Advanced Master's Degree
Robotics and Computer Vision

tech global university

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Advanced Master's Degree
Robotics 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-robotics-computer-vision**

Index

01
Introduction to the Program

Currently, robotics and computer vision are revolutionizing the world by transforming everyday processes and solving complex challenges. These technologies have enabled advancements such as the creation of autonomous vehicles and intelligent agricultural systems that optimize resources for a more sustainable future. For this reason, at the forefront of Artificial Intelligence, TECH, the world's largest online university according to Forbes, has designed this university program. The aim is to create professionals who develop both the knowledge and skills to excel and make an impact in this field. The best part is that it is based on a 100% online methodology.

"Transform how the world works and lives; learn to automate processes with this Advanced Master's Degree 100% online from TECH"

Artificial vision is not only simplifying our daily lives but also paving the way toward a more connected and technological future. Thanks to AI, computer vision systems can analyze images, identify patterns, and make decisions with astonishing accuracy, while robots learn from their environment and perform complex tasks autonomously.

Iconic companies like Boston Dynamics, NVIDIA, and Tesla are leading a revolutionary transformation in the tech industry by merging robotics, computer vision, and Artificial Intelligence to redefine key sectors. An outstanding example is the robots from Boston Dynamics, true marvels of engineering capable of navigating complex terrains and performing tasks with remarkable precision. Tesla, in turn, is setting milestones in mobility with its autonomous driving systems, which use computer vision to interpret and respond to real-time traffic conditions. Similarly, giants like Amazon and Google are also at the forefront, integrating these technologies into logistics through autonomous robots and drones. These companies are not just creating smarter and more autonomous machines, but they are building a future where efficiency and collaboration between humans and machines thrive. The urgent need for professionals focused on overcoming current and incredible stereotypes is the driving force behind this Advanced Master's Degree. This program aims to specialize students in the most advanced knowledge and skills in robotics with an up-to-date curriculum and syllabus.

What makes this program stand out is its 100% online methodology, designed so that students can balance their studies with their daily responsibilities, whether work or family-related. Moreover, it incorporates the innovative Relearning learning method, which adapts to each student's pace and ensures that knowledge is assimilated effectively and durably. Of course, such a high-level specialization requires a faculty of excellence, and this program is no exception. Every detail is carefully designed to create specialists who are prepared to excel in the workforce from day one.

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

- The development of practical cases presented by experts in Robotics 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 Robotics and Computer Vision
- 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

Break all boundaries with Robotics and AI, exploring both on Earth and beyond”

The true technological revolution begins with the most innovative teaching methodology in the current academic landscape"

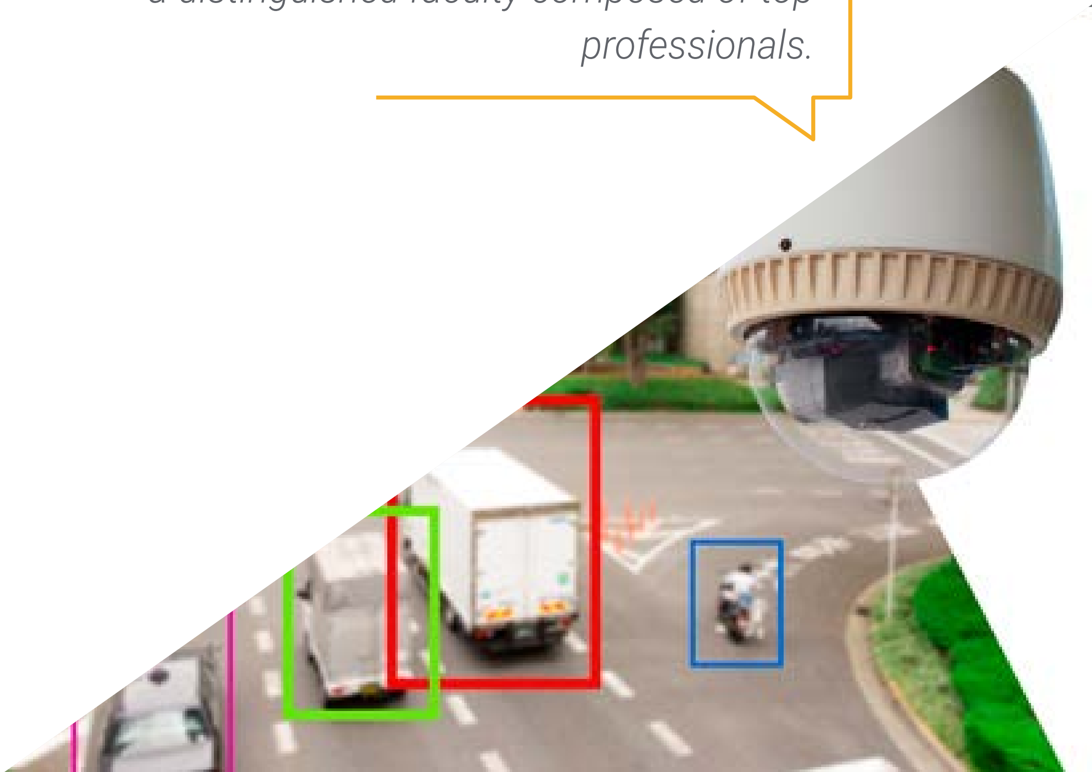
Free yourself from the toughest challenges of AI advancement by learning through TECH's unique learning method.

Discover new horizons and dare to explore the unknown with the guidance of a distinguished faculty composed of top professionals.

It includes in its teaching staff professionals belonging to the field of Robotics and Computer Vision, who pour into this program the experience of their work, in addition to recognized 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.



02

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.

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 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.

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.

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.

03

Syllabus

The syllabus of this university program is designed to shape the leaders of the future in cutting-edge technologies, integrating theory and practice in an innovative and multidisciplinary approach. Learning is enriched with practical applications in high-impact fields such as industrial automation, autonomous vehicles, state-of-the-art drones, and medical robotics. To complement this comprehensive approach, the program includes seminars on ethics, sustainability, and the social impact of these disruptive technologies. Together, this program prepares professionals to lead the technological transformation, paving the way for a more efficient, intelligent, and connected future.

Learn how computer vision is teaching us to view the world in ways we once thought impossible"

Module 1. Robotics. Robot Design and Modeling

1.1. Robotics and Industry 4.0
- 1.1.1. Robotics and Industry 4.0
- 1.1.2. Application Fields and Use Cases
- 1.1.3. Sub-Areas of Specialization in Robotics

1.2. Robot Hardware and Software Architectures
- 1.2.1. Hardware Architectures and Real-Time
- 1.2.2. Robot Software Architectures
- 1.2.3. Communication Models and Middleware Technologies
- 1.2.4. Robot Operating System (ROS) Software Integration

1.3. Mathematical Modeling of Robots
- 1.3.1. Mathematical Representation of Rigid Solids
- 1.3.2. Rotations and Translations
- 1.3.3. Hierarchical State Representation
- 1.3.4. Distributed Representation of the State in ROS (TF Library)

1.4. Robot Kinematics and Dynamics
- 1.4.1. Kinematics
- 1.4.2. Dynamics
- 1.4.3. Underactuated Robots
- 1.4.4. Redundant Robots

1.5. Robot Modeling and Simulation
- 1.5.1. Robot Modeling Technologies
- 1.5.2. Robot Modeling with URDF
- 1.5.3. Robot Simulation
- 1.5.4. Modeling with Gazebo Simulator

1.6. Robot Manipulators
- 1.6.1. Types of Manipulator Robots
- 1.6.2. Kinematics
- 1.6.3. Dynamics
- 1.6.4. Simulation

1.7. Land Mobile Robots
- 1.7.1. Types of Terrestrial Mobile Robots
- 1.7.2. Kinematics
- 1.7.3. Dynamics
- 1.7.4. Simulation

1.8. Aerial Mobile Robots
- 1.8.1. Types of Aerial Mobile Robots
- 1.8.2. Kinematics
- 1.8.3. Dynamics
- 1.8.4. Simulation

1.9. Aquatic Mobile Robots
- 1.9.1. Types of Aquatic Mobile Robots
- 1.9.2. Kinematics
- 1.9.3. Dynamics
- 1.9.4. Simulation

1.10. Bioinspired Robots
- 1.10.1. Humanoids
- 1.10.2. Robots with Four or More Legs
- 1.10.3. Modular Robots
- 1.10.4. Robots with Flexible Parts (Soft-Robotics)

Module 2. Intelligent Agents. Applying Artificial Intelligence to Robots and Softbots

2.1. Intelligent Agents and Artificial Intelligence
- 2.1.1. Intelligent Robots. Artificial Intelligence
- 2.1.2. Intelligent Agents
  - 2.1.2.1. Hardware Agents. Robots
  - 2.1.2.2. Software Agents. *Softbots*
- 2.1.3. Robotics Applications

2.2. Brain-Algorithm Connection
- 2.2.1. Biological Inspiration of Artificial Intelligence
- 2.2.2. Reasoning Implemented in Algorithms. Typology
- 2.2.3. Explainability of Results in Artificial Intelligence Algorithms.
- 2.2.4. Evolution of Algorithms up to Deep Learning

2.3. Search Algorithms in the Solution Space
- 2.3.1. Elements in Solution Space Searches
- 2.3.2. Solution Space Search Algorithms in Artificial Intelligence Problems
- 2.3.3. Applications of Search and Optimization Algorithms
- 2.3.4. Search Algorithms Applied to Machine Learning

2.4. Machine Learning
- 2.4.1. Machine Learning
- 2.4.2. Supervised Learning Algorithms
- 2.4.3. Unsupervised Learning Algorithms
- 2.4.4. Reinforcement Learning Algorithms

2.5. Supervised Learning
- 2.5.1. Supervised Learning Methods
- 2.5.2. Decision Trees for Classification
- 2.5.3. Support Vector Machines
- 2.5.4. Artificial Neural Networks
- 2.5.5. Applications of Supervised Learning

2.6. Unsupervised Learning
- 2.6.1. Unsupervised Learning
- 2.6.2. Kohonen Networks
- 2.6.3. Self-Organizing Maps
- 2.6.4. K-Means Algorithm

2.7. Reinforcement Learning
- 2.7.1. Reinforcement Learning
- 2.7.2. Agents Based on Markov Processes
- 2.7.3. Reinforcement Learning Algorithms
- 2.7.4. Reinforcement Learning Applied to Robotics

2.8. Probabilistic Inference
- 2.8.1. Probabilistic Inference
- 2.8.2. Types of Inference and Method Definition
- 2.8.3. Bayesian Inference as a Case Study
- 2.8.4. Nonparametric Inference Techniques
- 2.8.5. Gaussian Filters

2.9. From Theory to Practice: Developing a Robotic Intelligent Agent
- 2.9.1. Inclusion of Supervised Learning Modules in a Robotic Agent
- 2.9.2. Inclusion of Reinforcement Learning Modules in a Robotic Agent
- 2.9.3. Architecture of a Robotic Agent Controlled by Artificial Intelligence
- 2.9.4. Professional Tools for the Implementation of the Intelligent Agent
- 2.9.5. Phases of the Implementation of AI Algorithms in Robotic Agents

Module 3. *Deep Learning*

3.1. Artificial Intelligence
- 3.1.1. *Machine Learning*
- 3.1.2. *Deep Learning*
- 3.1.3. The Explosion of Deep Learning Why Now

3.2. Neural Networks
- 3.2.1. The Neural Network
- 3.2.2. Uses of Neural Networks
- 3.2.3. Linear Regression and Perceptron
- 3.2.4. Forward Propagation
- 3.2.5. *Backpropagation*
- 3.2.6. *Feature Vectors*

3.3. *Loss Functions*
- 3.3.1. *Loss Functions*
- 3.3.2. Types of Loss Functions
- 3.3.3. Choice of Loss Functions

3.4. Activation Functions
- 3.4.1. Activation Function
- 3.4.2. Linear Functions
- 3.4.3. Non-Linear Functions
- 3.4.4. Output vs. Hidden Layer Activation Functions

3.5. Regularization and Normalization
- 3.5.1. Regularization and Normalization
- 3.5.2. *Overfitting and Data Augmentation*
- 3.5.3. *Regularization Methods: L1, L2 and Dropout*
- 3.5.4. *Normalization Methods: Batch, Weight, Layer*

3.6. Optimization
- 3.6.1. *Gradient Descent*
- 3.6.2. Stochastic Gradient Descent
- 3.6.3. Mini Batch Gradient Descent
- 3.6.4. Momentum
- 3.6.5. *Adam*

3.7. Hyperparameter Tuning and Weights
- 3.7.1. Hyperparameters
- 3.7.2. Batch Size vs. Learning Rate vs. Step Decay
- 3.7.3. Weights

3.8. Evaluation Metrics of a Neural Network
- 3.8.1. *Accuracy*
- 3.8.2. *Dice Coefficient*
- 3.8.3. Sensitivity vs. Specificity / Recall vs. Precision
- 3.8.4. ROC Curve (AUC)
- 3.8.5. *F1-Score*
- 3.8.6. *Matrix Confusion*
- 3.8.7. *Cross-Validation*

3.9. Frameworks and Hardware
- 3.9.1. Tensor Flow
- 3.9.2. Pytorch
- 3.9.3. Caffe
- 3.9.4. Keras
- 3.9.5. Hardware for the Training Phase

3.10. Creation of a Neural Network – Training and Validation
- 3.10.1. *Dataset*
- 3.10.2. Network Construction
- 3.10.3. Education
- 3.10.4. Visualization of Results

Module 4. Robotics in the Automation of Industrial Processes

4.1. Design of Automated Systems
- 4.1.1. Hardware Architectures
- 4.1.2. Programmable Logic Controllers
- 4.1.3. Industrial Communication Networks

4.2. Advanced Electrical Design I: Automation
- 4.2.1. Design of Electrical Panels and Symbology
- 4.2.2. Power and Control Circuits. Harmonics
- 4.2.3. Protection and Grounding Elements

4.3. Advanced Electrical Design II: Determinism and Safety
- 4.3.1. Machine Safety and Redundancy
- 4.3.2. Safety Relays and Triggers
- 4.3.3. Safety PLCs
- 4.3.4. Safe Networks

4.4. Electrical Actuation
- 4.4.1. Motors and Servomotors
- 4.4.2. Frequency Inverters and Controllers
- 4.4.3. Electrically Actuated Industrial Robotics

4.5. Hydraulic and Pneumatic Actuation
- 4.5.1. Hydraulic Design and Symbology
- 4.5.2. Pneumatic Design and Symbology
- 4.5.3. ATEX Environments in Automation

4.6. Transducers in Robotics and Automation
- 4.6.1. Position and Velocity Measurement
- 4.6.2. Force and Temperature Measurement
- 4.6.3. Presence Measurement
- 4.6.4. Vision Sensors

4.7. Programming and Configuration of Programmable Logic Controllers PLCs
- 4.7.1. PLC Programming: LD
- 4.7.2. PLC Programming: ST
- 4.7.3. PLC Programming: FBD and CFC
- 4.7.4. PLC Programming: SFC

4.8. Programming and Configuration of Equipment in Industrial Plants
  4.8.1. Programming of Drives and Controllers
  4.8.2. HMI Scheduling
  4.8.3. Programming of Manipulator Robots
4.9. Programming and Configuration of Industrial Computer Equipment
  4.9.1. Programming of Vision Systems
  4.9.2. SCADA/Software Programming
  4.9.3. Network Configuration
4.10. Automation Implementation
  4.10.1. State Machine Design
  4.10.2. Implementation of State Machines in PLCs
  4.10.3. Implementation of Analog PID Control Systems in PLCs
  4.10.4. Automation Maintenance and Code Hygiene
  4.10.5. Automation and Plant Simulation

Module 5. Automatic Control Systems in Robotics

5.1. Analysis and Design of Nonlinear Systems
  5.1.1. Analysis and Modeling of Nonlinear Systems
  5.1.2. Feedback Control
  5.1.3. Linearization by Feedback
5.2. Design of Control Techniques for Advanced Non-Linear Systems
  5.2.1. Sliding Mode Control (Sliding Mode control)
  5.2.2. Lyapunov and Backstepping Control
  5.2.3. Control Based on Passivity
5.3. Control Architectures
  5.3.1. The Robotics Paradigm
  5.3.2. Control Architectures
  5.3.3. Applications and Examples of Control Architectures
5.4. Motion Control for Robotic Arms
  5.4.1. Kinematic and Dynamic Modeling
  5.4.2. Control in Joint Space
  5.4.3. Control in Operational Space

5.5. Actuator Force Control
 5.5.1. Force Control
 5.5.2. Impedance Control
 5.5.3. Hybrid Control
5.6. Terrestrial Mobile Robots
 5.6.1. Equations of Motion
 5.6.2. Control Techniques for Terrestrial Robots
 5.6.3. Mobile Manipulators
5.7. Aerial Mobile Robots
 5.7.1. Equations of Motion
 5.7.2. Control Techniques in Aerial Robots
 5.7.3. Aerial Manipulation
5.8. Control Based on Machine Learning Techniques
 5.8.2. Control Using Supervised Learning
 5.8.3. Control Using Reinforced Learning
 5.8.4. Control by Unsupervised Learning
5.9. Vision-Based Control
 5.9.1. Position-Based Visual Servoing
 5.9.2. Image-Based Visual Servoing
 5.9.3. Hybrid Visual Servoing
5.10. Predictive Control
 5.10.1. Models and State Estimation
 5.10.2. MPC Applied to Mobile Robots
 5.10.3. MPC Applied to UAVs

Module 6. Planning Algorithms in Robots

6.1. Classical Planning Algorithms
 6.1.1. Discrete Planning: State Space
 6.1.2. Planning Problems in Robotics. Robotic Systems Models
 6.1.3. Classification of Planners

6.2. The Trajectory Planning Problem in Mobile Robots
- 6.2.1. Forms of Environment Representation: Graphs
- 6.2.2. Search Algorithms in Graphs
- 6.2.3. Introduction of Costs in Networks
- 6.2.4. Search Algorithms in Heavy Networks
- 6.2.5. Algorithms with any Angle Approach

6.3. Planning in High Dimensional Robotic Systems
- 6.3.1. High Dimensionality Robotics Problems: Manipulators
- 6.3.2. Direct/Inverse Kinematic Model
- 6.3.3. Sampling Planning Algorithms PRM and RRT
- 6.3.4. Planning Under Dynamic Constraints

6.4. Optimal Sampling Planning
- 6.4.1. Problem of Sampling-Based Planners
- 6.4.2. RRT* Probabilistic Optimality Concept
- 6.4.3. Reconnection Step: Dynamic Constraints
- 6.4.4. CForest. Parallelizing Planning

6.5. Real Implementation of a Motion Planning System
- 6.5.1. Global Planning Problem. Dynamic Environments
- 6.5.2. Cycle of Action, Sensorization. Acquisition of Information from the Environment
- 6.5.3. Local and Global Planning

6.6. Coordination in Multi-Robot Systems I: Centralized System
- 6.6.1. Multirobot Coordination Problem
- 6.6.2. Collision Detection and Resolution: Trajectory Modification with Genetic Algorithms.
- 6.6.3. Other Bio-Inspired Algorithms: Particle Swarm and Fireworks
- 6.6.4. Collision Avoidance by Choice of Maneuver Algorithm

6.7. Coordination in Multi-Robot Systems II: Distributed Approaches I
- 6.7.1. Use of Complex Objective Functions
- 6.7.2. Pareto Front
- 6.7.3. Multi-Objective Evolutionary Algorithms

6.8. Coordination in Multirobot Systems III: Distributed Approaches II
- 6.8.1. Order 1 Planning Systems
- 6.8.2. ORCA Algorithm
- 6.8.3. Addition of Kinematic and Dynamic Constraints in ORCA

6.9. Decision Planning Theory
- 6.9.1. Decision Theory
- 6.9.2. Sequential Decision Systems
- 6.9.3. Sensors and Information Spaces
- 6.9.4. Planning for Uncertainty in Sensing and Actuation

6.10. Reinforcement Learning Planning Systems
- 6.10.1. Obtaining the Expected Reward of a System
- 6.10.2. Mean Reward Learning Techniques
- 6.10.3. Inverse Reinforcement Learning

Module 7. Computer Vision

7.1. Human Perception
- 7.1.1. Human Visual System
- 7.1.2. The Color
- 7.1.3. Visible and Non-Visible Frequencies

7.2. Chronicle of the Computer Vision
- 7.2.1. Principles
- 7.2.2. Evolution
- 7.2.3. The Importance of Computer Vision

7.3. Digital Image Composition
- 7.3.1. The Digital Image
- 7.3.2. Types of Images
- 7.3.3. Color Spaces
- 7.3.4. RGB
- 7.3.5. HSV and HSL
- 7.3.6. CMY-CMYK
- 7.3.7. YCbCr
- 7.3.8. Indexed Image

7.4. Image Acquisition Systems
- 7.4.1. Operation of a Digital Camera
- 7.4.2. The Correct Exposure for Each Situation
- 7.4.3. Depth of Field
- 7.4.4. Resolution
- 7.4.5. Image Formats
- 7.4.6. HDR Mode
- 7.4.7. High Resolution Cameras
- 7.4.8. High-Speed Cameras

7.5. Optical Systems
- 7.5.1. Optical Principles
- 7.5.2. Conventional Lenses
- 7.5.3. Telecentric Lenses
- 7.5.4. Types of Autofocus Lenses
- 7.5.5. Focal Length
- 7.5.6. Depth of Field
- 7.5.7. Optical Distortion
- 7.5.8. Calibration of an Image

7.6. Illumination Systems
- 7.6.1. Importance of Illumination
- 7.6.2. Frequency Response
- 7.6.3. LED Illumination
- 7.6.4. Outdoor Lighting
- 7.6.5. Types of Lighting for Industrial Applications. Effects

7.7. 3D Capture Systems
- 7.7.1. Stereo Vision
- 7.7.2. Triangulation
- 7.7.3. Structured Light
- 7.7.4. *Time of Flight*
- 7.7.5. *Lidar*

7.8. Multispectrum
- 7.8.1. Multispectral Cameras
- 7.8.2. Hyperspectral Cameras

7.9. Non-Visible Near Spectrum
- 7.9.1. IR Cameras
- 7.9.2. UV Cameras
- 7.9.3. Converting From Non-Visible to Visible by Illumination

7.10. Other Band Spectrums
- 7.10.1. X-Ray
- 7.10.2. Terahertz

Module 8. Applications and State-of-the-Art

8.1. Industrial Applications
- 8.1.1. Machine Vision Libraries
- 8.1.2. Compact Cameras
- 8.1.3. PC-Based Systems
- 8.1.4. Industrial Robotics
- 8.1.5. Pick and Place 2D
- 8.1.6. *Bin Picking*
- 8.1.7. Quality Control
- 8.1.8. Presence Absence of Components
- 8.1.9. Dimensional Control
- 8.1.10. Labeling Control
- 8.1.11. Traceability

8.2. Autonomous Vehicles
- 8.2.1. Driver Assistance
- 8.2.2. Autonomous Driving

8.3. Computer Vision for Content Analysis
   8.3.1. Filtering by Content
   8.3.2. Visual Content Moderation
   8.3.3. Tracking Systems
   8.3.4. Brand and Logo Identification
   8.3.5. Video Labeling and Classification
   8.3.6. Scene Change Detection
   8.3.7. Text or Credits Extraction
8.4. Medical Application
   8.4.1. Disease Detection and Localization
   8.4.2. Cancer and X-Ray Analysis
   8.4.3. Advances in Computer Vision given Covid19
   8.4.4. Assistance in the Operating Room
8.5. Spatial Applications
   8.5.1. Satellite Image Analysis
   8.5.2. Computer Vision for the Study of Space
   8.5.3. Mission to Mars
8.6. Commercial Applications
   8.6.1. Stock Control
   8.6.2. Video Surveillance, Home Security
   8.6.3. Parking Cameras
   8.6.4. Population Control Cameras
   8.6.5. Speed Cameras
8.7. Vision Applied to Robotics
   8.7.1. Drones
   8.7.2. AGV
   8.7.3. Vision in Collaborative Robots
   8.7.4. The Eyes of the Robots
8.8. Augmented Reality
   8.8.1. Operation
   8.8.2. Devices
   8.8.3. Applications in the Industry
   8.8.4. Commercial Applications
8.9. *Cloud Computing*
   8.9.1. Cloud Computing Platforms
   8.9.2. From Cloud Computing to Production
8.10. Research and State-of-the-Art
   8.10.1. Commercial Applications
   8.10.2. What's Cooking
   8.10.3. The Future of Computer Vision

Module 9. Computer Vision Techniques in Robotics: Image Processing and Analysis

9.1. Computer Vision
   9.1.1. Computer Vision
   9.1.2. Elements of a Computer Vision System
   9.1.3. Mathematical Tools
9.2. Optical Sensors for Robotics
   9.2.1. Passive Optical Sensors
   9.2.2. Active Optical Sensors
   9.2.3. Non-Optical Sensors
9.3. Image Acquisition
   9.3.1. Image Representation
   9.3.2. Color Space
   9.3.3. Digitizing Process
9.4. Image Geometry
   9.4.1. Lens Models
   9.4.2. Camera Models
   9.4.3. Camera Calibration
9.5. Mathematical Tools
   9.5.1. Histogram of an Image
   9.5.2. Convolution
   9.5.3. Fourier Transform

9.6. Image Preprocessing
    9.6.1. Noise Analysis
    9.6.2. Image Smoothing
    9.6.3. Image Enhancement
9.7. Image Segmentation
    9.7.1. Contour-Based Techniques
    9.7.3. Histogram-Based Techniques
    9.7.4. Morphological Operations
9.8. Image Feature Detection
    9.8.1. Point of Interest Detection
    9.8.2. Feature Descriptors
    9.8.3. Feature Matching
9.9. 3D Vision Systems
    9.9.1. 3D Perception
    9.9.2. Feature Matching between Images
    9.9.3. Multiple View Geometry
9.10. Computer Vision based Localization
    9.10.1. The Robot Localization Problem
    9.10.2. Visual Odometry
    9.10.3. Sensory Fusion

Module 10. Robot Visual Perception Systems with Machine Learning

10.1. Unsupervised Learning Methods applied to Computer Vision
    10.1.1. *Clustering*
    10.1.2. PCA
    10.1.3. *Nearest Neighbors*
    10.1.4. *Similarity and Matrix Decomposition*
10.2. Supervised Learning Methods Applied to Computer Vision
    10.2.1. “Bag of Words” Concept
    10.2.2. Support Vector Machine
    10.2.3. *Latent Dirichlet Allocation*
    10.2.4. Neural Networks
10.3. Deep Neural Networks: Structures, Backbones and Transfer Learning
    10.3.1. Feature Generating Layers
        10.3.1.1. VGG
        10.3.1.2. Densenet
        10.3.1.3. *ResNet*
        10.3.1.4. Inception
        10.3.1.5. GoogLeNet
    10.3.2. *Transfer Learning*
    10.3.3. The Data. Preparation for Training
10.4. Computer Vision with Deep Learning I: Detection and Segmentation.
    10.4.1. YOLO and SSD Differences and Similarities
    10.4.2. Unet
    10.4.3. Other Structures
10.5. Computer Vision with Deep Learning II: *Generative Adversarial Networks*
    10.5.1. Image Super-Resolution Using GAN
    10.5.2. Creation of Realistic Images
    10.5.3. *Scene Understanding*
10.6. Learning Techniques for Localization and Mapping in Mobile Robotics
    10.6.1. Loop Closure Detection and Relocation
    10.6.2. *Magic Leap. Super Point and Super Glue*
    10.6.3. *Depth from Monocular*
10.7. Bayesian Inference and 3D Modeling
    10.7.1. Bayesian Models and "Classical" Learning
    10.7.2. Implicit Surfaces with Gaussian Processes (GPIS)
    10.7.3. 3D Segmentation Using GPIS
    10.7.4. Neural Networks for 3D Surface Modeling
10.8. End-to-End Applications of Deep Neural Networks
    10.8.1. End-to-End System. Example of Person Identification
    10.8.2. Object Manipulation with Visual Sensors
    10.8.3. Motion Generation and Planning with Visual Sensors

10.9. Cloud Technologies to Accelerate the Development of Deep Learning Algorithms
- 10.9.1. Use of GPUs for Deep Learning
- 10.9.2. Agile Development with Google IColab
- 10.9.3. Remote GPUs, Google Cloud and AWS

10.10. Deployment of Neural Networks in Real Applications
- 10.10.1. Embedded Systems
- 10.10.2. Deployment of Neural Networks. Usage
- 10.10.3. Network Optimizations in Deployment, Example with TensorRT

Module 11. Visual SLAM. Robot Localization and Simultaneous Mapping Using Computer Vision Techniques

11.1. Simultaneous Localization and Mapping (SLAM)
- 11.1.1. Simultaneous Localization and Mapping. SLAM
- 11.1.2. SLAM Applications
- 11.1.3. SLAM Operation

11.2. Projective Geometry
- 11.2.1. Pin-Hole Model
- 11.2.2. Estimation of Intrinsic Parameters of a Chamber
- 11.2.3. Homography, Basic Principles and Estimation
- 11.2.4. Fundamental Matrix, Principles and Estimation

11.3. Gaussian Filters
- 11.3.1. Kalman Filter
- 11.3.2. Information Filter
- 11.3.3. Adjustment and Parameterization of Gaussian Filters

11.4. Stereo EKF-SLAM
- 11.4.1. Stereo Camera Geometry
- 11.4.2. Feature Extraction and Search
- 11.4.3. Kalman Filter for Stereo SLAM
- 11.4.4. Stereo EKF-SLAM Parameter Setting

11.5. Monocular EKF-SLAM
- 11.5.1. EKF-SLAM Landmark Parameterization
- 11.5.2. Kalman Filter for Monocular SLAM
- 11.5.3. Monocular EKF-SLAM Parameter Tuning

11.6. Loop Closure Detection
- 11.6.1. Brute Force Algorithm
- 11.6.2. FABMAP
- 11.6.3. Abstraction Using GIST and HOG
- 11.6.4. Deep Learning Detection

11.7. Graph-SLAM
- 11.7.1. Graph-SLAM
- 11.7.2. RGBD-SLAM
- 11.7.3. ORB-SLAM

11.8. Direct Visual SLAM
- 11.8.1. Analysis of the Direct Visual SLAM Algorithm
- 11.8.2. LSD-SLAM
- 11.8.3. SVO

11.9. Visual Inertial SLAM
- 11.9.1. Integration of Inertial Measurements
- 11.9.2. Low Coupling: SOFT-SLAM
- 11.9.3. High Coupling: *Vins-Mono*

11.10. Other SLAM Technologies
- 11.10.1. Applications Beyond Visual SLAM
- 11.10.2. Lidar-SLAM
- 11.10.2. Range-Only SLAM

Module 12. Application of Virtual and Augmented Reality Technologies to Robotics

12.1. Immersive Technologies in Robotics
- 12.1.1. Virtual Reality in Robotics
- 12.1.2. Augmented Reality in Robotics
- 12.1.3. Mixed Reality in Robotics
- 12.1.4. Difference between Realities

12.2. Construction of Virtual Environments
- 12.2.1. Materials and Textures
- 12.2.2. Lighting
- 12.2.3. Virtual Sound and Smell

12.3. Robot Modeling in Virtual Environments
- 12.3.1. Geometric Modeling
- 12.3.2. Physical Modeling
- 12.3.3. Model Standardization

12.4. Modeling of Robot Dynamics and Kinematics: Virtual Physical Engines
- 12.4.1. Physical Motors. Typology
- 12.4.2. Configuration of a Physical Engine
- 12.4.3. Physical Motors in the Industry

12.5. Platforms, Peripherals and Tools Most Commonly Used in Virtual Reality
- 12.5.1. Virtual Reality viewers
- 12.5.2. Interaction Peripherals
- 12.5.3. Virtual Sensors

12.6. Augmented Reality Systems
- 12.6.1. Insertion of Virtual Elements into Reality
- 12.6.2. Types of Visual Markers
- 12.6.3. Augmented Reality Technologies

12.7. Metaverse: Virtual Environments of Intelligent Agents and People
- 12.7.1. Avatar Creation
- 12.7.2. Intelligent Agents in Virtual Environments
- 12.7.3. Construction of Multi-User Environments for VR/AR

12.8. Creation of Virtual Reality Projects for Robotics
- 12.8.1. Phases of Development of a Virtual Reality Project
- 12.8.2. Deployment of Virtual Reality Systems
- 12.8.3. Virtual Reality Resources

12.9. Creating Augmented Reality Projects for Robotics
- 12.9.1. Phases of Development of an Augmented Reality Project
- 12.9.2. Deployment of Augmented Reality Projects
- 12.9.3. Augmented Reality Resources

12.10. Robot Teleoperation with Mobile Devices
- 12.10.1. Mixed Reality on Mobile Devices
- 12.10.2. Immersive Systems using Mobile Device Sensors
- 12.10.3. Examples of Mobile Projects

Module 13. Robot Communication and Interaction Systems

13.1. Speech Recognition: Stochastic Systems
- 13.1.1. Acoustic Speech Modeling
- 13.1.2. Hidden Markov Models
- 13.1.3. Linguistic Speech Modeling: N-Grams, BNF Grammars

13.2. Speech Recognition: *Deep Learning*
- 13.2.1. Deep Neural Networks
- 13.2.2. Recurrent Neural Networks
- 13.2.3. LSTM Cells

13.3. Speech Recognition: Prosody and Environmental Effects
- 13.3.1. Ambient Noise
- 13.3.2. Multi-Speaker Recognition
- 13.3.3. Speech Pathologies

13.4. Natural Language Understanding: Heuristic and Probabilistic Systems
- 13.4.1. Syntactic-Semantic Analysis: Linguistic Rules
- 13.4.2. Comprehension Based on Heuristic Rules
- 13.4.3. Probabilistic Systems: Logistic Regression and SVM
- 13.4.4. Understanding Based on Neural Networks

13.5. Dialogue Management: Heuristic/Probabilistic Strategies
- 13.5.1. Interlocutor's Intention
- 13.5.2. Template-Based Dialog
- 13.5.3. Stochastic Dialog Management: Bayesian Networks

13.6. Dialogue Management: Advanced Strategies
- 13.6.1. Reinforcement-Based Learning Systems
- 13.6.2. Neural Network-Based Systems
- 13.6.3. From Speech to Intention in a Single Network

13.7. Response Generation and Speech Synthesis
- 13.7.1. Response Generation: From Idea to Coherent Text
- 13.7.2. Speech Synthesis by Concatenation
- 13.7.3. Stochastic Speech Synthesis

13.8. Dialogue Adaptation and Contextualization
- 13.8.1. Dialogue Initiative
- 13.8.2. Adaptation to the Speaker
- 13.8.3. Adaptation to the Context of the Dialogue

13.9. Robots and Social Interactions: Emotion Recognition, Synthesis and Expression.
- 13.9.1. Artificial Voice Paradigms: Robotic Voice and Natural Voice
- 13.9.2. Emotion Recognition and Sentiment Analysis
- 13.9.3. Emotional Voice Synthesis

13.10. Robots and Social Interactions: Advanced Multimodal Interfaces
- 13.10.1. Combination of Vocal and Tactile Interfaces
- 13.10.2. Sign Language Recognition and Translation
- 13.10.3. Visual Avatars: Voice to Sign Language Translation

Module 14. Digital Image Processing

14.1. Computer Vision Development Environment
- 14.1.1. Computer Vision Libraries
- 14.1.2. Programming Environment
- 14.1.3. Visualization Tools

14.2. Digital image Processing
- 14.2.1. Pixel Relationships
- 14.2.2. Image Operations
- 14.2.3. Geometric Transformations

14.3. Pixel Operations
- 14.3.1. Histogram
- 14.3.2. Histogram Transformations
- 14.3.3. Operations on Color Images

14.4. Logical and Arithmetic Operations
- 14.4.1. Addition and Subtraction
- 14.4.2. Product and Division
- 14.4.3. And/Nand
- 14.4.4. Or/Nor
- 14.4.5. Xor/Xnor

14.5. Filters
- 14.5.1. Masks and Convolution
- 14.5.2. Linear Filtering
- 14.5.3. Non-Linear Filtering
- 14.5.4. Fourier Analysis

14.6. Morphological Operations
- 14.6.1. *Erosion and Dilation*
- 14.6.2. Closing and Opening
- 14.6.3. Top_hat and Black hat
- 14.6.4. Contour Detection
- 14.6.5. Skeleton
- 14.6.6. Hole Filling
- 14.6.7. *Convex Hull*

14.7. Image Analysis Tools
- 14.7.1. Edge Detection
- 14.7.2. Detection of Blobs
- 14.7.3. Dimensional Control
- 14.7.4. Color Inspection

14.8. Object Segmentation
- 14.8.1. Image Segmentation
- 14.8.2. Classical Segmentation Techniques
- 14.8.3. Real Applications

14.9. Image Calibration
- 14.9.1. Image Calibration
- 14.9.2. Methods of Calibration
- 14.9.3. Calibration Process in a 2D Camera/Robot System

14.10. Image Processing in a Real Environment
- 14.10.1. Problem Analysis
- 14.10.2. Image Processing
- 14.10.3. Feature Extraction
- 14.10.4. Final Results

Module 15. Advanced Digital Image Processing

15.1. Optical Character Recognition (OCR)
- 15.1.1. Image Pre-Processing
- 15.1.2. Text Detection
- 15.1.3. Text Recognition

15.2. Code Reading
- 15.2.1. 1D Codes
- 15.2.2. 2D Codes
- 15.2.3. Applications

15.3. Pattern Search
- 15.3.1. Pattern Search
- 15.3.2. Patterns Based on Gray Level
- 15.3.3. Patterns Based on Contours
- 15.3.4. Patterns Based on Geometric Shapes
- 15.3.5. Other Techniques

15.4. Object Tracking with Conventional Vision
- 15.4.1. Background Extraction
- 15.4.2. *Meanshift*
- 15.4.3. *Camshift*
- 15.4.4. *Optical Flow*

15.5. Facial Recognition
- 15.5.1. *Facial Landmark Detection*
- 15.5.2. Applications
- 15.5.3. Facial Recognition
- 15.5.4. Emotion Recognition

15.6. Panoramic and Alignment
- 15.6.1. *Stitching*
- 15.6.2. Image Composition
- 15.6.3. Photomontage

15.7. High Dynamic Range (HDR) and Photometric Stereo
- 15.7.1. Increasing the Dynamic Range
- 15.7.2. Image Compositing for Contour Enhancement
- 15.7.3. Techniques for the Use of Dynamic Applications

15.8. Image Compression
- 15.8.1. Image Compression
- 15.8.2. Types of Compressors
- 15.8.3. Image Compression Techniques

15.9. Video Processing
- 15.9.1. Image Sequences
- 15.9.2. Video Formats and Codecs
- 15.9.3. Reading a Video
- 15.9.4. Frame Processing

15.10. Real Application of Image Processing
- 15.10.1. Problem Analysis
- 15.10.2. Image Processing
- 15.10.3. Feature Extraction
- 15.10.4. Final Results

Module 16. 3D Image Processing

16.1. 3D Imaging
- 16.1.1. 3D Imaging
- 16.1.2. 3d Image Processing Software and Visualizations
- 16.1.3. Metrology Software

16.2. Open3D
- 16.2.1. Library for 3D Data Processing
- 16.2.2. Characteristics
- 16.2.3. Installation and Use

16.3. The Data
- 16.3.1. Depth Maps in 2D Image
- 16.3.2. *Pointclouds*
- 16.3.3. Normal
- 16.3.4. Surfaces

16.4. Visualization
- 16.4.1. Data Visualization
- 16.4.2. Controls
- 16.4.3. Web Display

16.5. Filters
- 16.5.1. Distance Between Points, Eliminate Outliers
- 16.5.2. High Pass Filter
- 16.5.3. Downsampling

16.6. Geometry and Feature Extraction
- 16.6.1. Extraction of a Profile
- 16.6.2. Depth Measurement
- 16.6.3. Volume
- 16.6.4. 3D Geometric Shapes
- 16.6.5. Shots
- 16.6.6. Projection of a Point
- 16.6.7. Geometric Distances
- 16.6.8. Kd Tree
- 16.6.9. 3D Features

16.7. Registration and Meshing
- 16.7.1. Concatenation
- 16.7.2. ICP
- 16.7.3. Ransac 3D

16.8. 3D Object Recognition
- 16.8.1. Searching for an Object in the 3d Scene
- 16.8.2. Segmentation
- 16.8.3. *Bin Picking*

16.9. Surface Analysis
- 16.9.1. *Smoothing*
- 16.9.2. Orientable Surfaces
- 16.9.3. *Octree*

16.10. Triangulation
- 16.10.1. From Mesh to Point Cloud
- 16.10.2. Depth Map Triangulation
- 16.10.3. Triangulation of Unordered PointClouds

Module 17. Convolutional Neural Networks and Image Classification

17.1. Convolutional Neural Networks
- 17.1.1. Introduction
- 17.1.2. Convolution
- 17.1.3. CNN Building Blocks

17.2. Types of CNN Layers
- 17.2.1. *Convolutional*
- 17.2.2. *Activation*
- 17.2.3. *Batch Normalization*
- 17.2.4. *Polling*
- 17.2.5. *Fully Connected*

17.3. Metrics
- 17.3.1. Matrix Confusion
- 17.3.2. *Accuracy*
- 17.3.3. Precision
- 17.3.4. *Recall*
- 17.3.5. F1 Score
- 17.3.6. ROC Curve
- 17.3.7. AUC

17.4. Main Architectures
- 17.4.1. *AlexNet*
- 17.4.2. VGG
- 17.4.3. *Resnet*
- 17.4.4. *GoogleLeNet*

17.5. Image Classification
- 17.5.1. Introduction
- 17.5.2. Analysis of Data
- 17.5.3. Data Preparation
- 17.5.4. Model Training
- 17.5.5. Model Validation

17.6. Practical Considerations for CNN Training
- 17.6.1. Optimizer Selection
- 17.6.2. Learning Rate Scheduler
- 17.6.3. Check Training Pipeline
- 17.6.4. Training with Regularization

17.7. Best Practices in Deep Learning
- 17.7.1. *Transfer Learning*
- 17.7.2. *Fine Tuning*
- 17.7.3. *Data Augmentation*

17.8. Statistical Data Evaluation
- 17.8.1. Number of Datasets
- 17.8.2. Number of Labels
- 17.8.3. Number of Images
- 17.8.4. Data Balancing

17.9. *Deployment*
- 17.9.1. Saving and Loading Models
- 17.9.2. Onnx
- 17.9.3. Inference

17.10. Practical Case: Image Classification
- 17.10.1. Data Analysis and Preparation
- 17.10.2. Testing the Training Pipeline
- 17.10.3. Model Training
- 17.10.4. Model Validation

Module 18. Object Detection

18.1. Object Detection and Tracking
- 18.1.1. Object Detection
- 18.1.2. Use Cases
- 18.1.3. Object Tracking
- 18.1.4. Use Cases
- 18.1.5. Occlusions, Rigid and Non-Rigid Poses

18.2. Assessment Metrics
- 18.2.1. IOU - Intersection Over Union
- 18.2.2. *Confidence Score*
- 18.2.3. *Recall*
- 18.2.4. Precision
- 18.2.5. Recall – Precision Curve
- 18.2.6. Mean Average Precision (mAP)

18.3. Traditional Methods
- 18.3.1. *Sliding Window*
- 18.3.2. Viola Detector
- 18.3.3. HOG
- 18.3.4. Non-Maximal Suppresion (NMS)

18.4. *Datasets*
- 18.4.1. Pascal VC
- 18.4.2. MS Coco
- 18.4.3. ImageNet (2014)
- 18.4.4. MOTA Challenge

18.5. Two Shot Object Detector
- 18.5.1. R-CNN
- 18.5.2. Fast R-CNN
- 18.5.3. Faster R-CNN
- 18.5.4. Mask R-CNN

18.6. *Single Shot Object Detector*
- 18.6.1. SSD
- 18.6.2. YOLO
- 18.6.3. RetinaNet
- 18.6.4. CenterNet
- 18.6.5. EfficientDet

18.7. Backbones
- 18.7.1. VGG
- 18.7.2. *ResNet*
- 18.7.3. Mobilenet
- 18.7.4. Shufflenet
- 18.7.5. Darknet

18.8. Object Tracking
 18.8.1. Classical Approaches
 18.8.2. Particulate Filters
 18.8.3. Kalman
 18.8.4. *Sort Tracker*
 18.8.5. *Deep Sort*
18.9. Deployment
 18.9.1. Computing Platform
 18.9.2. Choice of Backbone
 18.9.3. Choice of Framework
 18.9.4. Model Optimization
 18.9.5. Model Versioning
18.10. Study: People Detection and Tracking
 18.10.1. Detection of People
 18.10.2. Monitoring of People
 18.10.3. Re-Identification
 18.10.4. Counting People in Crowds

Module 19. Image Segmentation with Deep Learning

19.1. Object Detection and Segmentation
 19.1.1. Semantic Segmentation
  19.1.1.1. Semantic Segmentation Use Cases
 19.1.2. Instantiated Segmentation
  19.1.2.1. Instantiated Segmentation Use Cases
19.2. Evaluation Metrics
 19.2.1. Similarities with Other Methods
 19.2.2. *Pixel Accuracy*
 19.2.3. Dice Coefficient (F1 Score)
19.3. Cost Functions
 19.3.1. *Dice Loss*
 19.3.2. *Focal Loss*
 19.3.3. *Tversky Loss*
 19.3.4. Other Functions
19.4. Traditional Segmentation Methods
 19.4.1. Threshold Application with Otsu and Riddlen
 19.4.2. Self-Organized Maps
 19.4.3. GMM-EM Algorithm
19.5. Semantic Segmentation Applying Deep Learning: FCN
 19.5.1. FCN
 19.5.2. Architecture
 19.5.3. FCN Applications
19.6. Semantic Segmentation Applying Deep Learning: U-NET
 19.6.1. U-NET
 19.6.2. Architecture
 19.6.3. U-NET Application
19.7. Semantic Segmentation Applying Deep Learning: *Deep Lab*
 19.7.1. *Deep Lab*
 19.7.2. Architecture
 19.7.3. Deep Lab Application
19.8. Instantiated Segmentation Applying Deep Learning: RCNN Mask
 19.8.1. RCNN Mask
 19.8.2. Architecture
 19.8.3. Application of a RCNN Mask
19.9. Video Segmentation
 19.9.1. STFCN
 19.9.2. Semantic Video CNNs
 19.9.3. *Clockwork Convnets*
 19.9.4. *Low-Latency*
19.10. Point Cloud Segmentation
 19.10.1. The Point Cloud
 19.10.2. PointNet
 19.10.3. A-CNN

Module 20. Advanced Image Segmentation and Advanced Computer Vision Techniques

20.1. Database for General Segmentation Problems
- 20.1.1. *Pascal Context*
- 20.1.2. CelebAMask-HQ
- 20.1.3. *Cityscapes Dataset*
- 20.1.4. CCP Dataset

20.2. Semantic Segmentation in Medicine
- 20.2.1. Semantic Segmentation in Medicine
- 20.2.2. Datasets for Medical Problems
- 20.2.3. Practical Application

20.3. Annotation Tools
- 20.3.1. *Computer Vision Annotation Tool*
- 20.3.2. *LabelMe*
- 20.3.3. Other Tools

20.4. Segmentation Tools Using Different Frameworks
- 20.4.1. Keras
- 20.4.2. Tensorflow v2
- 20.4.3. Pytorch
- 20.4.4. Other

20.5. Semantic Segmentation Project. The Data, Phase 1
- 20.5.1. Problem Analysis
- 20.5.2. Input Source for Data
- 20.5.3. Data Analysis
- 20.5.4. Data Preparation

20.6. Semantic Segmentation Project. Training, Phase 2
- 20.6.1. Algorithm Selection
- 20.6.2. Education
- 20.6.3. Evaluation

20.7. Semantic Segmentation Project. Results, Phase 3
- 20.7.1. Fine Tuning
- 20.7.2. Presentation of The Solution
- 20.7.3. Conclusions

20.8. Autoencoders
- 20.8.1. Autoencoders
- 20.8.2. Autoencoder Architecture
- 20.8.3. Noise Elimination Autoencoders
- 20.8.4. Automatic Coloring Autoencoder

20.9. Generative Adversarial Networks (GANs)
- 20.9.1. Generative Adversarial Networks (GANs)
- 20.9.2. DCGAN Architecture
- 20.9.3. Conditional GAN Architecture

20.10. Enhanced Generative Adversarial Networks
- 20.10.1. Overview of the Problem
- 20.10.2. WGAN
- 20.10.3. LSGAN
- 20.10.4. ACGAN

"The true magic of Artificial Intelligence lies in how it transforms data into knowledge and knowledge into action"

04

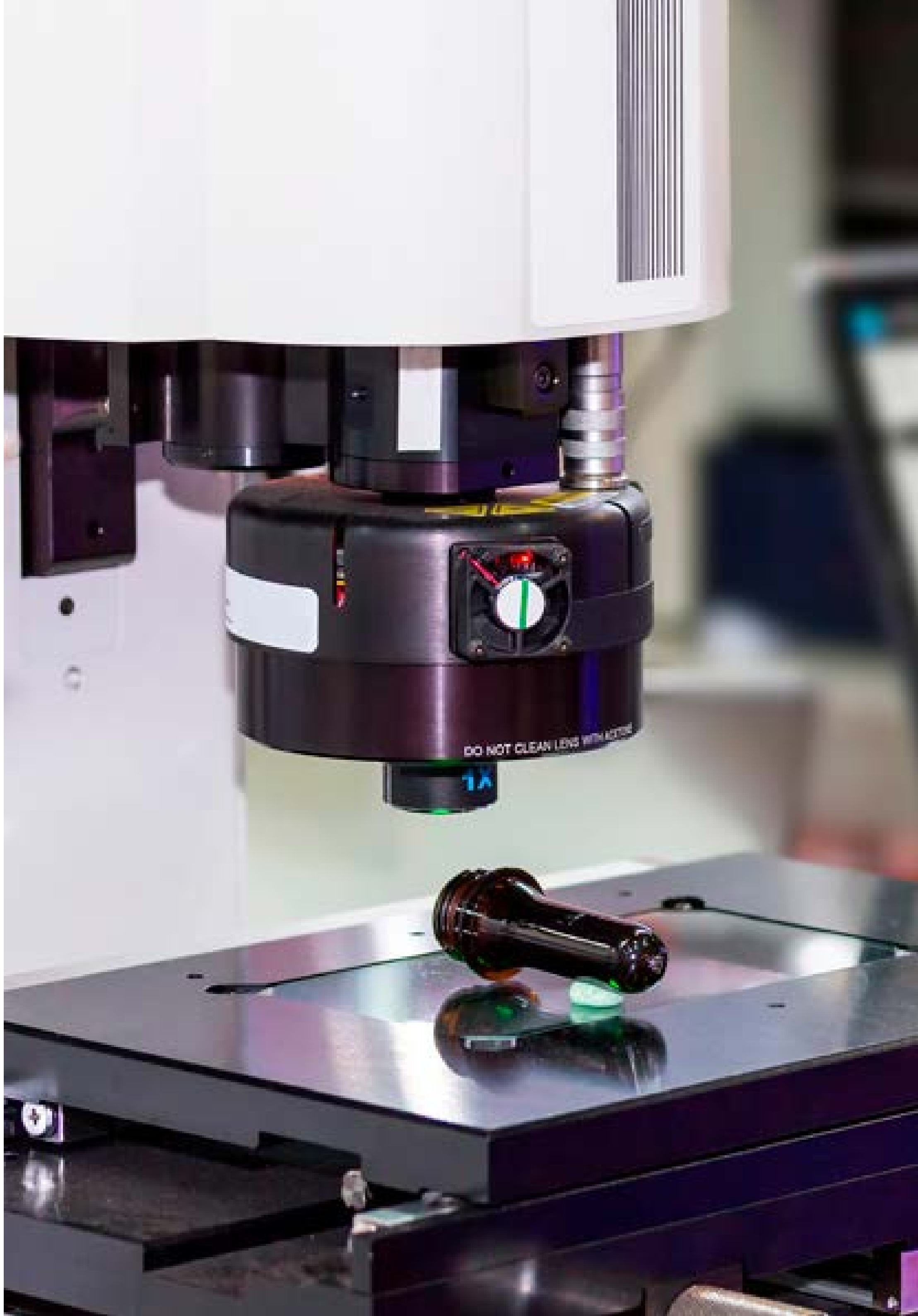
Teaching Objectives

The objectives focus on providing students with expertise to design, develop, and implement advanced technological solutions in robotics and Artificial Intelligence. Additionally, the program seeks to foster their ability to solve complex problems in key sectors such as automation, autonomous mobility, and healthcare. In doing so, it promotes a critical and ethical mindset, preparing students to lead innovative projects that contribute to sustainable technological progress and social well-being.

Experience the best way to bridge technology, connecting our imagination with reality"

General Objectives

- Design intelligent robotic systems applied to real-world environments
- Integrate computer vision into robotic platforms for autonomous tasks
- Program visual perception algorithms for robots
- Apply image processing techniques in automated systems
- Develop robotic solutions with navigation and object recognition
- Implement sensors and cameras for environmental analysis
- Optimize human-machine interaction through computer vision
- Automate industrial processes with advanced robotics technologies
- Design control systems for mobile robots and manipulators
- Utilize Artificial Intelligence in robotic decision-making
- Evaluate the performance of computer vision systems in robotics
- Apply Deep Learning in tasks of detection and visual classification
- Innovate in robotic applications in sectors such as healthcare, agriculture, and industry
- Integrate hardware and software architectures into robotic systems
- Manage multidisciplinary projects in robotics and computer vision
- Design user interfaces for the control and monitoring of robots
- Develop simulation environments for robotic testing
- Apply stereoscopic vision and 3D reconstruction in dynamic environments
- Lead the implementation of robotic solutions in production processes
- Analyze visual data to improve robotic behavior



Specific Objectives

Module 1. Robotics. Robot Design and Modeling
- Delve into the use of Gazebo Simulation Technology
- Master the use of the URDF Robot Modeling language

Module 2. Intelligent Agents. Applying Artificial Intelligence to Robots and Softbots
- Analyze the biological inspiration of Artificial Intelligence and intelligent agents
- Assess the need for intelligent algorithms in today's society

Module 3. *Deep Learning*
- Analyze the families that make up the artificial intelligence world
- Compile the main Frameworks of Deep Learning

Module 4. Robotics in the Automation of Industrial Processes
- Analyze the use, applications and limitations of industrial communication networks
- Establish machine safety standards for correct design

Module 5. Automatic Control Systems in Robotics
- Generate specialized knowledge for the design of nonlinear controllers
- Analyze and study control problems

Module 6. Planning Algorithms in Robots
- Establish the different types of planning algorithms
- Analyze the complexity of motion planning in robotics

Module 7. Computer Vision
- Establishing how the human vision system works and how an image is digitized
- Analyze the evolution of computer vision

Module 8. 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 9. Computer Vision Techniques in Robotics: Image Processing and Analysis
- Analyze and understand the importance of vision systems in robotics.
- Establish the characteristics of the different perception sensors in order to choose the most appropriate ones according to the application

Module 10. Robot Visual Perception Systems with Machine Learning

- Master the machine learning techniques most widely used today in academia and industry
- Delve into the architectures of neural networks to apply them effectively in real problems

Module 11. Visual SLAM. Robot Localization and Simultaneous Mapping Using Computer Vision Techniques

- Specify the basic structure of a Simultaneous Localization and Mapping (SLAM) system
- Identify the basic sensors used in Simultaneous Localization and Mapping (visual SLAM)

Module 12. Application of Virtual and Augmented Reality Technologies to Robotics

- Determine the difference among the different types of realities
- Analyze the current standards for modeling virtual elements

Module 13. Robot Communication and Interaction Systems

- Analyze current natural language processing strategies: heuristic, stochastic, neural network-based, reinforcement-based learning
- Assess the benefits and weaknesses of developing cross-cutting, or situation-focused, interaction systems

Module 14. Digital Image Processing

- Introduce image filters
- Analyze the importance and use of histograms

Module 15. Advanced Digital Image Processing

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

Module 16. 3D Image Processing

- Developing open3D
- Determine the relevant data in a 3D image

Module 17. Convolutional Neural Networks and Image Classification

- Generate specialized knowledge on convolutional neural networks
- Establish evaluation metrics

Module 18. Object Detection

- Analyze how object detection networks work
- Examine traditional methods

Module 19. Image Segmentation with Deep Learning

- Analyze how semantic segmentation networks work
- Evaluate traditional methods

Module 20. Advanced Image Segmentation and Advanced Computer Vision Techniques

- Generate specialized knowledge on the handling of tools
- Examine Semantic Segmentation in medicine

Be part of the creation of robotics and AI to bring about real change in society"

05

Career Opportunities

Upon completing this program, graduates will have access to a wide range of professional opportunities in innovative and high-demand sectors. They will possess a deep understanding of the field of autonomous mobility. Additionally, they will be capable of contributing to the development of driverless vehicles and intelligent drones. In the healthcare field, they will be able to apply their knowledge in medical robotics and computer vision, improving diagnostics. Through this academic opportunity, students will develop a strategic vision in innovation, sustainability, and ethics. Graduates will be prepared to lead multidisciplinary teams, drive research, and contribute to the advancement of technologies that not only improve quality of life but also pave the way for future breakthroughs.

Create autonomous solutions and lead the forefront of technological innovation with this Advanced Master's Degree from TECH"

Graduate Profile

A professional capable of leading technological evolution across various industries. With a solid focus on robotics, artificial intelligence, and computer vision. This graduate will master the design and development of autonomous systems applied to automation, autonomous mobility, and healthcare. Additionally, their profile will be characterized by an ability to think innovatively, applying advanced solutions to complex problems. They will be a leader with an ethical and critical mindset, prepared to address the social and sustainable challenges that arise with technological advancements. With a strategic mindset, they will be ready to drive projects that generate technological breakthroughs.

Design the future, develop the skills and knowledge necessary to become the best professional in this field.

- **Research and Development Capabilities:** The graduate will be a researcher capable of identifying areas for improvement in current systems, developing new solutions, and contributing to the advancement of knowledge in the field of robotics and computer vision.
- **Leadership and Strategic Decision Making:** They will develop leadership skills, managing teams, making strategic decisions in innovative projects, and guiding their teams toward success in an advanced technological context.
- **Technical and Collaborative Communication Skills:** They will be able to communicate effectively and clearly with both experts and non-technical teams, translating complex concepts into understandable information and facilitating interdisciplinary collaboration.
- **Adaptability to New Technologies:** They will have the ability to quickly adapt to technological and methodological advancements, being capable of integrating new tools and approaches into their projects in an agile and effective manner.

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

1. **Robotics Engineer:** Responsible for the design, development, and implementation of robotic systems for various industrial and commercial applications.
2. **Artificial Intelligence Developer:** Responsible for creating and optimizing algorithms and Artificial Intelligence systems to enhance the performance of autonomous machines and processes.
3. **Computer Vision Specialist:** Developer of systems that enable machines to interpret, analyze, and respond to images and videos of the environment in real time.
4. **Industrial Robotics Project Leader:** Responsible for planning, executing, and overseeing robotic projects aimed at automating processes in the industry.
5. **Robotics and AI Researcher:** In charge of researching and developing new technological solutions in robotics and Artificial Intelligence, contributing to the advancement of science and technology.
6. **Automation Solutions Consultant:** Advisor to companies on the implementation of robotic and automated solutions to improve operational efficiency.
7. **Robotic Control Engineer:** Supervisor of the design and calibration of control systems for robots, ensuring their accuracy and efficiency in various tasks.
8. **Autonomous Drone Developer:** Coordinator of the design and programming of drones that operate autonomously, without direct human intervention.
9. **Technology Innovation Manager:** Leader of technology innovation projects, incorporating robotic and intelligent solutions into business strategies.

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

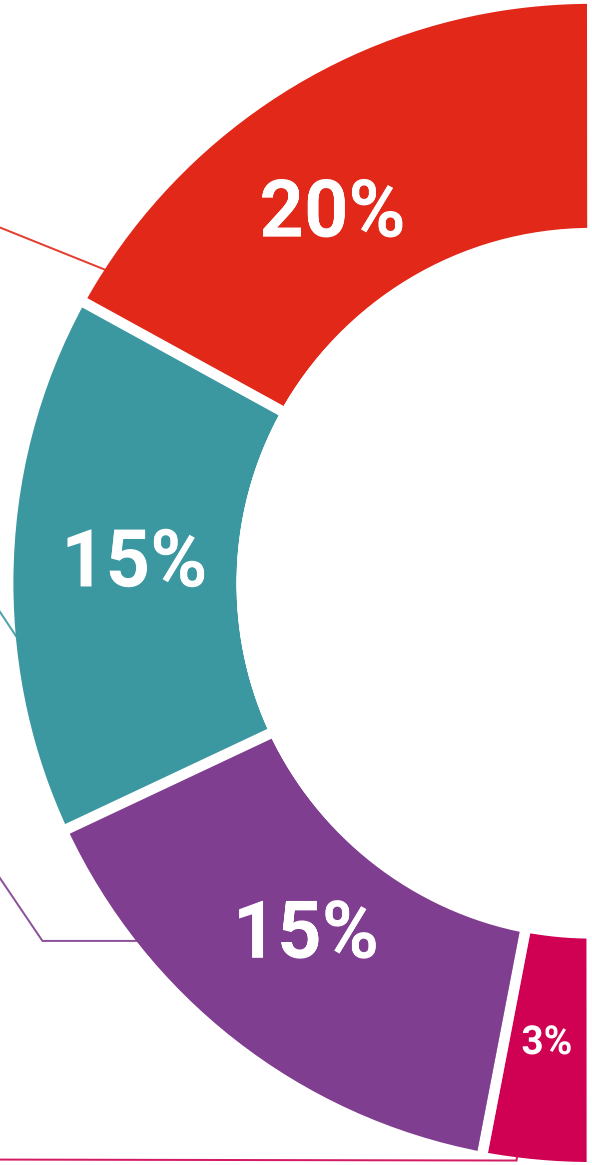
The results of this innovative teaching model can be seen in the overall satisfaction levels of TECH graduates.

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

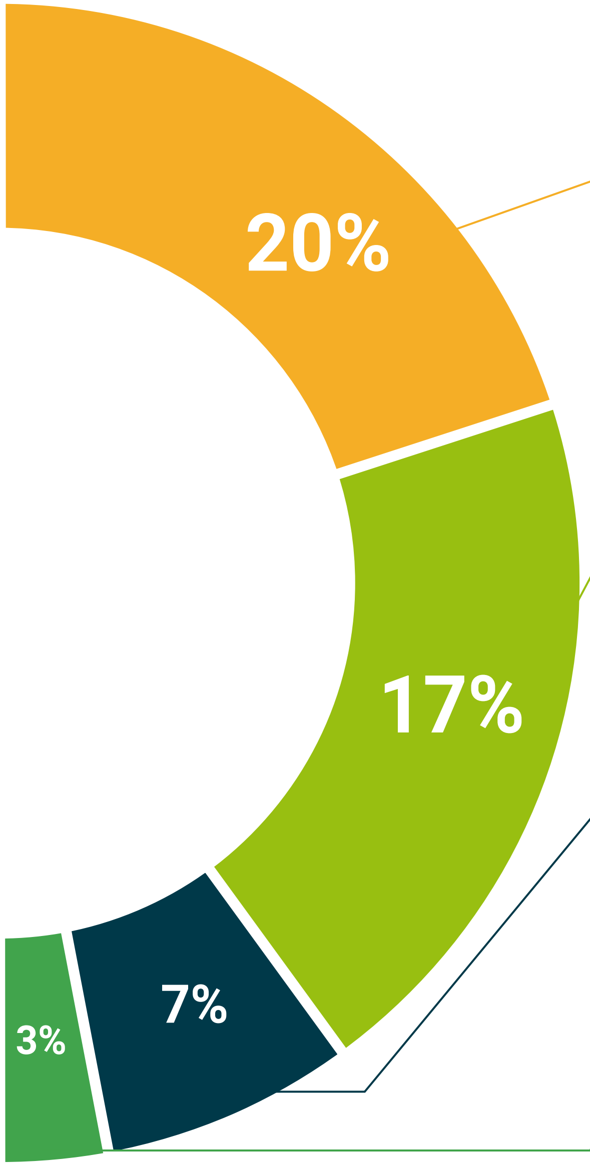
You will carry out activities to develop specific competencies and skills in each thematic field. Exercises and activities to acquire and develop the skills and abilities that a specialist needs to develop within the framework of the globalization we live in.

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

The primary principle of TECH is to provide an educational experience of exceptional quality. For this reason, a rigorous selection process is undertaken to choose the faculty members who make up its university programs. For this Advanced Master's Degree, TECH has selected a first-class faculty. Specialized in Artificial Intelligence, these professionals have extensive professional backgrounds, having worked in areas such as Robotics and Computer Vision. Moreover, these specialists stay up-to-date with the latest trends in these fields to develop fully innovative proposals. As such, students are assured the guarantees needed to ensure their professional development.

Build foundations, alongside the best professionals, and be part of the next advancements in society"

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

Dr. Ramón Fabresse, Felipe

- Senior Software Engineer at Acurable
- NLP Software Engineer at Intel Corporation
- Software Engineer in CATEC, Indisys
- Researcher in Aerial Robotics at the University of Seville
- PhD Cum Laude in Robotics, Autonomous Systems and Telerobotics at the University of Seville.
- Degree in Computer Engineering at the University of Seville
- Master's Degree in Robotics, Automation and Telematics at the University of Seville.

Teachers

Mr. Gutiérrez Olabarría, José Ángel

- Project Management, Software Analysis and Design, and C Programming for Quality Control and Industrial Computing Applications
- Engineer specializing in Computer Vision and Sensors
- Market Manager in the Steel and Metallurgical Sector, responsible for Client Relations, Contracting, 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 - Machine 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 of 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

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

Dr. Íñigo Blasco, Pablo
- Software Engineer at PlainConcepts
- Founder of Intelligent Behavior Robots
- Robotics Engineer at CATEC Advanced Center for Aerospace Technologies
- Aeroespaciales (CATEC)
- Developer and Consultant at Syderis
- PhD in Industrial Informatics Engineering at the University of Seville
- Degree in Computer Engineering at the University of Seville
- Master in Software Engineering and Technology

Mr. Campos Ortiz, Roberto
- Software Engineer Quasar Scence Resources
- Software Engineer at the European Space Agency (ESA-ESAC) for the Solar Orbiter mission
- Content creator and Artificial Intelligence expert in the course: "Artificial Intelligence: The technology of the present-future" for the Andalusian Regional Government. Euroformac Group
- Quantum Computing Scientist Zapata Computing Inc
- Graduated in Computer Engineering at Carlos III University

- Master in Computer Science and Technology at Carlos III University

Mr. Rosado Junquera, Pablo J.
- Engineer Specialist in Robotics and Automatization
- R&D Automation and Control Engineer at Becton Dickinson & Company
- Amazon Logistic Control Systems Engineer at Dematic
- Automation and Control Engineer at Aries Ingeniería y Sistemas
- Graduate in Energy and Materials Engineering at Rey Juan Carlos University.
- Master's Degree in Robotics and Automation at the Polytechnic University of Madrid
- Master's Degree in Industrial Engineering at the University of Alcalá

Dr. Alejo Teissière, David
- Telecommunications Engineer.with Specialization in Robotics
- Postdoctoral Researcher in the European projects SIAR and NIx ATEX at Pablo de Olavide University
- Systems Developer at Aertec
- PhD in Automation, Robotics and Telematics at the University of Seville
- Graduated in Telecommunication Engineering at the University of Seville
- Master's Degree in Automation, Robotics and Telematics from the University of Seville

- 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
- Graduated in Audiovisual Systems Engineering at 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

Dr. Pérez Grau, Francisco Javier
- Head of the Perception and Software Unit at CATEC
- R&D Project Manager at CATEC
- R&D Project Engineer at CATEC
- Associate Professor at the University of Cadiz.
- Associate Professor at the University International of Andalucia
- Researcher in the Robotics and Perception group at the University of Zurich
- Researcher at the Australian Centre for Field Robotics at the University of Sydney
- PhD in Robotics and Autonomous Systems from the University of Seville.
- Degree in Telecommunications Engineering and Computer and Network Engineering from the University of Seville

Mr. Jiménez Cano, Antonio Enrique
- Engineer at Aeronautical Data Fusion Engineer
- Researcher in European projects (ARCAS, AEROARMS and AEROBI) at the University of Seville
- Researcher in Navigation Systems at CNRS-LAAS
- LAAS MBZIRC2020 System Developer
- Group of Robotics, Vision and Control (GRVC) of the University of Seville
- PhD in Automatics, Electronics and Telecommunications at the University of Seville
- Graduated in Automatic Engineering and Industrial Electronics at the University of Seville
- Degree in Technical Engineering in Computer Systems at the University of Seville

Dr. Ramon Soria, Pablo
- Computational Vision Engineer at Meta
- Applied Science Team Leader and Senior Software Engineer at Vertical Engineering Solutions
- CEO and founder of Domocracy
- ACFR Researcher (Australia)
- Researcher in the GRIFFIN and HYFLIERS projects at the University of Seville
- PhD in Computational Vision for Robotics at the University of Seville
- Graduated in Industrial Engineer, Robotics and Automatization from University of Seville

Dr. Caballero Benítez, Fernando
- Researcher in the European projects COMETS, AWARE, ARCAS and SIAR
- Degree in Telecommunications Engineering from the University of Seville
- PhD in Telecommunications Engineering at the University of Seville
- Full Professor of Systems Engineering and Automatics at the University of Seville
- Associate editor of the journal Robotics and Automation Letters

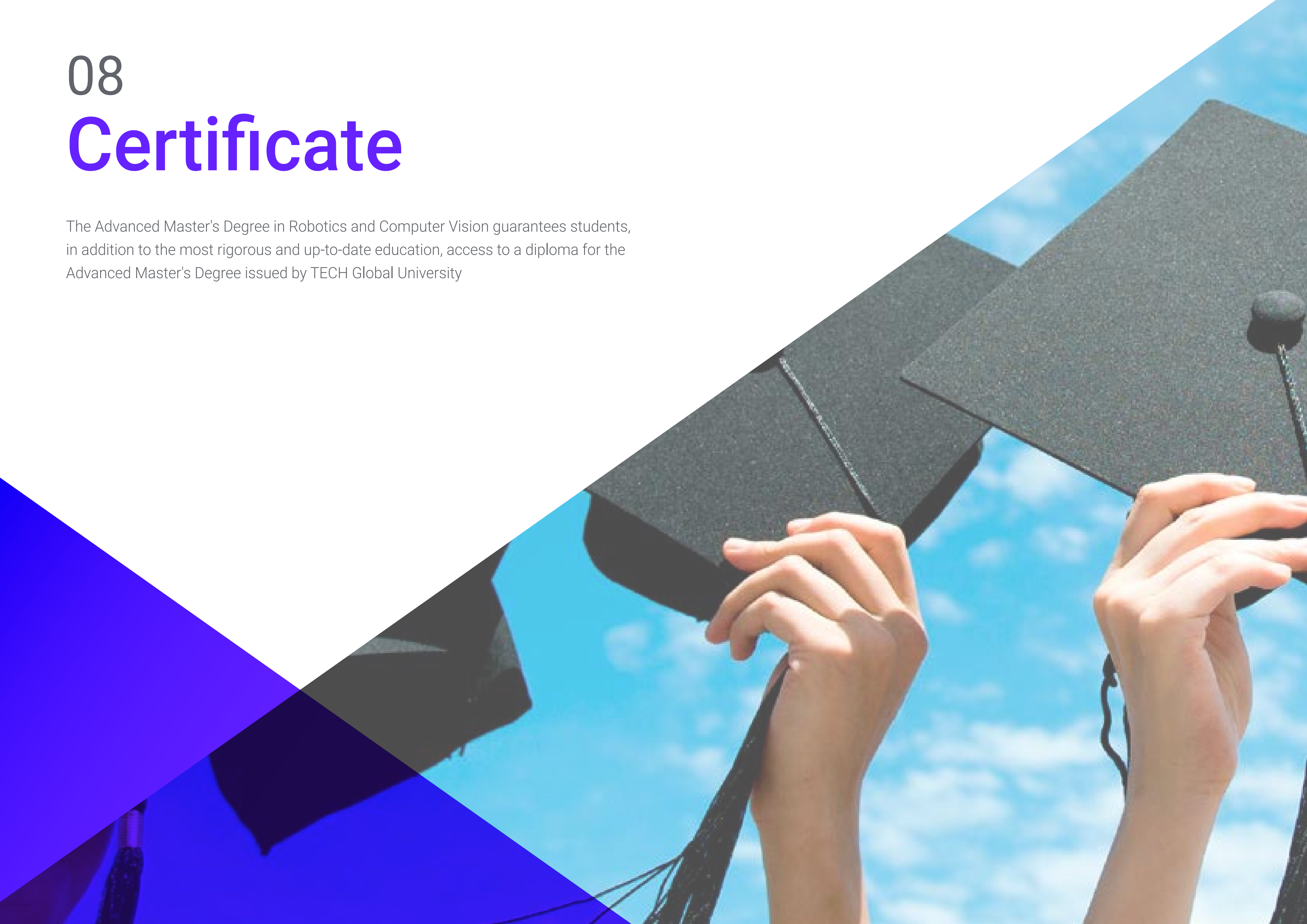
Dr. Lucas Cuesta, Juan Manuel
- Senior Software Engineer and Analyst at Indizen– Believe in Talent
- Senior Software Engineer and Analyst at Krell Consulting and IMAGiNA Artificial Intelligence
- Software Engineer at Intel Corporation
- Software Engineer at Intelligent Dialog Systems
- Doctorate in Electronic Systems Engineering for Intelligent Environments at the Polytechnic University of Madrid
- Graduate in Telecommunications Engineering at the Polytechnic University of Madrid
- Master's Degree in Electronic Systems Engineering for Intelligent Environments at the Polytechnic University of Madrid

Mr. Márquez Ruiz de Lacanal, Juan Antonio
- Software Developer at GTD Defense & Security Solutions
- Software Developer at Solera Inc
- Development and Research Engineer at GRVC Sevilla
- Co-founder of Unmute
- Co-founder of VR Educa
- Academic Exchange in Engineering and Entrepreneurship at the University of
- California, Berkeley
- Degree in Industrial Engineering from the University of Seville

08

Certificate

The Advanced Master's Degree in Robotics 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 Robotics and Computer Vision** endorsed by **TECH Global University**, the worlds 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 Robotics 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 Robotics and Computer Vision

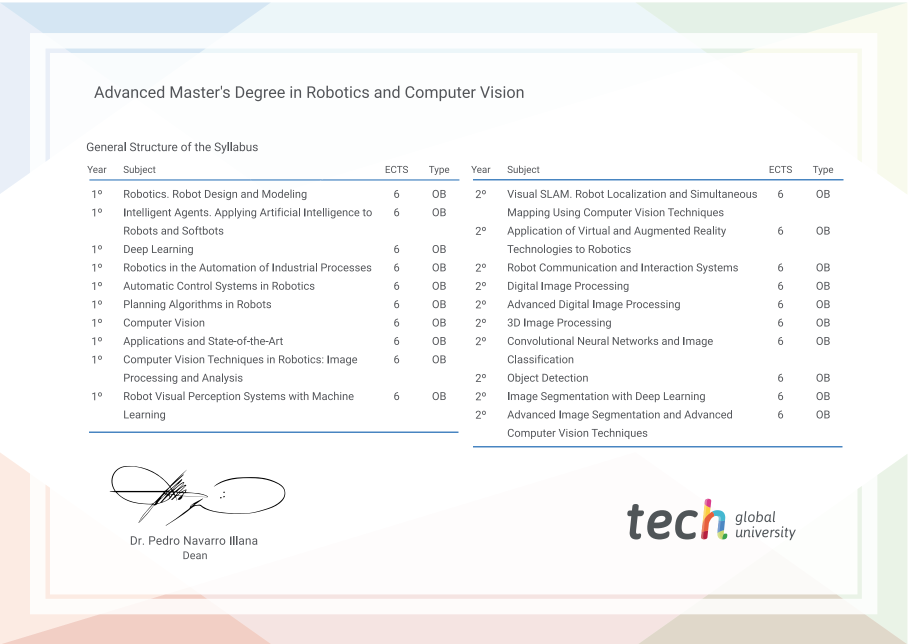
This is a private qualification of 3,600 hours of duration equivalent to 120 ECTS, with a start date of dd/mm/yyyy and an end date of dd/mm/yyyy.

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 Robotics and Computer Vision

General Structure of the Syllabus

Year	Subject	ECTS	Type
1º	Robotics. Robot Design and Modeling	6	OB
1º	Intelligent Agents. Applying Artificial Intelligence to Robots and Softbots	6	OB
1º	Deep Learning	6	OB
1º	Robotics in the Automation of Industrial Processes	6	OB
1º	Automatic Control Systems in Robotics	6	OB
1º	Planning Algorithms in Robots	6	OB
1º	Computer Vision	6	OB
1º	Applications and State-of-the-Art	6	OB
1º	Computer Vision Techniques in Robotics: Image Processing and Analysis	6	OB
1º	Robot Visual Perception Systems with Machine Learning	6	OB

Year	Subject	ECTS	Type
2º	Visual SLAM. Robot Localization and Simultaneous Mapping Using Computer Vision Techniques	6	OB
2º	Application of Virtual and Augmented Reality Technologies to Robotics	6	OB
2º	Robot Communication and Interaction Systems	6	OB
2º	Digital Image Processing	6	OB
2º	Advanced Digital Image Processing	6	OB
2º	3D Image Processing	6	OB
2º	Convolutional Neural Networks and Image Classification	6	OB
2º	Object Detection	6	OB
2º	Image Segmentation with Deep Learning	6	OB
2º	Advanced Image Segmentation and Advanced Computer Vision Techniques	6	OB

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

Robotics 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
Robotics and Computer Vision

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