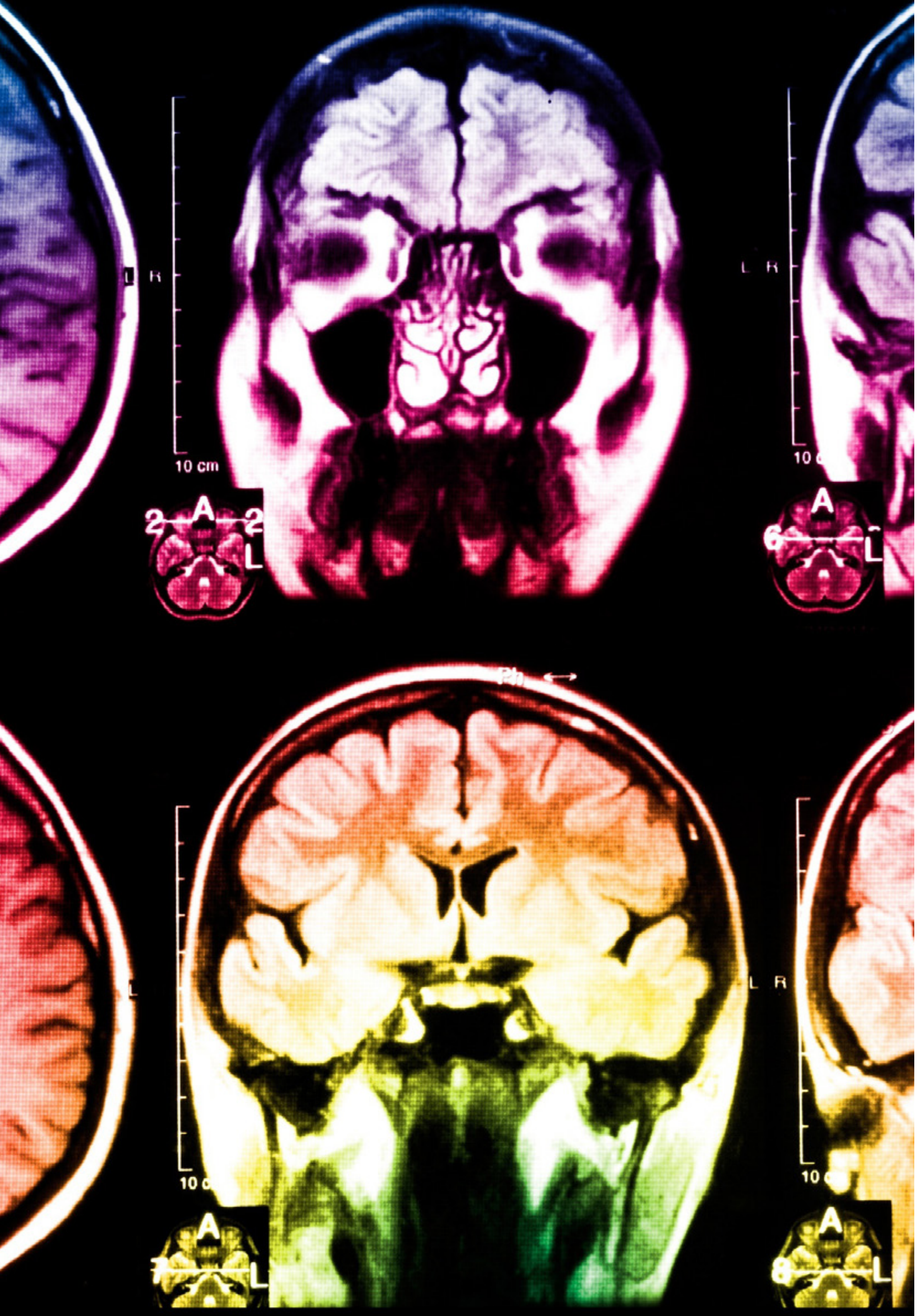
In order to facilitate tutor-student contact as much as possible, you will have a wide range of communication possibilities, both in real time and delayed (internal messaging, telephone answering service, email contact with the technical secretary, chat and videoconferences).

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

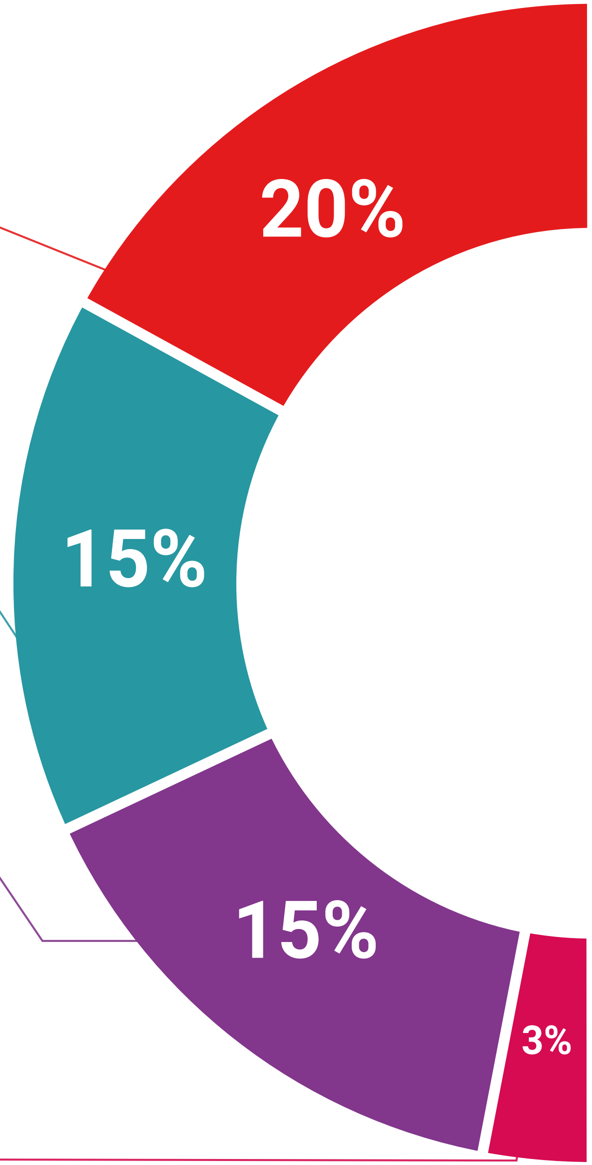
The results of this innovative teaching model can be seen in the overall satisfaction levels of TECH graduates.

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

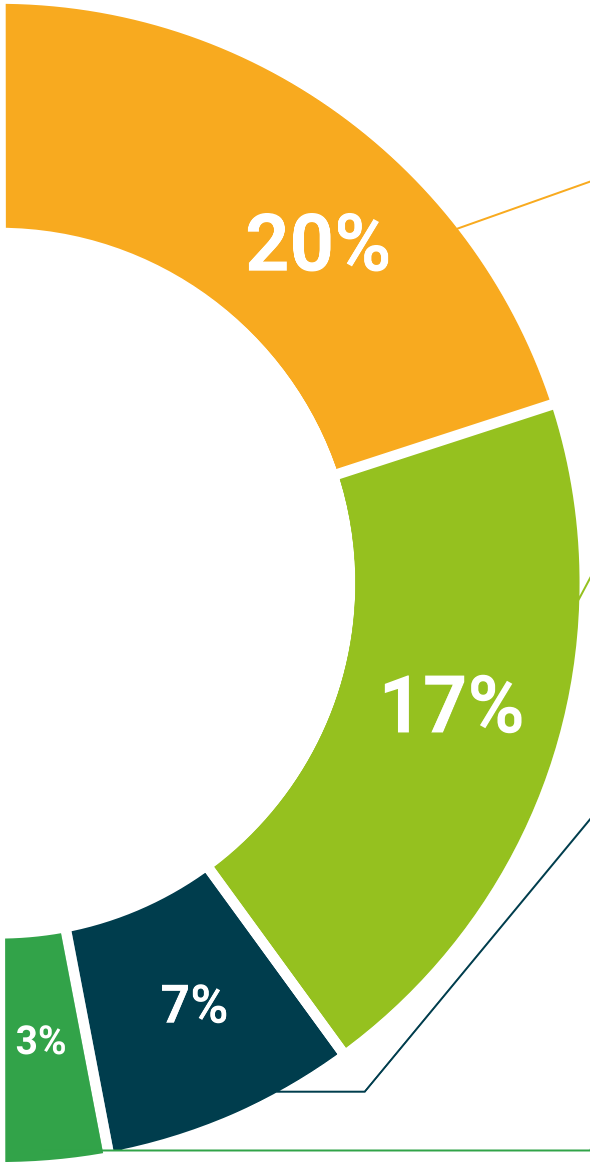
You will carry out activities to develop specific competencies and skills in each thematic field. Exercises and activities to acquire and develop the skills and abilities that a specialist needs to develop within the framework of the globalization we live in.

### 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.




**Case Studies**

Students will complete a selection of the best case studies in the field. Cases that are presented, analyzed, and supervised by the best specialists in the world.

**Testing & Retesting**

We periodically assess and re-assess your knowledge throughout the program. We do this on 3 of the 4 levels of Miller's Pyramid.

**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 for future difficult decisions.

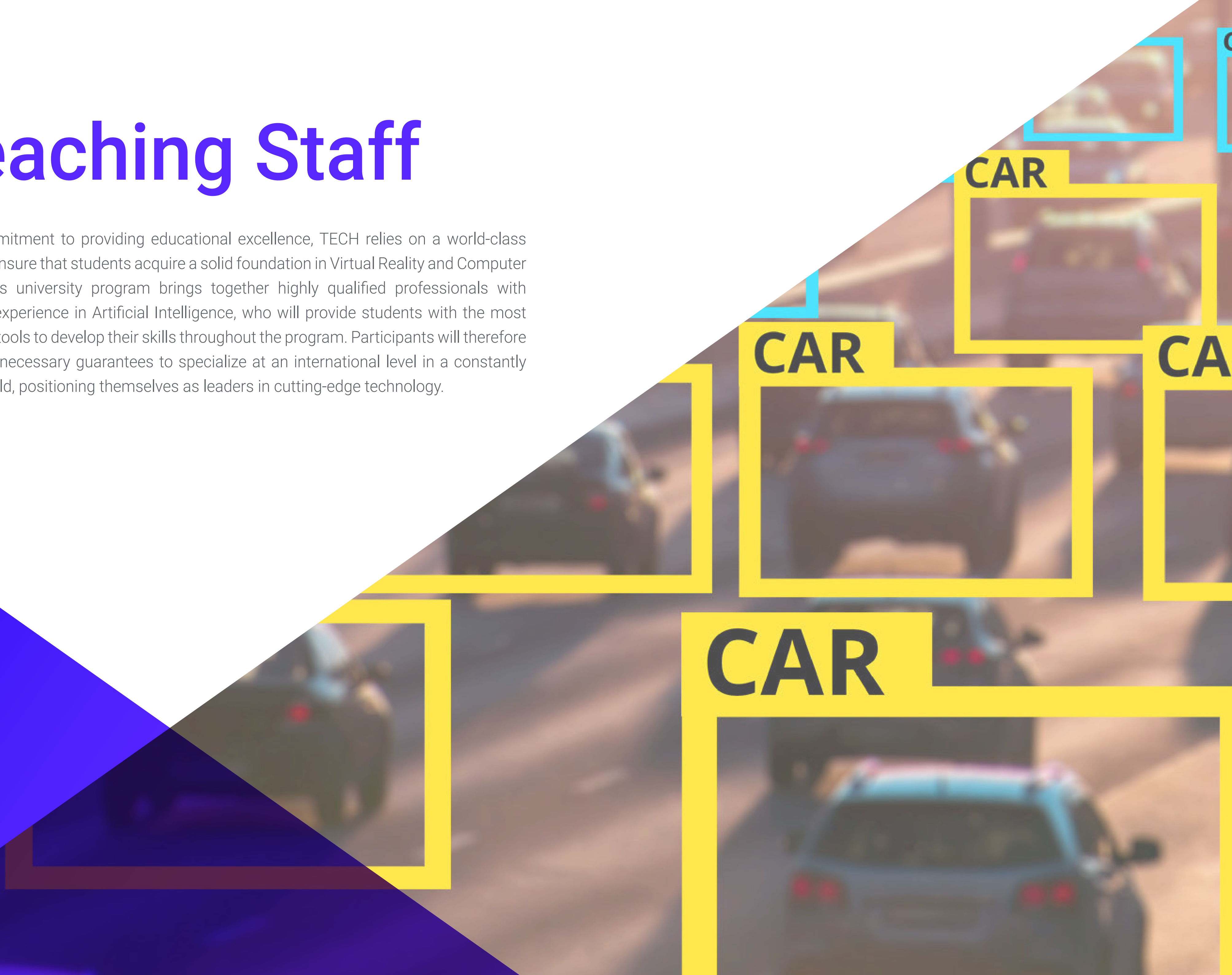
**Quick Action Guides**

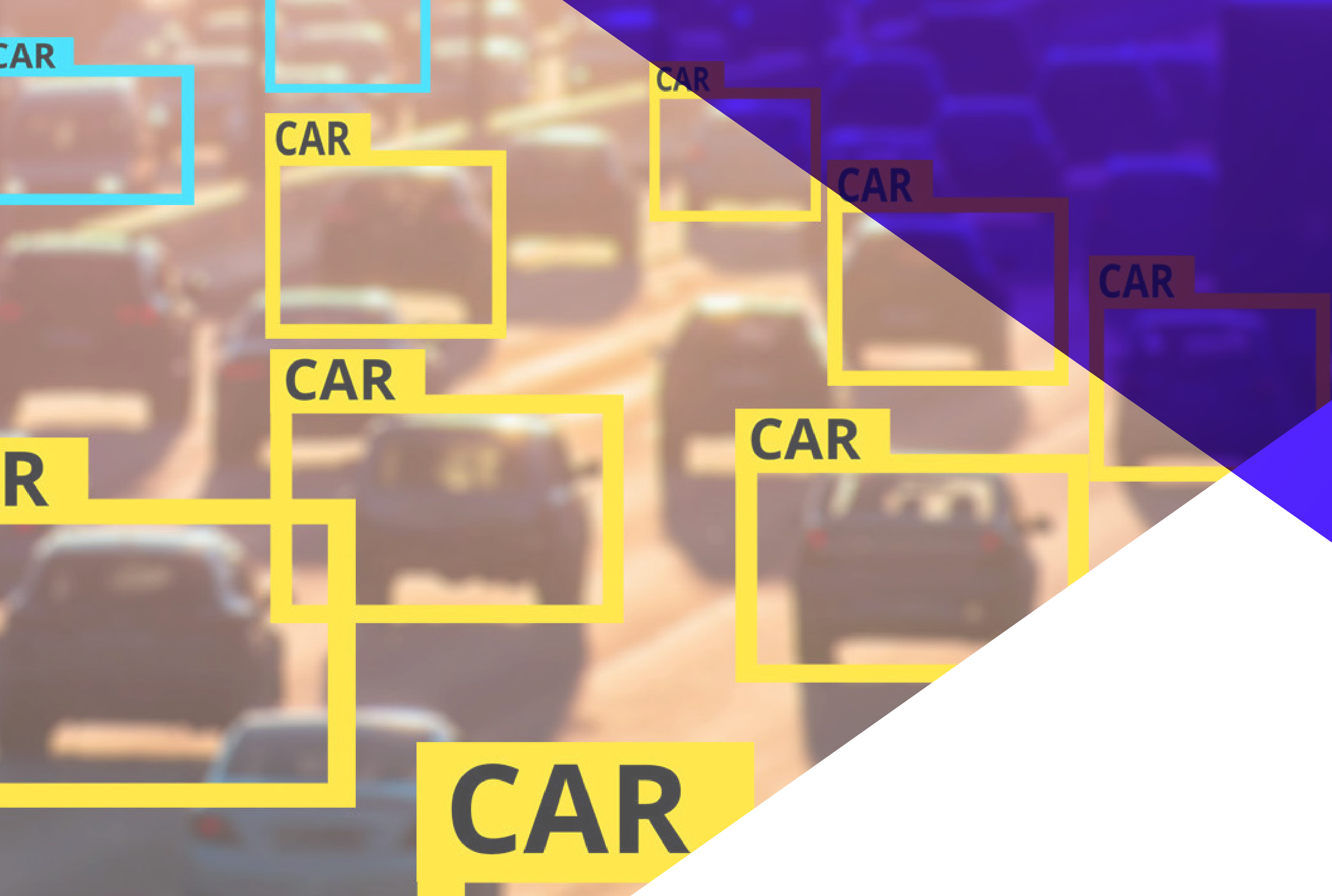
TECH offers the most relevant contents of the course in the form of worksheets or quick action guides. A synthetic, practical and effective way to help students progress in their learning.

07

# Teaching Staff

In its commitment to providing educational excellence, TECH relies on a world-class faculty to ensure that students acquire a solid foundation in Virtual Reality and Computer Vision. This university program brings together highly qualified professionals with extensive experience in Artificial Intelligence, who will provide students with the most innovative tools to develop their skills throughout the program. Participants will therefore obtain the necessary guarantees to specialize at an international level in a constantly growing field, positioning themselves as leaders in cutting-edge technology.






*"Succeed alongside the best and acquire the knowledge and skills you need to excel in Virtual Reality and Computer Vision"*

## Management

### Mr. Redondo Cabanillas, Sergio

- Specialist in Machine Vision Research and Development at BCN Vision
- Development and Backoffice Team Leader at BCN Vision
- Project and Development Director of Machine Vision Solutions
- Sound Technician at Media Arts Studio
- Technical Engineering in Telecommunications with specialization in Image and Sound by the Polytechnic University of Catalonia
- Degree in Artificial Intelligence applied to Industry from the Autonomous University of Barcelona
- Higher Grade Training Cycle in Sound by CP Villar

### Mr. Ortega Ordóñez, Juan Pablo

- Director of Engineering and Gamification Design for the Intervenía Group
- Professor at ESNE of Video Game Design, Level Design, Video Game Production, Middleware, Creative Media Industries, etc
- Advisor in the foundation of companies such as Avatar Games or Interactive Selection
- Author of the book Video Game Design
- Member of the Advisory Board of Nima World

## Professors

### Mr. Gutiérrez Olabarría, José Ángel

- Project Management, Software Analysis and Design and C Programming of Quality Control and Industrial Informatics Applications
- Specialist Engineer in Machine Vision and Sensors
- Market Manager of the Iron and Steel Sector, performing functions of Customer Contact, Recruitment, Market Plans and Strategic Accounts
- Computer Engineer by the University of Deusto
- Master’s Degree in Robotics and Automation from ETSII/IT of Bilbao
- Diploma in Advanced Studies in Automation and Electronics Doctorate Program by ETSII/IT of Bilbao

### Mr. Enrich Llopart, Jordi

- Chief Technology Officer of Bcnvision - Computer Vision
- Project and application engineer Bcnvision - Computer Vision
- Project and application engineer PICVISA Machine Vision
- Degree 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

### Dr. Riera i Marín, Meritxell

- Deep Learning Systems Developer at Sycai Medical
- Researcher at Centre National de la Recherche Scientifique (CNRS), France
- Software Engineer at Zhilabs
- IT Technician, Mobile World Congress
- Software Engineer at Avanade
- Engineering of Telecommunications by the Polytechnic University of Catalonia
- *Master of Science:* Signal, Image, Embedded Systems and Automation Specialization (SISEA) at IMT Atlantique, France
- Master's Degree in Telecommunications Engineering from the Polytechnic University of Catalonia

### 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
- 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
- Industrial Engineer by Miguel Hernández University

**Mr. Higón Martínez, Felipe**
- Electronics, Telecommunications and Computer Engineer
- Validation and Prototyping Engineer
- Applications Engineer
- Support Engineer
- Master's Degree in Advanced and Applied Artificial Intelligence by IA3
- Technical Engineer in Telecommunications
- Degree in Electronic Engineering from the University of Valencia

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

**Mr. Delgado Gonzalo, Guillem**
- Computer Vision and Artificial Intelligence Researcher at Vicomtech
- Computer Vision and Artificial Intelligence Engineer at Gestoos
- Junior Engineer at Sogeti
- Degree in Audiovisual Systems Engineering from the Polytechnic University of Catalonia
- MSc in Computer Vision at Universitat Autónoma de Barcelona
- Degree in Computer Science at Aalto University
- Degree in Audiovisual Systems UPC - ETSETB Telecos BCN

**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)
- 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 from the Polytechnic University of Catalonia
- BSc in Telecommunications Technologies and Services Engineering, mention in Audiovisual Systems from the Polytechnic University of Catalonia

**Mr. Olivo García, Alejandro**
- Vision Application Engineer at Bcnvision
- Degree in Industrial Technologies Engineering from the School of Industrial Engineering of the Polytechnic University of Cartagena
- Master's Degree in Industrial Engineering from the School of Industrial Engineering of the Polytechnic University of Cartagena
- Research Chair Scholarship for the company MTorres
- Programming in C# .NET in Computer Vision Applications

### Mr. Núñez Martín, Daniel

- Producer at Cateffects S.L
- Music producer specialized in the composition and design of original music for audiovisual media and video games
- Audio designer and music composer at Risin' Goat
- Sound Technician for Audiovisual Dubbing at SOUNDUB S.A
- Content creator for the Talentum Master in Video Game Creation at Telefónica Educación Digital
- Higher Technician in Professional Sound Training from the Francisco de Vitoria University
- Intermediate Degree of Official Music Education by the Conservatorio Manuel de Falla, specializing in Piano and Saxophone

### Dr. Pradana, Noel

- Specialist in Rigging and 3D Animation for videogames
- 3D Graphic Artist at Dog Lab Studios
- Producer at Imagine Games leading the video game development team
- Graphic artist at Wildbit Studios with 2D and 3D works
- Teaching experience in ESNE and in the CFGS in 3D Animation: games and educational environments
- Masters Degree in Video Game Design and Development from ESNE University
- Master's Degree for Teachers by URJC
- Specialist in Rigging and 3D Animation Voxel School

### Mr. Martínez Alonso, Sergio

- Senior Unity Developer at NanoReality Games Ltd
- Lead Programmer and Game Designer at NoobO Games
- Teacher in several educational centers such as iFP, Implika or Rockbotic
- Programmer at Stage Clear Studios
- Professor at the University School of Design, Innovation and Technology
- Degree in Computer Engineering from the University of Murcia
- Professional Masters Degree in Video Game Design and Development from the University School of Design, Innovation and Technology

### Mr. Ferrer Mas, Miquel

- Senior Unity Developer at Quantic Brains
- Lead programmer at Big Bang Box
- Co-founder and programmer of Videogames at Carbonbyte
- Audiovisual Programmer at Unkasoft Advergaming
- Videogame programmer at Enne
- Design Director at Bioalma
- Superior Technician in Computer Science at Na Camel-la
- Master's Degree in Video Game Programming by CICE
- Introduction to Deep Learning with PyTorch course by Udacity

08

# Certificate

The Advanced Master's Degree in Virtual Reality and Computer Vision guarantees students, in addition to the most rigorous and up-to-date education, access to a diploma for the Advanced Master's Degree 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 diploma for the **Advanced Master's Degree in Virtual Reality and 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: **Advanced Master's Degree in Virtual Reality and Computer Vision**

Modality: **online**

Duration: **2 years**

Accreditation: **120 ECTS**


tech global university

Mr./Ms. ________________, with identification document ____________
has successfully passed and obtained the title of:

**Advanced Master's Degree in Virtual Reality and Computer Vision**

This is a private qualification of 3,600 hours of duration equivalent to 120 ECTS, with a start date of dd/mm/yyyy and an end date of dd/mm/yyyy.

TECH Global University is a university officially recognized by the Government of Andorra on the 31st of January of 2024, which belongs to the European Higher Education Area (EHEA).

In Andorra la Vella, on the 28th of February of 2024

Dr. Pedro Navarro Illana
Dean

Unique TECH Code: AFWORD23S techtitute.com/certificates


Advanced Master's Degree in Virtual Reality and Computer Vision

General Structure of the Syllabus

| Year | Subject | ECTS | Type | Year | Subject | ECTS | Type |
|---|---|---|---|---|---|---|---|
| 1º | Computer Vision | 6 | CO | 2º | The 3D Industry | 6 | CO |
| 1º | Applications and State-of-the-Art | 6 | CO | 2º | Art and 3D in the Video Game Industry | 6 | CO |
| 1º | Digital Image Processing | 6 | CO | 2º | Advanced 3D | 6 | CO |
| 1º | Digital Image Processing | 6 | CO | 2º | 3D Animation | 6 | CO |
| 1º | Image Processing | 6 | CO | 2º | Unity 3D and Artificial Intelligence Proficiency | 6 | CO |
| 1º | Deep Learning | 6 | CO | 2º | 2D and 3D Video Game Development | 6 | CO |
| 1º | Convolutional Neural Networks and Image Classification | 6 | CO | 2º | Programming, Mechanics Generation and Video Game | 6 | CO |
| 1º | Object Detection | 6 | CO | 2º | Prototyping Techniques | | CO |
| 1º | Image Segmentation with Deep Learning | 6 | CO | 2º | VR Immersive Game Development | 6 | CO |
| 1º | Advanced Image Segmentation and Advanced Computer | 6 | CO | 2º | Professional Audio for 3d VR Video Games | 6 | CO |
| 1º | Vision Techniques | 6 | CO | 2º | Video Game Production and Financing | 6 | CO |

Dr. Pedro Navarro Illana
Dean

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

# Advanced Master's Degree
## Virtual Reality and Computer Vision

- » Modality: **online**
- » Duration: **2 years**
- » Certificate: **TECH Global University**
- » Accreditation: **120 ECTS**
- » Schedule: **at your own pace**
- » Exams: **online**

# Advanced Master's Degree
## Virtual Reality and Computer Vision

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