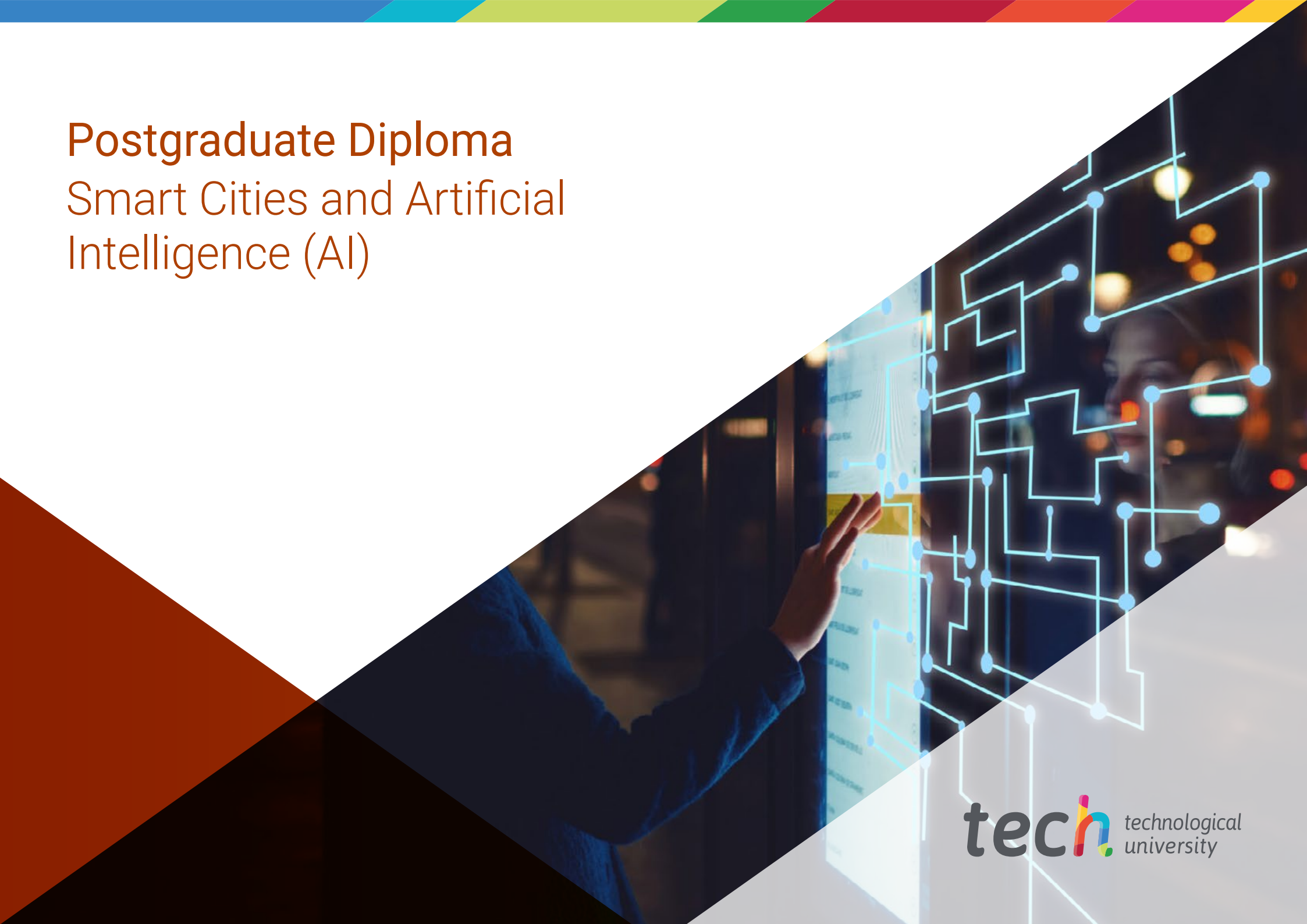
Postgraduate Diploma

Smart Cities and Artificial Intelligence (AI)



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Postgraduate Diploma
Smart Cities and Artificial Intelligence (AI)

- Modality: **online**
- Duration: **6 months**
- Certificate: **TECH Technological University**
- Dedication: **16h/week**
- Schedule: **at your own pace**
- Exams: **online**

Website: **www.techtitute.com/in/engineering/postgraduate-diploma/postgraduate-diploma-smart-cities-artificial-intelligence**

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01

Introduction

Industry experts around the world anticipate that, in the near future, 90% of the electronic devices used by a city's inhabitants will be connected to the Internet. The Smart City model presented in this 100% online program is based on a neural system of sensors that collect and return data in real time, turning it into an entity with a life of its own. Engineers will acquire in-depth knowledge of these platforms, which will transform current infrastructures into more efficient, sustainable and safe spaces. This way, they will learn how to develop new business opportunities in engineering based on their own connectivity. All this while examining the commercial uses of computer vision and acquiring the necessary skills to develop specialized knowledge in Artificial Intelligence

If you want to learn about the tools that have revolutionized the industrial sector, this is your best option"

A city is an urban space with a high population density in which diverse activities are developed for social life with a high level of interaction. Consequently, a Smart City provides a traditional city with tools and systems that make its habitability more efficient. This program teaches the basics of Smart Cities technological engineering, such as the parameterization and sensorization of their environments, the datification of public infrastructures, the measurement and scanning of social events and the advanced analysis of urban dynamics, among others.

At the same time, there is Natural Language Processing (NLP), understood as the study of how machines understand human language. Nowadays, NLP is used for various functions such as mail filters, wizards, search results, automatic translations, sentiment analysis, automatic subtitles, etc. This Postgraduate Diploma provides specialized knowledge about the main current uses of NLP and the libraries that allow working with NLP focused on industrial projects.

Training a model from scratch requires a large amount of previously catalogued information, approximately 10,000 photos of each of the types to be differentiated. This takes hours to achieve good results. But in many cases, it is possible to start from previously trained models, this technique is known as Transfer Learning. This program examines which network models are currently available, in order to facilitate the training of any industrial model by applying the Transfer Learning technique.

Furthermore, the graduate has the best 100% online study methodology, which eliminates the need to attend classes in person or to comply with a predetermined schedule. Over the course of 6 months, engineers will deepen their understanding of the scope of application of each technology, understanding the competitive advantages they bring, so that they will be positioned at the technological forefront and will be able to lead ambitious industrial projects, now and in the future.

This **Postgraduate Diploma in Smart Cities and Artificial Intelligence (AI)** contains the most complete and up-to-date educational program on the market. Its most notable features are:

- Case studies presented by experts in Smart Cities and Artificial Intelligence
- The graphic, schematic, and practical contents with which they are created, provide and practical information on the disciplines that are essential for professional practice
- Practical exercises where the self-assessment process can be carried out to improve learning
- Its special emphasis on innovative methodologies
- Theoretical lessons, questions to the expert, debate forums on controversial topics, and individual reflection assignments
- Content that is accessible from any fixed or portable device with an Internet connection

Completing this Postgraduate Diploma will position you as an engineering and industry professional at the forefront of the latest developments in the sector"

You will be able to develop a Smart City project, an industrial technology that collects and returns data in real time, turning a city into an entity with a life of its own"

This 100% online program will allow you to combine your studies with your professional work. You choose the time and place.

In-depth knowledge of the scope of application of each technology, understanding the competitive advantages it brings.

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

The multimedia content, developed with the latest educational technology, will provide professionals with situated and contextual learning, i.e., a simulated environment that will provide immersive training, designed for training oneself in real situations.

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

02

Objectives

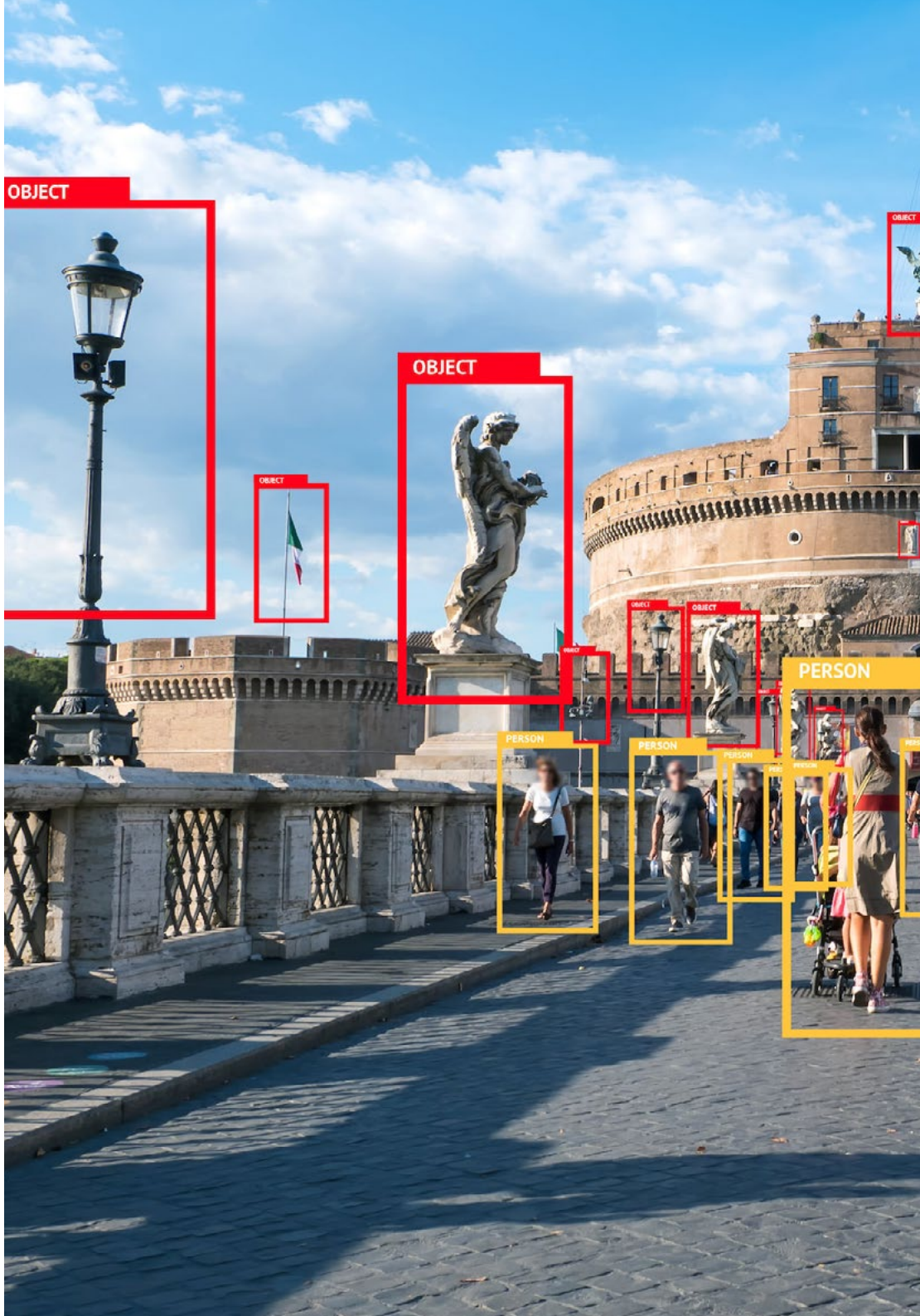
The Postgraduate Diploma in Smart Cities and Artificial Intelligence (AI) focuses on addressing the Smart Cities, NLP/NLU in Embeddings and Transformers and Computer Vision topics. Everything from a practical point of view and focused on engineering, to generate a sense of security in the student that will allow him to be more effective in his daily practice. The direct application of the acquired knowledge is an added professional value, which very few engineers specialized in information and communication technologies can offer.

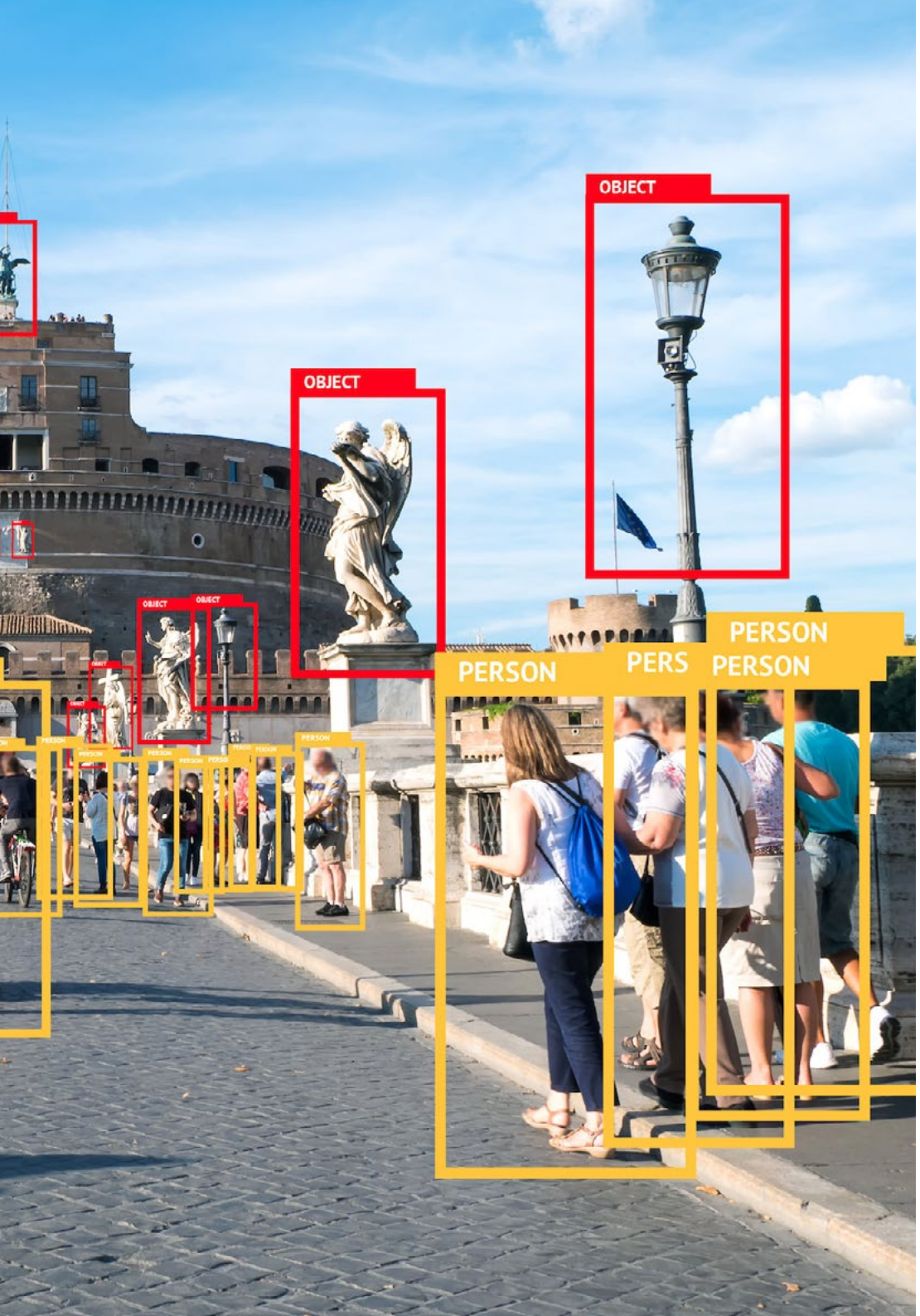
Increase your skills in developing sector solutions in the digital industry and set yourself up for success"

General Objectives

- Present the current panorama of the Smart City model in different countries
- Analyze the advantages of a hyperconnected Smart City model
- Establish different Big Data models and their prediction models
- Propose application scenarios in different city typologies
- Develop specialized knowledge of NLP and NLU
- Examine the operation of Word Embeddings
- Analyze the mechanism of Transformers
- Develop Use Cases of where to apply NLP
- Determine how the Convolution layer works and how Transfer Learning works
- Identify the different types of algorithms mainly used in Computer Vision

You are looking at a comprehensive and multidisciplinary program, which will allow you to excel in your career, following the latest advances in the field of Artificial Intelligence in the industry"





Specific Objectives

Module 1. Smart Cities as innovation tools

- Analyze the technological platform
- Determine what a City Digital Twin is (Virtual Model)
- Establish which are the monitoring layers: density, movement, consumptions, water, wind, solar radiation, etc.
- Carry out a comparative analysis of the following variables
- Integrate the different sensor networks (IoT/M2M), as well as the behavioral parameters of the inhabitants of the city (treated as human sensors)
- Develop a detailed vision of how Smart Cities will influence the future of people
- Generate interest in the implementation of smart city models

Module 2. R&D and AI NLP/NLU. Embeddings and transformers

- Develop specialized knowledge of NLP (Natural Language Processing)
- Identify NLU (Natural Language Understanding)
- Differences between NLP and NLU
- Word Embeddings and examples using Word2vec
- Analyze Transformers
- Examine examples of various Applied Transformers

Module 3. R&D and AI *Computer Vision* Object identification and tracking

- Analyze what Computer Vision is
- Determine typical computer vision tasks
- Analyze, step-by-step, how Convolution and Transfer Learning works
- Identify what mechanisms we have available to create modified images, from our own, to have more training data
- Compile typical tasks that can be performed with computer vision
- Examine commercial computer vision use cases

03

Course Management

This Postgraduate Diploma in Smart Cities and Artificial Intelligence (AI) has highly qualified engineers with first-hand knowledge of these disruptive technologies. They will offer students specialized content during the course, with the aim of helping them specialize in the application of the technologies of the future, but with real applications in the present. As a result, engineers will develop specialized knowledge, allowing them to become catalysts for future technologies, starting right now.

Engineers with years of experience in the Artificial Intelligence sector will give you the keys you need to significantly enhance your work"

Management

Mr. Molina Molina, Jerónimo

- He is currently leading several relevant projects in the field of Artificial Intelligence.
- AI Engineer & Software Architect. NASSAT - Internet Satellite in Motion
- Sr. Consultant at Hexa Ingenieros
- Expert in Artificial Intelligence based solutions.
- He is currently leading several relevant projects in the field of Artificial Intelligence.
- Computer Engineer (Alicante University)
- Expert in Business Creation and Development (Bancaixa - FUNDEUN Alicante)
- Computer Engineer (Alicante University)
- Executive MBA (European Business Campus Forum)
- Master in Artificial Intelligence (Avila Catholic University)

Professors

Dr. Villalba García, Alfredo

- Professor of Domotics at CEDOM
- Design Engineer at ITT Standard Electric and ALCATEL
- Industrial Engineer from the School of Industrial Engineering of the Polytechnic University of Madrid.
- Specialist in Robotics and Automation
- Master's Degree in Retail Technology
- Master's Degree in Industrial Automation
- Master's Degree in Domotics and Inmotics
- Ph.D. in Computer Science from the University of Fontainebleau
- CEO and Founding Partner of INMOMATICA and CQUENT

Mr. Pi Morell, Oriol

- Degree in Technical Engineering in Computer Management from the Autonomous University of Madrid.
- Master's Degree in Artificial Intelligence
- Master's Degree in Business Administration MBA
- Master's Degree in Information Systems Management
- Functional Analyst at Fihoca, Atmira and Capgemini
- CDMON Hosting and Mail Product Owner

04

Structure and Content

This Postgraduate Diploma consists of a 3-module syllabus focused on the industrial market. The first module focuses on innovation, through Smart Cities, which is a booming area of work. On the other hand, modules 2 and 3 address two of the most promising fields in the world of Artificial Intelligence: NLP and Computer Vision, both of which are closely related to robotics, autonomous vehicles and the emerging field of Emotive Computing, making it essential to specialize as an engineer.

Engineers who complete this program become unique professionals in their field"

Module 1. Smart Cities as Innovation Tools

1.1. From Cities to Smart Cities
- 1.1.1. From Cities to Smart Cities
- 1.1.2. Cities Over Time and Cultures in Cities
- 1.1.3. Evolution of City Models

1.2. Technologies
- 1.2.1. Technological Application Platforms
- 1.2.2. Services/Citizen Interfaces
- 1.2.3. Technological Typologies

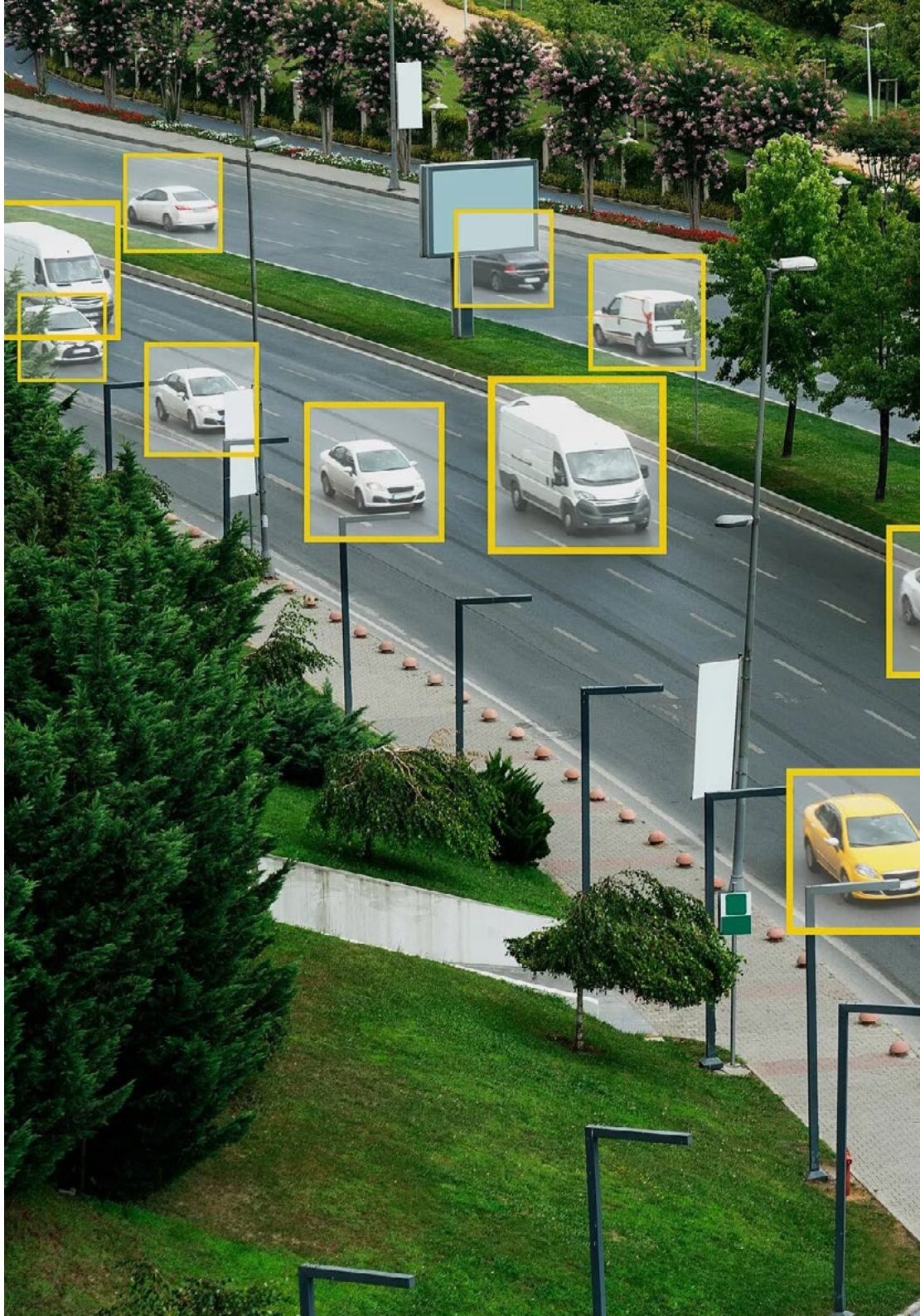
1.3. City as a Complex System
- 1.3.1. Components of a City
- 1.3.2. Interactions between Components
- 1.3.3. Applications: Products and Services in the City

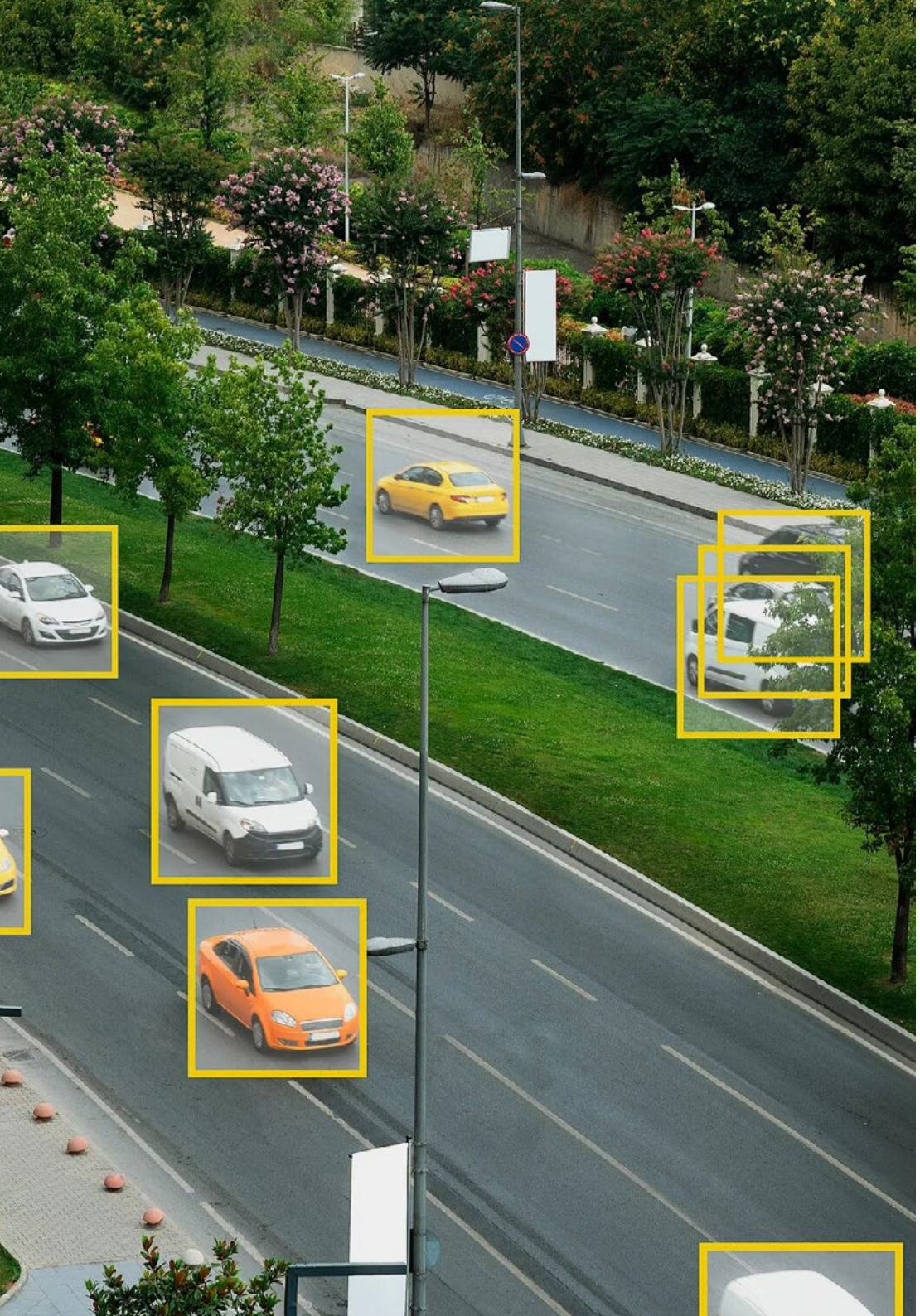
1.4. Intelligent Safety Management
- 1.4.1. Current State
- 1.4.2. Technological Management Environments in the City
- 1.4.3. Future: Smart Cities in the Future

1.5. Intelligent Cleaning Management
- 1.5.1. Application Models in Intelligent Cleaning Services
- 1.5.2. Systems: Application of Intelligent Cleaning Services
- 1.5.3. Future of Intelligent Cleaning Services

1.6. Intelligent Traffic Management
- 1.6.1. Traffic Evolution: Complexity and Factors Hindering Traffic Management
- 1.6.2. Problems
- 1.6.3. E-Mobility
- 1.6.4. Solutions

1.7. Sustainable City
- 1.7.1. Energy
- 1.7.2. The Water Cycle
- 1.7.3. Management Platform





1.8. Intelligent Leisure Management
- 1.8.1. Business Models
- 1.8.2. Urban Leisure Evolution
- 1.8.3. Associated Services

1.9. Large Social Event Management
- 1.9.1. Movement
- 1.9.2. Capacities
- 1.9.3. Health

1.10. Conclusions on the Present and Future of Smart Cities
- 1.10.1. Technology Platforms and Problems
- 1.10.2. Technologies, Integration in Heterogeneous Environments
- 1.10.3. Practical Applications in Different City Models

Module 2. R&D and AI NLP/NLU Embeddings and Transformers

2.1. *Natural Language Processing* (NLP)
- 2.1.1. *Natural Language Processing*. Uses of NLP
- 2.1.2. *Nautral Language Processing* (NLP). Libraries
- 2.1.3. Stoppers in NLP Application

2.2. *Natural Lenguage Understanding/Natural Language Generation* (NLU/NLG)
- 2.2.1. NLG AI NLP/NLU Embeddings and Transformers
- 2.2.2. NLU/NLG. Uses
- 2.2.3. NLP/NLG. Differences

2.3. *Word Embeddings*
- 2.3.1. *Word Embeddings*
- 2.3.2. *Word Embeddings* Uses
- 2.3.3. Word2vec. Libraries

2.4. Embeddings. Practical Application
- 2.4.1. Word2vec Code
- 2.4.2. Word2vec. Real Cases
- 2.4.3. Corpus for Word2vec Use. Examples:

2.5. *Transformers*
- 2.5.1. *Transformers*
- 2.5.2. Models Created with Transformers
- 2.5.3. Pros and Cons of Transformers

2.6. Sentiment Analysis
- 2.6.1. Sentiment Analysis
- 2.6.2. Practical Application of Sentiment Analysis
- 2.6.3. Uses of Sentiment Analysis

2.7. GPT *Open* AI
- 2.7.1. GPT *Open* AI
- 2.7.2. GPT 2. Free Disposal Model
- 2.7.3. GPT 3. Payment Model

2.8. Hugging Face Community
- 2.8.1. Hugging Face Community
- 2.8.2. Hugging Face Community Possibilities
- 2.8.3. Hugging Face Community Examples:

2.9. Barcelona Super Computing Case
- 2.9.1. BSC Case
- 2.9.2. MARIA Model
- 2.9.3. Existing Corpus
- 2.9.4. Importance of Having a Large Spanish Language Corpus

2.10. Practical Applications
- 2.10.1. Automatic Summary
- 2.10.2. Text Translation
- 2.10.3. Sentiment Analysis
- 2.10.4. Speech Recognition

Module 3. R&D and AI Computer Vision Object Identification and Tracking

3.1. Computer Vision
- 3.1.1. *Computer Vision*
- 3.1.2. Computational Vision
- 3.1.3. Interpretation of the Machines in an Image

3.2. Activation Functions
- 3.2.1. Activation Functions
- 3.2.2. Sigmoid
- 3.2.3. ReLU
- 3.2.4. Hyperbolic Tangent
- 3.2.5. *Softmax*

3.3. Convolutional Neural Network Construction
- 3.3.1. Convolution Operation
- 3.3.2. ReLU Layer
- 3.3.3. *Pooling*
- 3.3.4. *Flattering*
- 3.3.5. *Full Connection*

3.4. Convolution Process
- 3.4.1. How a Convolution Works
- 3.4.2. Convolution Code
- 3.4.3. Convolution. Application

3.5. Transformations with Images
- 3.5.1. Transformations with Images
- 3.5.2. Advanced Transformations
- 3.5.3. Transformations with Images Application
- 3.5.4. Transformations with Images *Use Case*

3.6. Transfer Learning
- 3.6.1. Transfer Learning
- 3.6.2. Transfer Learning Typology
- 3.6.3. Deep Networks to Apply Transfer Learning

3.7. Computer Vision *Use Case*
- 3.7.1. Image Classification
- 3.7.2. Object Detection
- 3.7.3. Object Identification
- 3.7.4. Object Segmentation

3.8. Object Detection
- 3.8.1. Convolution-based Detection
- 3.8.2. R-CNN, Selective Search
- 3.8.3. Rapid Detection with YOLO
- 3.8.4. Other Possible Solutions

3.9. GAN. Generative Adversarial Networks
- 3.9.1. Generative Adversarial Networks
- 3.9.2. Code for a GAN
- 3.9.3. GAN. Application

3.10. Application of Computer Vision Models
- 3.10.1. Content Organization
- 3.10.2. Visual Search Engines
- 3.10.3. Facial Recognition
- 3.10.4. Augmented Reality
- 3.10.5. Autonomous Driving
- 3.10.6. Fault Identification in Each Assembly
- 3.10.7. Pest Identification
- 3.10.8. Health

05

Methodology

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

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

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

At TECH we use the Case Method

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

At TECH, you will experience a way of learning that is shaking the foundations of traditional universities around the world"

We are the first online university to combine Harvard Business School case studies with a 100% online learning system based on repetition.

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

A learning method that is different and innovative

This intensive Engineering program at TECH Technological University prepares you to face all the challenges in this field, both nationally and internationally. We are committed to promoting your personal and professional growth, the best way to strive for success, that is why at TECH Technological University you will use Harvard *case studies*, with which we have a strategic agreement that allows us, to offer you material from the best university in the world.

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

The case method is the most widely used learning system by the best faculties in the world. The case method was developed in 1912 so that law students would not only learn the law based on theoretical content. It consisted of presenting students with real-life, complex situations for them to make informed decisions and value judgments on how to resolve them. In 1924, Harvard adopted it as a standard teaching method.

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

Relearning Methodology

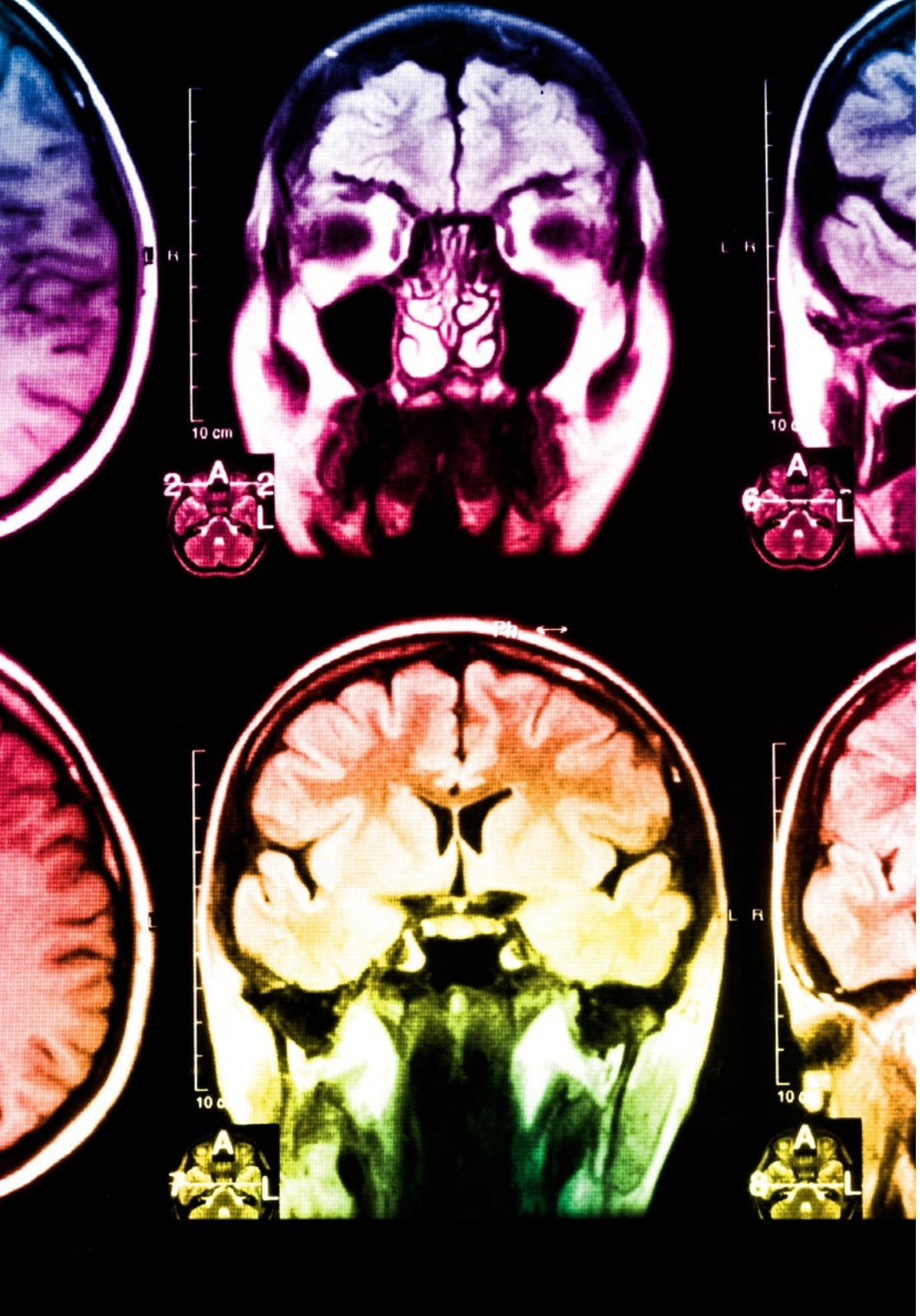
TECH is the first university in the world to combine Harvard University *case studies*with a 100% online learning system based on repetition, which combines 8 different didactic elements in each lesson.

We enhance Harvard *case studies* with the best 100% online teaching method: Relearning.

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

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

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



In our program, learning is not a linear process, but rather a spiral (learn, unlearn, forget, and re-learn). Therefore, we combine each of these elements concentrically. This methodology has trained more than 650,000 university graduates with unprecedented success in fields as diverse as biochemistry, genetics, surgery, international law, management skills, sports science, philosophy, law, engineering, journalism, history, and financial markets and instruments. All this in a highly demanding environment, where the students have a strong socio-economic profile and an average age of 43.5 years.

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

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

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

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

Study Material

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

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

Classes

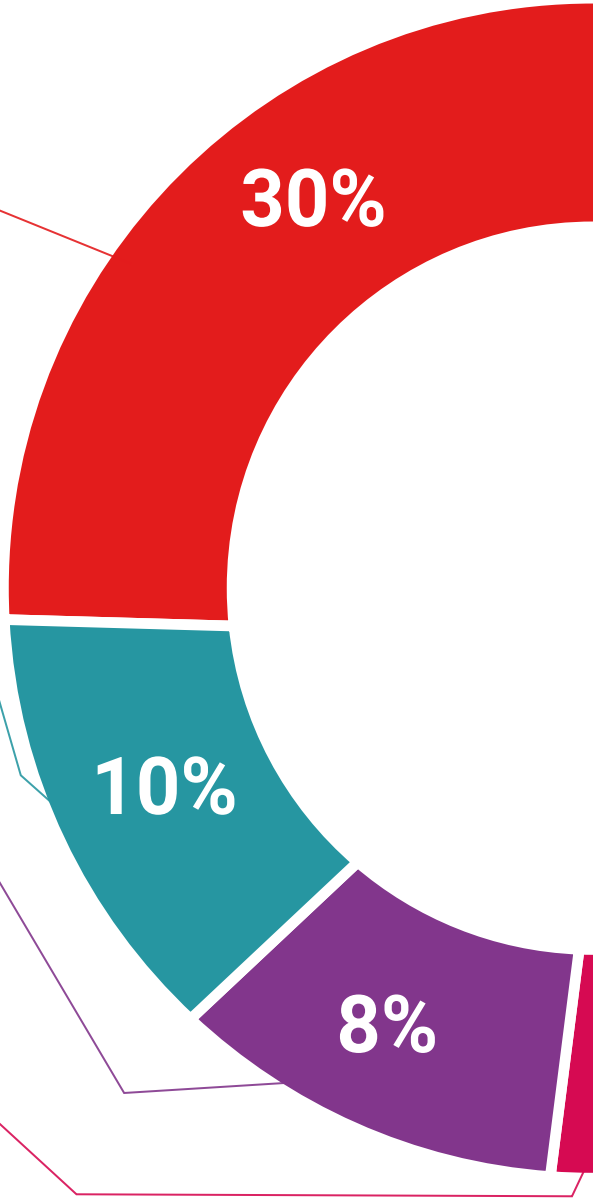
There is scientific evidence suggesting that observing third-party experts can be useful. Learning from an Expert strengthens knowledge and memory, and generates confidence in future difficult decisions.

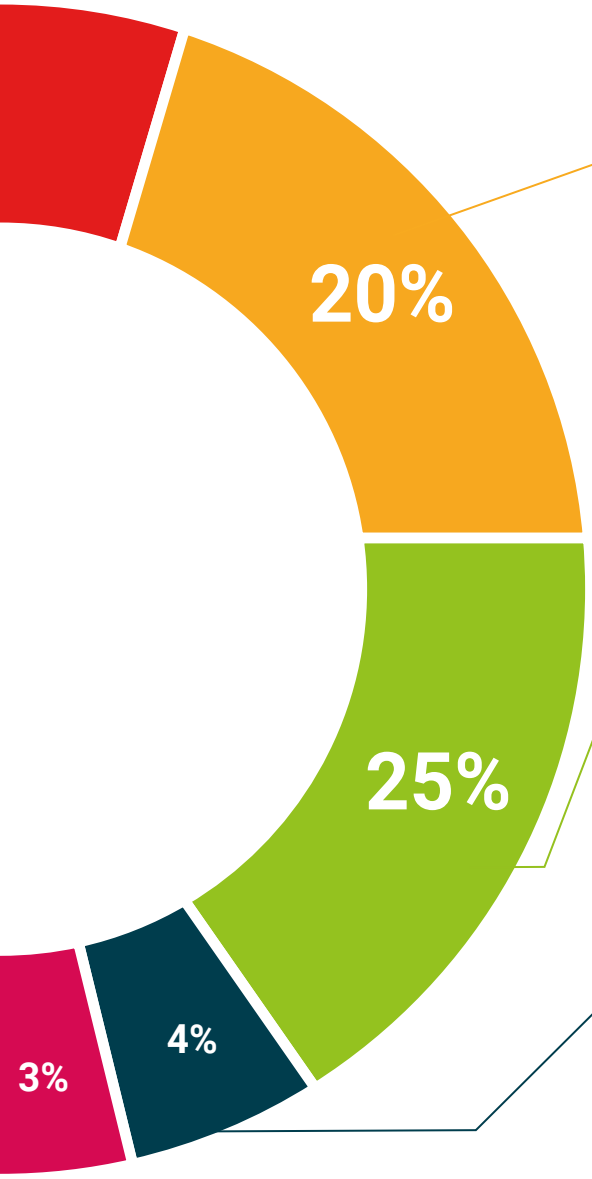
Practising Skills and Abilities

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

Additional Reading

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





Case Studies

They will complete a selection of the best case studies in the field used at Harvard. Cases that are presented, analyzed, and supervised by the best senior management specialists in the world.

Interactive Summaries

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

This exclusive multimedia content presentation training Exclusive system was awarded by Microsoft as a "European Success Story".

Testing & Retesting

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

06

Certificate

This Postgraduate Diploma in Smart Cities and Artificial Intelligence guarantees, in addition to the most rigorous and up-to-date education, access to a Postgraduate Diploma issued by TECH Technological University.

Successfully complete this training program and receive your university certificate without travel or laborious paperwork"

This **Postgraduate Diploma in Smart Cities and Artificial Intelligence (AI)** contains the most complete and up-to-date program on the market.

After the student has passed the assessments, they will receive their corresponding **Postgraduate Diploma** issued by **TECH Technological University** via tracked delivery*.

The certificate issued by **TECH Technological University** will reflect the qualification obtained in the Postgraduate Diploma, and meets the requirements commonly demanded by labor exchanges, competitive examinations, and professional career evaluation committees.

Title: **Postgraduate Diploma in Smart Cities and Artificial Intelligence (AI)**

Official Nº of Hours: **450 h.**

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Awards the following

CERTIFICATE

to

Mr./Ms. _____ with identification number _____.

For having passed and accredited the following program

POSTGRADUATE DIPLOMA

in

Smart Cities and Artificial Intelligence (AI)

This is a qualification awarded by this University, equivalent to 450 hours, with a start date of dd/mm/yyyy and an end date of dd/mm/yyyy.

TECH is a Private Institution of Higher Education recognized by the Ministry of Public Education as of June 28, 2018.

June 17, 2020

Tere Guevara Navarro
Dean

This qualification must always be accompanied by the university degree issued by the competent authority to practice professionally in each country. Unique TECH Code: AFWORD23S techtitute.com/certificates

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

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