

# Postgraduate Diploma Smart Cities and Artificial Intelligence (AI)



## 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.techtute.com/in/artificial-intelligence/postgraduate-diploma/postgraduate-diploma-smart-cities-artificial-intelligence-ai](http://www.techtute.com/in/artificial-intelligence/postgraduate-diploma/postgraduate-diploma-smart-cities-artificial-intelligence-ai)

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# 01

# Introduction

According to data from the United Nations, the transformation of cities into Smart Cities represents not only a technological evolution, but also a strategic opportunity to address contemporary challenges aligned with the Sustainable Development Goals. In this sense, Artificial Intelligence constitutes a valuable tool for efficient management of resources such as water or transportation. For example, algorithms can predict energy demand and adjust distribution to reduce waste. In this way, smart systems reduce environmental impact while improving the quality of life of citizens. Faced with this reality, TECH creates an online program focused on *Smart Cities*, which will offer innovative tools to improve the environment.





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*The current importance of Artificial Intelligence makes this Postgraduate Diploma a safe bet, with a market in continuous growth and full of opportunities”*

Convolutional Neural Networks (CNN) are key elements for solving machine learning problems related to visual data. These architectures have a wide range of applications, being especially useful in the healthcare field. Health professionals use CNNs in their medical programs to diagnose diseases through images such as X-rays or CT scans. In this way, these systems are highly beneficial in planning radiotherapy treatments, thus helping to determine the optimal irradiation dose. Moreover, these elements can be used to develop innovative solutions that can include remote monitoring.

In this context, TECH implements a Postgraduate Diploma oriented to Research, Development and Innovation in the area of Artificial Intelligence.

The curriculum will delve into aspects such as Computer Vision, Transfer Learning or Antagonistic Generative Networks. In addition, the didactic materials will analyze in detail the Natural Language Processing, including advanced techniques such as Word Embeddings, Transformers or Sentiment Analysis. The program will also provide the keys to the correct use of GTP Open AI, so that students will be able to generate coherent texts from a given input.

Since this university program is taught completely online, students will enjoy a first-class educational experience without the need to travel to a study center. Similarly, students will strengthen their knowledge through a library of multimedia resources, including case studies and interactive summaries. On the other hand, TECH employs the revolutionary Relearning teaching system. Thanks to this, specialists will enjoy a natural and progressive learning.

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

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



*Tackle Transfer Learning at the world's best digital university according to Forbes"*

“

*Want to specialize in GTP Open AI? Get it with this university program in just 450 hours"*

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

The multimedia content, developed with the latest educational technology, will provide the professional with situated and contextual learning, i.e., a simulated environment that will provide immersive education programmed to learn in real situations.

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

*You will master Transform Models and use them to translate texts in different languages accurately.*

*Thanks to the revolutionary Relearning methodology, you will enjoy a flexible and positive learning experience.*



# 02

# Objectives

Thanks to this Postgraduate Diploma, graduates will gain a solid understanding of Smart Cities and Artificial Intelligence to broaden their professional horizons. Students will enrich their daily practice with new skills that will allow them to successfully manage the most advanced tools of Natural Language Processing. Likewise, professionals will master Computer Vision to identify and classify objects by images or videos. They will then be able to make the leap into a wide range of industries, ranging from cybersecurity to medicine and transportation.





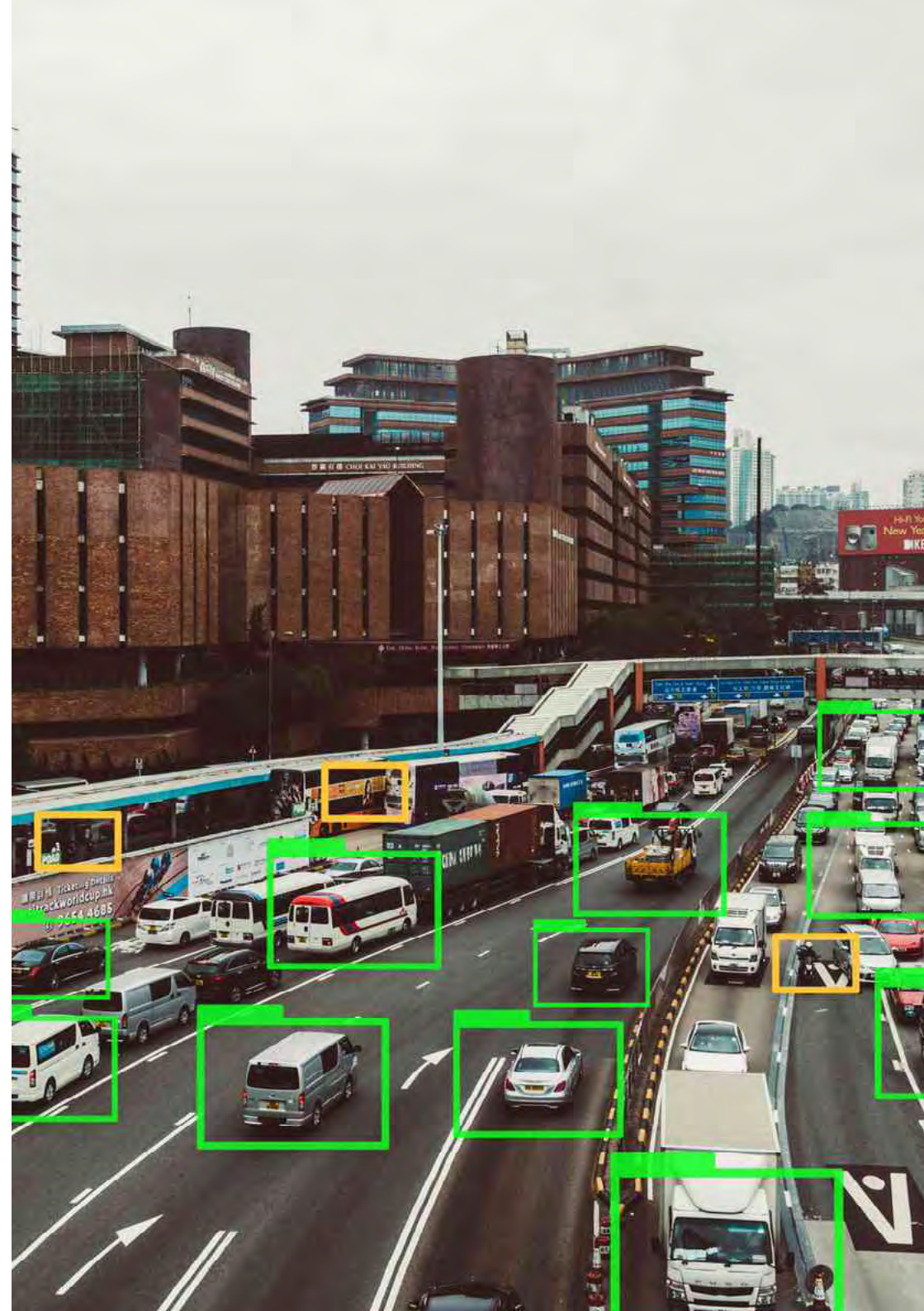
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*You will delve into the area of Smart Cities to improve the quality of life of the population”*



## 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





## Specific Objectives

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### Module 1. Smart Cities as Innovation Tools

- ♦ Analyze the technological platform
- ♦ Determine what a Digital City 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

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

- ♦ Develop specialized knowledge on NLP Natural Language Processing
- ♦ Identify NLU (Natural Language Understanding)
- ♦ Understanding the use of Word Embeddings and examples using Word2vec
- ♦ Analyze Transformers
- ♦ Examine examples of various Applied Transformers
- ♦ Delve into the NLP/NLU field through common Case Studies

### 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 works and how 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



*You will specialize in Computer Vision to perform facial recognition and excel in fields such as Security"*

03

# Course Management

Thanks to TECH's commitment to constantly raise the academic level of its university programs, this program has the best professionals in the field of Smart Cities and Artificial Intelligence. These specialists have been in charge of both the design and development of all the teaching materials available in this Postgraduate Diploma. Therefore, students will have access to top-quality academic resources that will enable them to acquire new skills, to take advantage of all the opportunities offered by the technology industry.



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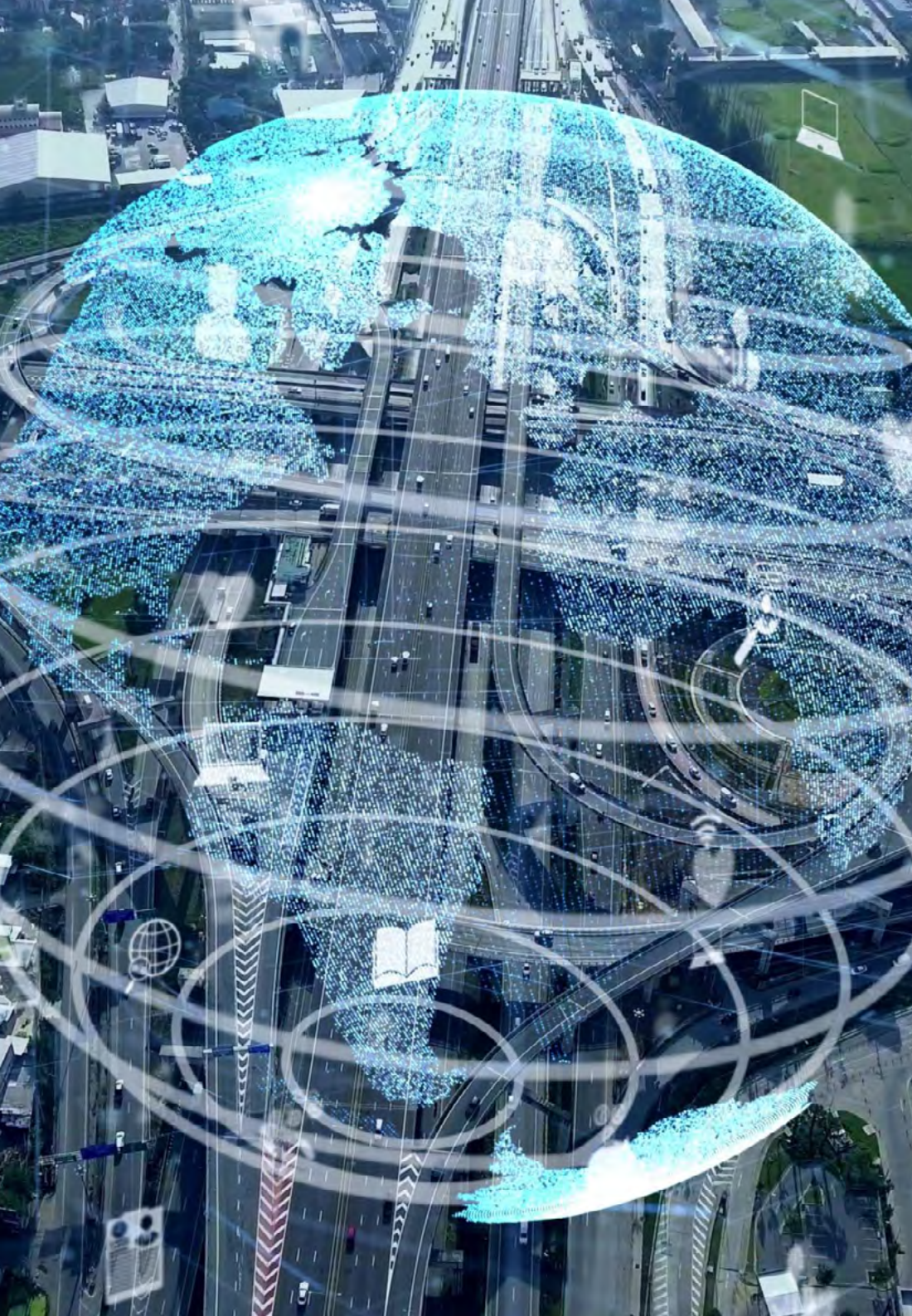
*You will have the support of a teaching team made up of specialists in Smart Cities and Artificial Intelligence”*

## Management



### Mr. Molina Molina, Jerónimo

- ♦ Head of the Artificial Intelligence Department at Ibermática
- ♦ AI Engineer & Software Architect at NASSAT, Internet Satellite in Motion
- ♦ Senior Consultant at Hexa Ingenieros
- ♦ Introducer of Artificial Intelligence (ML and CV)
- ♦ Expert in Artificial Intelligence Based Solutions in the fields of Computer Vision, ML/DL and NLP
- ♦ Expert in Business Creation and Development at Bancaixa - FUNDEUN Alicante
- ♦ Computer Engineer from the University of Alicante
- ♦ Master's Degree in Artificial Intelligence from the Catholic University of Avila
- ♦ Executive MBA European Business Campus Forum)



## Professors

### Dr. Villalba García, Alfredo

- ◆ Industrial Engineer with specialization in Domotics and Inmotics
- ◆ Director of Fractalia Smart Projects
- ◆ CEO and Founding Partner of INMOMATICA
- ◆ Director of Technology and Operations at BBVA
- ◆ Industrial Systems Director at Alcatel
- ◆ Ph.D. in La Computer Science from the University of Fontainebleau
- ◆ Professional Master's Degree in Domotics and Industrial Automation, Polytechnic University of Madrid
- ◆ Member of: Board of Directors of Spanish Association of Home Automation

### Mr. Pi Morell, Oriol

- ◆ Functional Analyst at Fihoca
- ◆ Hosting and Mail Product Owner CDMON
- ◆ Functional Analyst and Software Engineer at Atmira and CapGemini
- ◆ Teacher at ORACLE Forms CapGemini and Atmira
- ◆ Professional Master's Degree in Technical Engineering in Computer Management from the Autonomous University of Barcelona
- ◆ Master's Degree in Artificial Intelligence from the Catholic University of Avila
- ◆ Professional's Degree in Business Administration and Management by IMF Smart Education
- ◆ Master's Degree in Information of Systems Management by IMF Smart Education
- ◆ Postgraduate Degree in Design in Patterns, Catalunya Open University

# 04

# Structure and Content

This program will provide students with a holistic view of Smart Cities and Artificial Intelligence. Developed by experts in this field, the academic itinerary will delve into Smart Cities, as tools for innovation in diverse fields ranging from security to cleanliness. On the other hand, the program will delve into Natural Language Processing, which will make it possible to analyze large volumes of data to analyze users' feelings. It will also address the construction of Convolutional Neural Networks, aimed at solving a variety of problems in computer vision.





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*With TECH you will be up to date with the latest technological advances in the field of Convolutional Neural Networks"*

## 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: Intelligent Cleaning Services Application
  - 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. Natural Language Processing (NLP). Libraries
  - 2.1.3. Stoppers in NLP Application
- 2.2. Natural Language Understanding/Natural Language Generation (NLU/NLG)
  - 2.2.1. NLG. I.A. 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

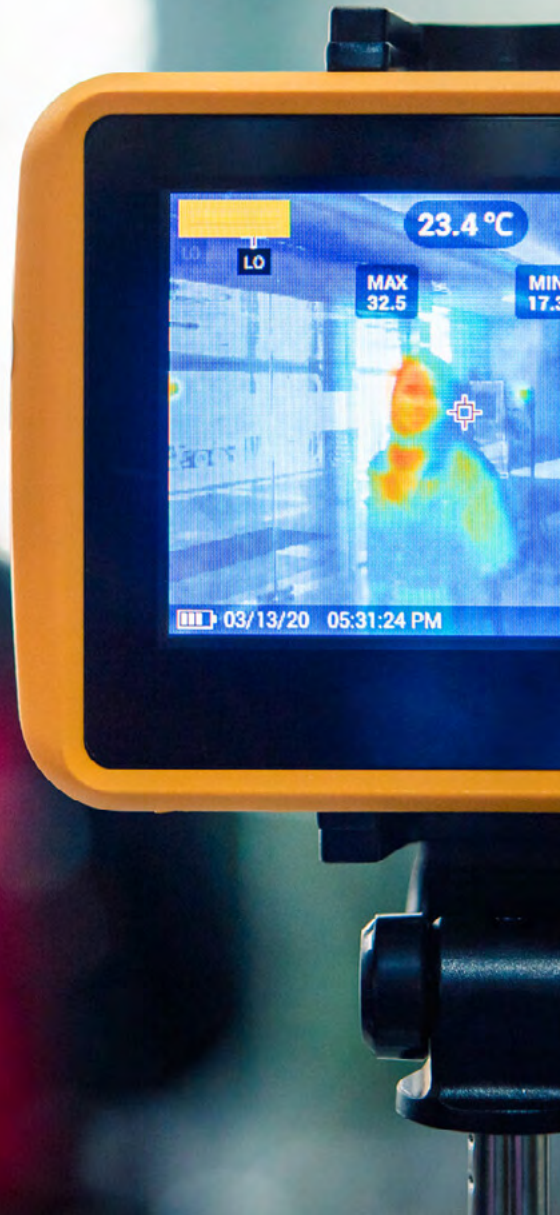
- 2.6. Sentiment Analysis
  - 2.6.1. Sentiment Analysis
  - 2.6.2. Practical Application of Sentiment Analysis
  - 2.6.3. Uses of Sentiment Analysis
- 2.7. GPT Open AI
  - 2.7.1. GPT Open AI
  - 2.7.2. GPT 2. Free Disposal Model
  - 2.7.3. GPT 3. Payment Model
- 2.8. Hugging Face Community
  - 2.8.1. 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. Operation of a Convolution
  - 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 at each Assembly
  - 3.10.7. Pest Identification
  - 3.10.8. Health



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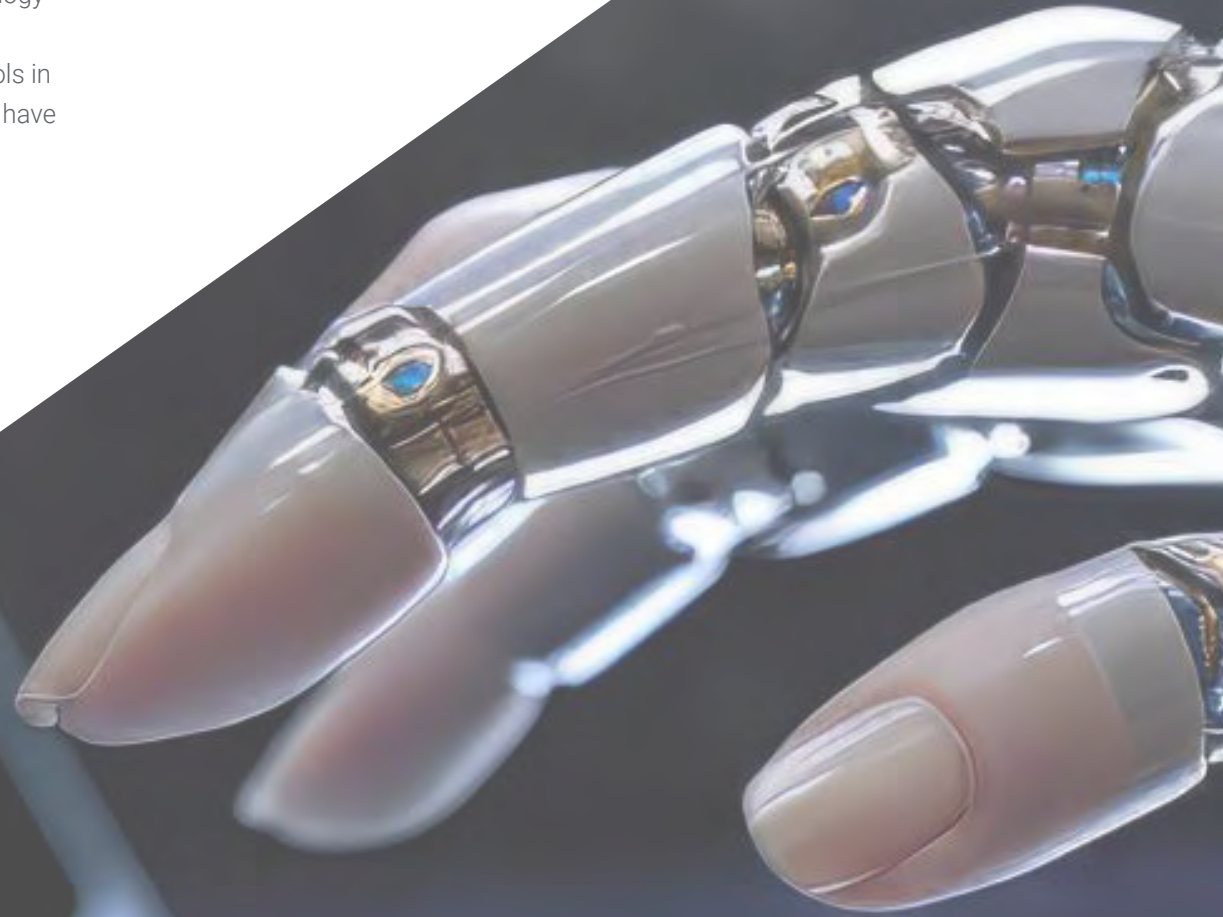
*You will achieve your goals with the help of TECH's didactic tools, including Case Study and interactive summaries”*

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.





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

## Case Study to contextualize all content

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

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



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





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

### A learning method that is different and innovative

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

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

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

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

## Relearning Methodology

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

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

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

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

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



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

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

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

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

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



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



### Study Material

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

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



### Classes

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

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



### Practising Skills and Abilities

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



### Additional Reading

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





#### Case Studies

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



#### Interactive Summaries

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

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



#### Testing & Retesting

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



06

# Certificate

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





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*Successfully complete this program and receive your university qualification without having to travel or fill out 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 N° of Hours: **450 h.**



\*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.



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



## 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**

# Postgraduate Diploma Smart Cities and Artificial Intelligence (AI)

