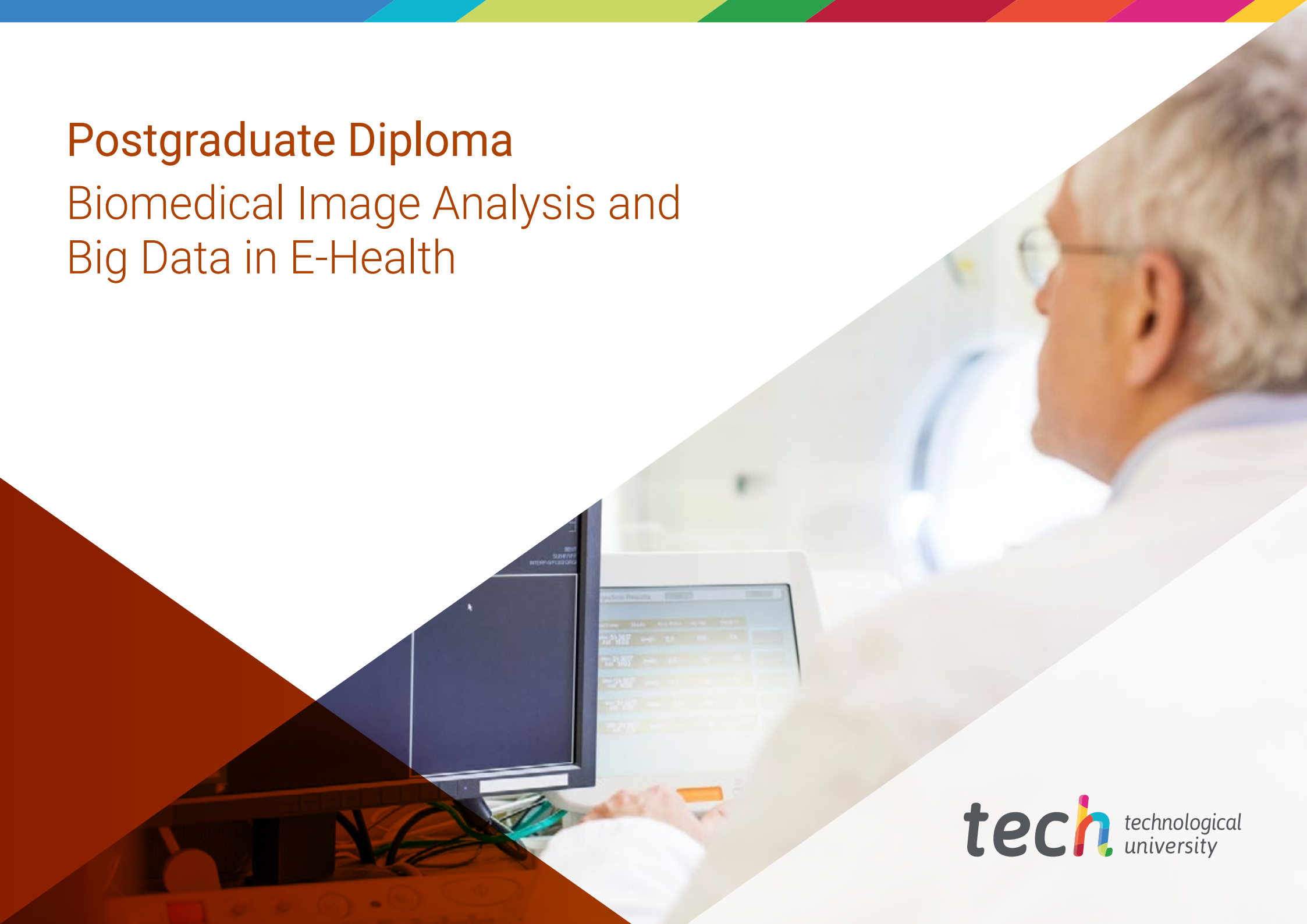
# Postgraduate Diploma

## Biomedical Image Analysis and Big Data in E-Health



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# Postgraduate Diploma
## Biomedical Image Analysis and Big Data in E-Health

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

Website: **www.techtitute.com/pk/engineering/postgraduate-diploma/postgraduate-diploma-biomedical-image-analysis-big-data-e-health**

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# Introduction

The public administration's growing interest in streamlining healthcare processes puts healthcare optimization at the top of the list of priorities. To achieve this, engineers in the field are equipping themselves with technological tools that enable them to automate data comparison and use technical tools to improve patient care.

This is where an imminent labor market demand has been found to welcome professionals who know industrial advances and know how to put them into practice. TECH offers a program that brings this qualification to engineers and helps them to achieve it with the endorsement of experts in the field. In addition, it does so through a 100% online program, which facilitates flexible learning and adapted to the circumstances of each student.

*A program that will qualify you in the field of biomedical image analysis and the control of socio-health data, in order to optimize medical care"*

Far from applying mechanical and sanitary care, data analysis and biomedical imaging make it possible to improve the diagnosis for each individual case. The extensive collection of data available to healthcare centers can be managed quickly and easily thanks to Big Data, but, above all, it allows heterogeneous information from different centers to be contrasted. Given the need, public health requires professionals who know how to respond to problems and can implement the latest tools.

TECH has detected the demand for professionals by companies and, therefore, offers this Postgraduate Diploma in Biomedical Image Analysis and Big Data in E-Health to graduates in Engineering who wish to update their knowledge in this field. Students who receive the program will have a *Relearning* methodology that will avoid long hours of study and will enable them to assimilate the concepts in a simple and progressive way.

In addition, TECH is supported by a team of professionals who work in this field and who even have their own research in telemedicine. Thanks to their experience and the exhaustive and personalized tutoring they offer, students will be able to resolve their doubts at any time and place. Likewise, they will have downloadable content in different formats that will provide them with all the necessary information to guarantee their education.

This **Postgraduate Diploma in Biomedical Image Analysis and Big Data in E-Health** contains the most complete and up-to-date educational program on the market. Its most notable features are:

- The development of practical cases presented by experts in biomedical imaging and databases
- 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

*Thanks to TECH, you will learn about the applications of Big Data in public health, such as risk predictions or personalized medicine through biomarkers"*

*Inquire into the direct relationship between surgical interventions and imaging techniques, delving into their usefulness for recognizing medical patterns"*

*Learn about the benefits of IoT in patient monitoring and care and understand its contribution to the rehabilitation of those affected.*

*Thanks to the knowledge that TECH will transmit to you, you will learn about the multiple advantages that IoT brings by communicating devices with each other.*

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

Its multimedia content, developed with the latest educational technology, will allow the professional a situated and contextual learning; that is, a simulated environment that will provide an 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 course. For this purpose, the student will be assisted by an innovative interactive video system created by renowned and experienced experts.

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# Objectives

The syllabus of this Postgraduate Diploma in Biomedical Image Analysis and Big Data in E-Health aims to instruct engineers who have a technical background and wish to expand their knowledge towards medical imaging and the applications of artificial intelligence and the Internet of Things (IoT) in telemedicine. In just six months, TECH will provide students with technological knowledge applied to medicine through a 100% downloadable content-based modality, which will be available even without an Internet connection. In addition, the study has been approached in a dynamic way to arouse interest and project the students' performance.


*A program designed for you to understand how tools like Machine Learning work and to apply artificial intelligence algorithms in your own research"*

## General Objectives

- Develop key concepts of medicine that serve as a vehicle to understand clinical medicine
- Determine the major diseases affecting the human body, classified by apparatus or systems, structuring each module into a clear outline of pathophysiology, diagnosis, and treatment
- Determine how to obtain metrics and tools for healthcare management
- Understand the basics of basic and translational scientific methodology
- Examine the ethical and best practice principles governing the different types of research in health sciences
- Identify and generate the means of funding, assessing and disseminating scientific research
- Identify the real clinical applications of the various techniques
- Develop the key concepts of computational science and theory
- Determine the applications of computation and its implication in bioinformatics
- Provide the necessary resources to practically apply all the concepts in the modules
- Develop the fundamental concepts of databases
- Determine the importance of medical databases
- Delve into the most important techniques in research
- Identify the opportunities offered by the IoT in the field of e-Health
- Provide specialized knowledge of the technologies and methodologies used in the design, development and assessment of telemedicine systems
- Determine the different types and applications of telemedicine
- Delve into the most common ethical aspects and regulatory frameworks of telemedicine
- Analyze the use of medical devices
- Develop the key concepts of entrepreneurship and innovation in e-Health
- Determine what a business model is and the types that exist
- Collect e-Health success stories and mistakes to avoid
- Apply the knowledge acquired to an original business idea

*Meet your goal, delve into radiology and learn about the tools involved in nuclear medicine such as SPECT and PET”*

## Specific Objectives

### Module 1. Techniques, Recognition and Intervention using Biomedical Imaging

- Examine the fundamentals of medical imaging technologies
- Develop expertise in radiology, clinical applications and physical fundamentals
- Analyze ultrasound, clinical applications and physical fundamentals
- Delve into tomography computed and emission tomography, clinical applications and physical fundamentals
- Determine how to manage magnetic resonance imaging, clinical applications and physical fundamentals
- Generate advanced knowledge of nuclear medicine, differences between PET and SPECT, clinical applications and physical fundamentals
- Discriminate noise in the image, reasons for it and image processing techniques to reduce it
- Present image segmentation technologies and explain their usefulness
- Gain an in-depth understanding of the direct relationship between surgical interventions and imaging techniques
- Establish the possibilities offered by artificial intelligence in the recognition of patterns in medical images, thereby furthering innovation in the sector

### Module 2. *Big Data* in Medicine: Massive Medical Data Processing

- Gain specialized knowledge of massive data acquisition techniques in biomedicine
- Analyze the importance of data pre-processing in *Big Data*
- Determine the differences between the data derived from different massive data collection techniques, as well as their special characteristics in terms of pre-processing and handling
- Provide ways of interpreting results from massive data analysis
- Examine the applications and future trends in the field of *Big Data* in biomedical research and public health

### Module 3. Applications of Artificial Intelligence and the Internet of Things (IoT) in Telemedicine

- Propose communication protocols in different scenarios in the healthcare field
- Analyze IoT communication, as well as its application areas in e-Health
- Substantiate the complexity of artificial intelligence models in its use in healthcare
- Identify the optimization brought by parallelization in GPU-accelerated applications and its use in healthcare
- Present all the *Cloud* technologies available to implement e-Health and the IoT products, both in computing and communication

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# Course Management

According to the needs of engineering graduates and their intellectual endowment in biomedical imaging and Big Data in e-Health, TECH has turned to a professional team working directly in this field. In addition, they have experience in participatory projects and research in bioengineering. This makes the Postgraduate Diploma an opportunity for those engineering graduates who want to get an education, with the endorsement of professional figures who already occupy important positions in the labor market.


*Explore the massive processing of medical data through Big Data tools with the tutoring of professionals in the sector, so that you can count on the guarantees of a guided education"*

## Management

### Ms. Sirera Pérez, Ángela

- Biomedical Engineer expert in Nuclear Medicine and exoskeleton design
- Designer of specific parts for 3D printing at Technadi
- Technician in the Nuclear Medicine area of the University Clinic of Navarra
- Degree in Biomedical Engineering from the University of Navarra
- MBA and Leadership in Healthcare and Medical Technology Companies

## Professors

### Ms. Muñoz Gutiérrez, Rebeca

- Data Scientist at INDITEX
- Firmware Engineer for Clue Technologies
- Graduate in Health Engineering, specializing in Biomedical Engineering, University of Malaga and University of Seville
- Master's Degree in Intelligent Avionics, Clue Technologies, in collaboration with the University of Málaga
- NVIDIA: Fundamentals of Accelerated Computing with CUDA C/C++
- NVIDIA: Accelerating CUDA C++ Applications with Multiple GPUs

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# Structure and Content

The syllabus of this Postgraduate Diploma in Biomedical Image Analysis and Big Data in E-Health has been designed in detail by professionals working in the field of genomic medicine, biomechanics and artificial intelligence. Thanks to their contribution and the incorporation of practical tools, students will have at their disposal audiovisual content in different formats that will help them in their education. Likewise, the Relearning methodology applied by TECH allows the students to assimilate the knowledge gradually, making it easier for them to achieve the title of expert. In addition, as it is a 100% online modality, the pace of study can be adapted to the students' personal and professional commitments.

*Understand how health and well-being tools, such as blood pressure monitoring wristbands, work and integrate them into your business models"*

## **Module 1.** Techniques, Recognition and Intervention using Biomedical Imaging

1.1. Medical Imaging
- 1.1.1. Modalities in Medical Imaging
- 1.1.2. Objectives in Medical Imaging Systems
- 1.1 3. Medical Imaging Storage Systems

1.2. Radiology
- 1.2.1. Imaging Method
- 1.2.2. Radiology Interpretation
- 1.2.3. Clinical Applications

1.3. Computed Tomography (CT)
- 1.3.1. Principle of Operation
- 1.3.2. Image Generation and Acquisition
- 1.3.3. Computerized Tomography. Typology
- 1.3.4. Clinical Applications

1.4. Magnetic Resonance Imaging (MRI)
- 1.4.1. Principle of Operation
- 1.4.2. Image Generation and Acquisition
- 1.4.3. Clinical Applications

1.5. Ultrasound: Ultrasound and Doppler Sonography
- 1.5.1. Principle of Operation
- 1.5.2. Image Generation and Acquisition
- 1.5.3. Typology
- 1.5.4. Clinical Applications

1.6. Nuclear Medicine
- 1.6.1. Physiological Basis in Nuclear Studies. Radiopharmaceuticals and Nuclear Medicine
- 1.6.2. Image Generation and Acquisition
- 1.6.3. Types of Tests
  - 1.6.3.1. Gammagraphy
  - 1.6.3.2. SPECT
  - 1.6.3.3. PET:
  - 1.6.3.4. Clinical Applications

1.7. Image-Guided Interventions
- 1.7.1. Interventional Radiology
- 1.7.2. Interventional Radiology Objectives
- 1.7.3. Procedures
- 1.7.4. Advantages and Disadvantages

1.8. Image Quality
- 1.8.1. Technique
- 1.8.2. Contrast
- 1.8.3. Resolution
- 1.8.4. Noise
- 1.8.5. Distortion and Artifacts

1.9. Medical Imaging Tests. Biomedicine
- 1.9.1. Creating 3D Images
- 1.9.2. Biomodels
  - 1.9.2.1. DICOM Standard
  - 1.9.2.2. Clinical Applications

1.10. Radiological Protection
- 1.10.1. European Legislation Applicable to Radiology Services
- 1.10.2. Safety and Action Protocols
- 1.10.3. Radiological Waste Management
- 1.10.4. Radiological Protection
- 1.10.5. Care and Characteristics of Rooms

## **Module 2.** *Big Data* in Medicine: Massive Medical Data Processing

2.1. *Big Data* in Biomedical Research
- 2.1.1. Data Generation in Biomedicine
- 2.1.2. *High-Throughput* Technology
- 2.1.3. Uses of High-Throughput Data. Hypotheses in the Age of *Big Data*

2.2. Data Pre-Processing in *Big Data*
- 2.2.1. Data Pre-Processing
- 2.2.2. Methods and Approaches
- 2.2.3. Problems with Data Pre-Processing in *Big Data*

2.3. Structural Genomics
- 2.3.1. Sequencing the Human Genome
- 2.3.2. Sequencing vs. Chips
- 2.3.3. Variant Discovery

2.4. Functional Genomics
- 2.4.1. Functional Notation
- 2.4.2. Mutation Risk Predictors
- 2.4.3. Association Studies in Genomics

2.5. Transcriptomics
- 2.5.1. Techniques to Obtain Massive Data in Transcriptomics: RNA-seq
- 2.5.2. Data Normalization in Transcriptomics
- 2.5.3. Differential Expression Studies

2.6. Interactomics and Epigenomics
- 2.6.1. The Role of Chromatin in Gene Expression
- 2.6.2. High-Throughput Studies in Interactomics
- 2.6.3. High-Throughput Studies in Epigenetics

2.7. Proteomics
- 2.7.1. Analysis of Mass Spectrometry Data
- 2.7.2. Post-Translational Modifications Study
- 2.7.3. Quantitative Proteomics

2.8. Enrichment and *Clustering* Techniques
- 2.8.1. Contextualizing Results
- 2.8.2. *Clustering* Algorithms in Omics Techniques
- 2.8.3. Repositories for Enrichment: Gene Ontology and KEGG

2.9. Applying *Big Data* to Public Health
- 2.9.1. Discovery of New Biomarkers and Therapeutic Targets
- 2.9.2. Risk Predictors
- 2.9.3. Personalized Medicine

2.10. *Big Data* Applied to Medicine
- 2.10.1. Potential for Diagnostic and Preventive Assistance
- 2.10.2. Use of *Machine Learning* Algorithms in Public Health
- 2.10.3. The Problem of Privacy

## **Module 3.** Applications of Artificial Intelligence and the Internet of Things (IoT) in Telemedicine

3.1. E-Health Platforms. Personalizing Healthcare Services
- 3.1.1. E-Health Platform
- 3.1.2. Resources for E-Health Platforms
- 3.1.3. Digital Europe Program. Digital Europe-4-Health and Horizon Europe

3.2. Artificial Intelligence in Healthcare I: New Solutions in Computer Applications
- 3.2.1. Remote Analysis of Results
- 3.2.2. Chatbox
- 3.2.3. Prevention and Real-Time Monitoring
- 3.2.4. Preventive and Personalized Medicine in Oncology

3.3. Artificial Intelligence in Healthcare II: Monitoring and Ethical Challenges
- 3.3.1. Monitoring Patients with Reduced Mobility
- 3.3.2. Cardiac Monitoring, Diabetes, Asthma
- 3.3.3. Health and Wellness Apps
  - 3.3.3.1. Heart Rate Monitors
  - 3.3.3.2. Blood Pressure Bracelets
- 3.3.4. Ethical Use of AI in the Medical Field. Data Protection

3.4. Artificial Intelligence Algorithms for Image Processing
- 3.4.1. Artificial Intelligence Algorithms for Image Handling
- 3.4.2. Image Diagnosis and Monitoring in Telemedicine
  - 3.4.2.1. Melanoma Diagnosis
- 3.4.3. Limitations and Challenges in Image Processing in Telemedicine

3.5. Application Acceleration using Graphics Processing Units (GPU) in Medicine
- 3.5.1. Program Parallelization
- 3.5.2. GPU Operations
- 3.5.3. Application Acceleration using GPU in Medicine

3.6. Natural Language Processing (NLP) in Telemedicine
- 3.6.1. Text Processing in the Medical Field. Methodology
- 3.6.2. Natural Language Processing in Therapy and Medical Records
- 3.6.3. Limitations and Challenges in Natural Language Processing in Telemedicine

3.7. The Internet of Things (IoT) in Telemedicine. Applications
- 3.7.1. Monitoring Vital Signs. *Wearables*
  - 3.7.1.1. Blood Pressure, Temperature, and Heart Rate
- 3.7.2. The IoT and *Cloud* Technology
  - 3.7.2.1. Data Transmission to the Cloud
- 3.7.3. Self-Service Terminals

3.8. IT in Patient Monitoring and Care
- 3.8.1. IoT Applications for Emergency Detection
- 3.8.2. The Internet of Things in Patient Rehabilitation
- 3.8.3. Artificial Intelligence Support in Victim Recognition and Rescue

3.9. Nanorobots. Typology
- 3.9.1. Nanotechnology
- 3.9.2. Types of Nanorobots
  - 3.9.2.1. Assemblers. Applications
  - 3.9.2.2. Self-Replicators. Applications

3.10. Artificial Intelligence in COVID-19 Control
- 3.10.1. COVID-19 and Telemedicine
- 3.10.2. Management and Communication of Breakthroughs and Outbreaks
- 3.10.3. Outbreak Prediction in Artificial Intelligence

*A program designed for professionals like you, who understand the future of medicine by applying artificial intelligence"*

05

# Methodology

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

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

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

## Case Study to contextualize all content

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

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


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

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

## A learning method that is different and innovative

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

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

The case method is the most widely used learning system in 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

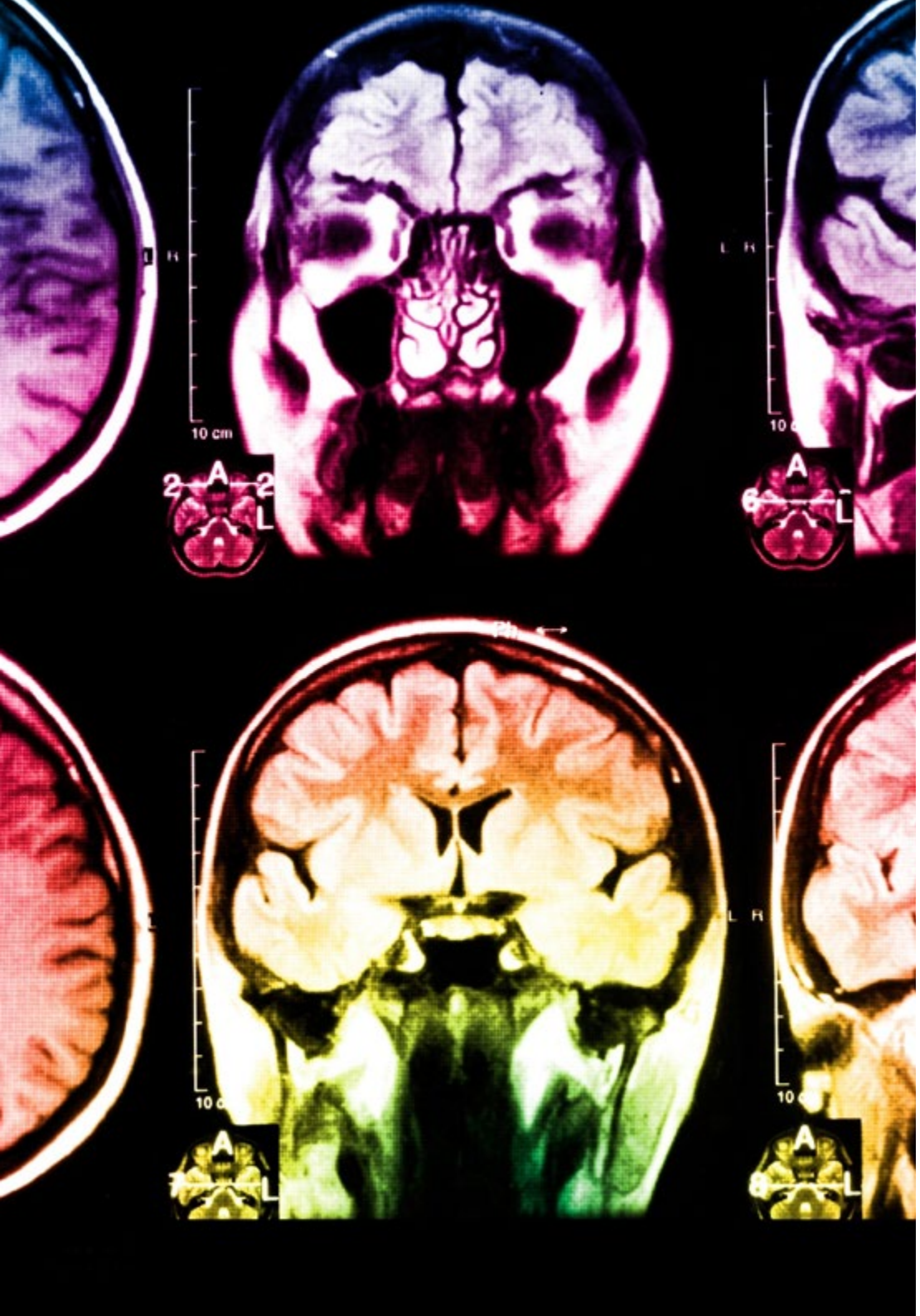
TECH effectively combines the Case Study methodology with a 100% online learning system based on repetition, which combines 8 different teaching elements in each lesson.

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.

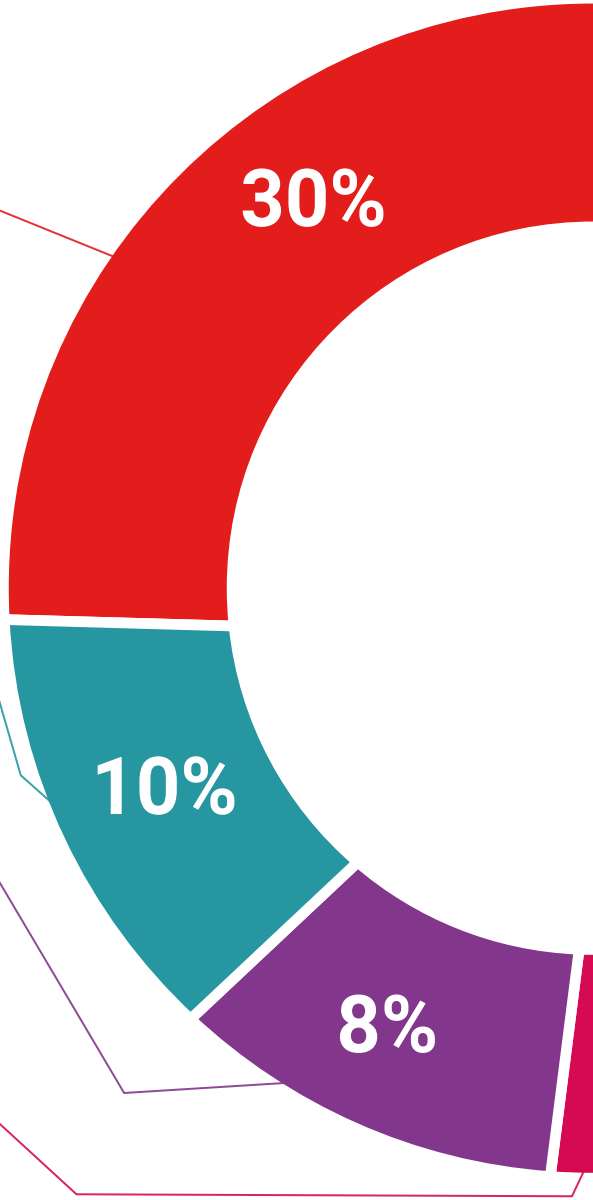
Learning from an Expert strengthens knowledge and memory, and generates confidence in future difficult decisions.

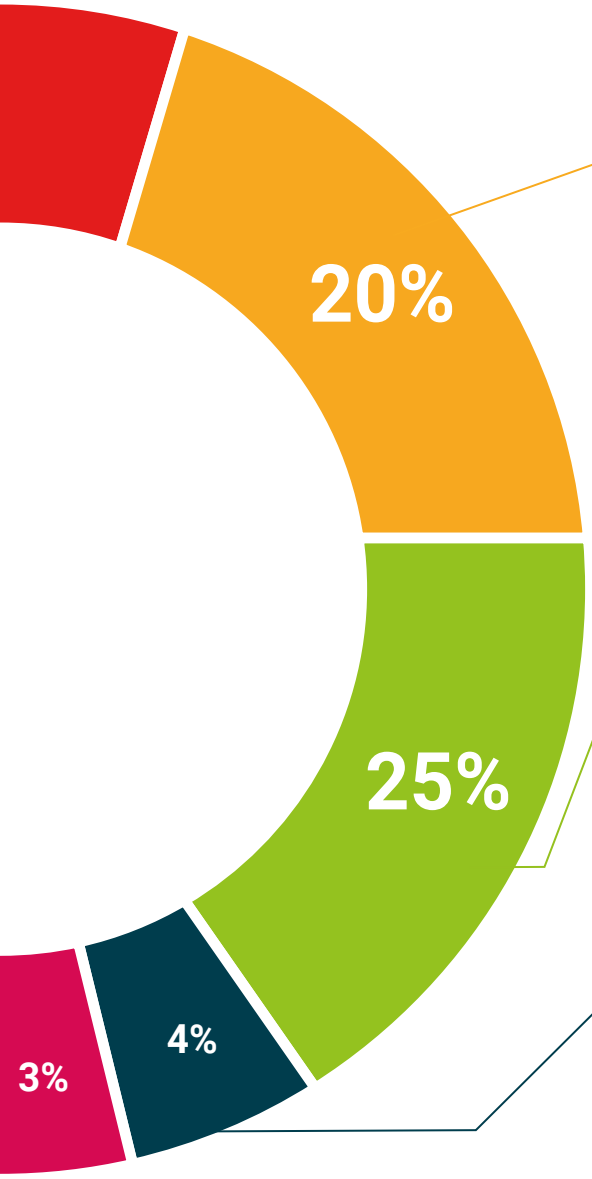
### Practising Skills and Abilities

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 Biomedical Image Analysis and Big Data in E-Health guarantees students, in addition to the most rigorous and up-to-date education, access to a Postgraduate Diploma issued by TECH Technological University.

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

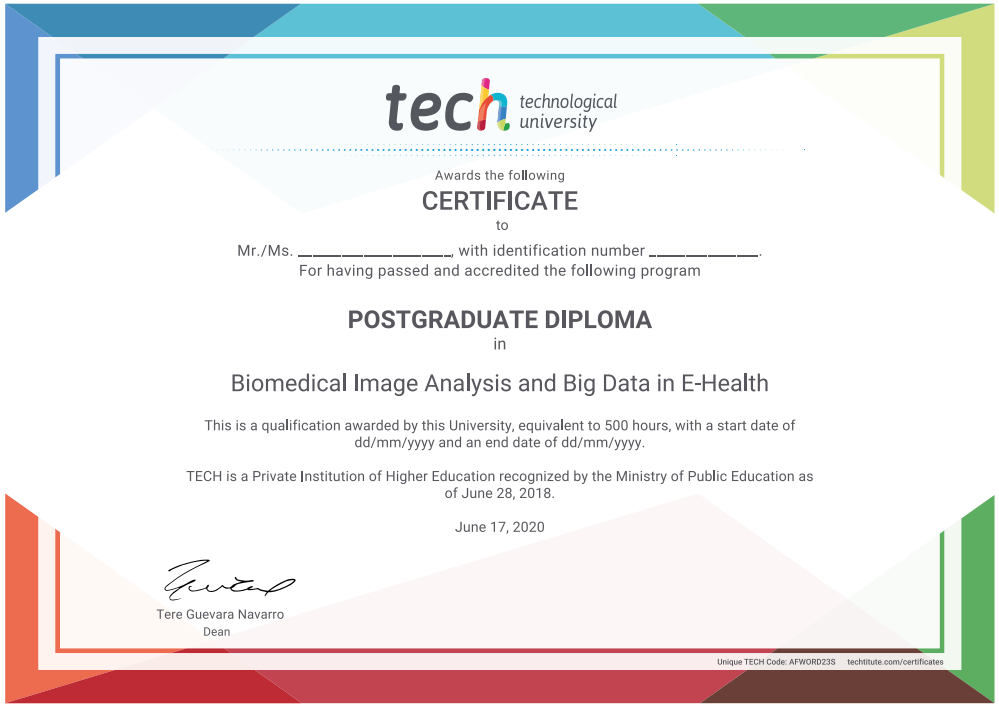
This **Postgraduate Diploma in Biomedical Image Analysis and Big Data in E-Health** contains the most complete and up-to-date program on the market.

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 Biomedical Image Analysis and Big Data in E-Health**

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

Biomedical Image Analysis and Big Data in E-Health

This is a qualification awarded by this University, equivalent to 500 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

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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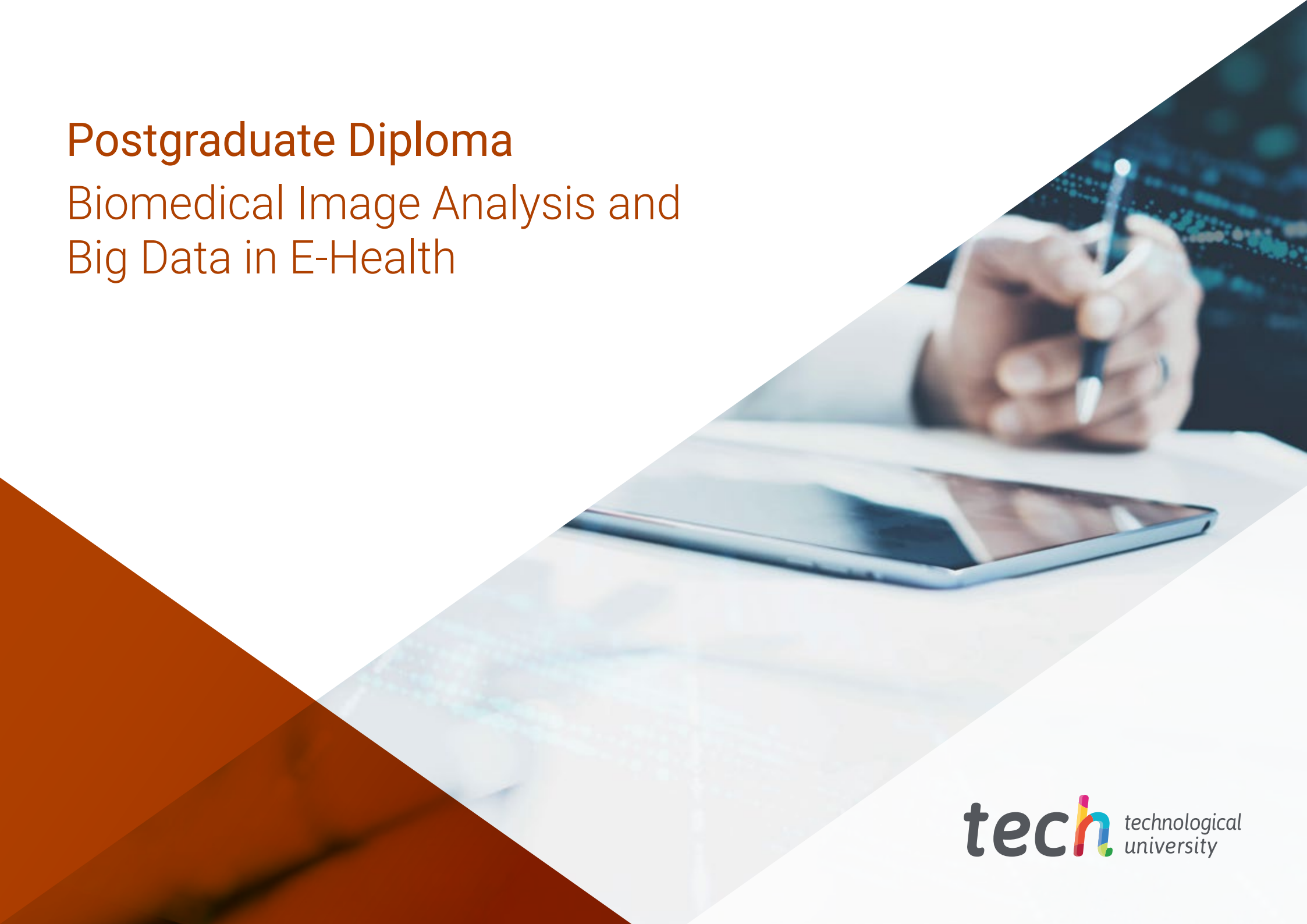

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