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/us/medicine/postgraduate-diploma/postgraduate-diploma-biomedical-image-analysis-big-data-e-health**

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01

Introduction

The growing advance of Biomedicine and the processing of massive health data has improved the quality of patient care, as well as the prevention, diagnosis and treatment of diseases. All this, driven by technological development, nuclear medicine and the tools used in Big Data in healthcare. A reality that is possible thanks to the involvement of the different actors involved, including medical professionals. It is to them, who TECH addresses with this 100% online program, which will take you to delve into the latest technical progress in the study of biomedical imaging or the Internet of Things applied to Medicine. All this, with quality multimedia content that you can access, comfortably, whenever and wherever you need.

A 100% online Postgraduate Diploma, which gives you the opportunity to update your knowledge in just 6 months on Biomedical Image Analysis and Big Data in E-Health"

Big Data applied to the healthcare field, the analysis of its results and technical advances in biomedical imaging have made it possible in recent years to improve the diagnosis of different pathologies. In this way, the extensive collection of health data has contributed to scientific research, the adjustment of Human Resources policies, the management of staff shifts or the purchase of materials in hospitals.

Therefore, nowadays it is essential for medical professionals to be aware of the existing problems regarding the use of this technology, as well as the benefits of using certain tools to assess patients. Given this reality, this educational institution has created this Postgraduate Diploma in Biomedical Image Analysis and Big Data in E-Health, which consists of 6 months of current and intensive knowledge.

For this purpose, TECH has brought together an excellent team of professionals versed in this field, who will contribute their extensive experience in an advanced syllabus. This will allow the specialist to investigate the latest developments in techniques and devices used in biomedical imaging, data collection and applications of artificial intelligence and the internet of things (IoT) to telemedicine.

This information will reach the graduate in a dynamic and attractive way, thanks to the multimedia pills that make up the library of resources to which they will have access at any time of the day. In addition, the professional will reduce the long hours of study and memorization with the *Relearning* system, used by this institution in all its programs.

A 100% online Postgraduate Diploma, which is an excellent opportunity for professionals who wish to update their knowledge through a flexible program. You only need an electronic device (computer, tablet or cell phone) with an Internet connection to view the content hosted on the Virtual Campus.
A convenient and ideal option for those seeking a high-level program compatible with the most demanding responsibilities.

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

Enroll in an educational program that will allow you to learn about nuclear medicine, the differences between PET and SPECT and their clinical applications"

Access the most advanced syllabus in Biomedical Image Analysis and Big Data in E-Health through any electronic device with an Internet connection"

Investigate recent technological and scientific advances in structural genomics and functional genomics.

This program will lead you to discover the benefits of the use of artificial intelligence in the control of COVID-19.

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.

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 throughout the program. For this purpose, the student will be assisted by an innovative interactive video system created by renowned and experienced experts.

02

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 6 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.

With this program you will get an update on IoT applications used today to detect emergencies"

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

This university program provides a theoretical and practical view of the complexity of artificial intelligence models in healthcare applications"

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 preprocessing 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

03

Course Management

In a subject as specific as innovative, TECH has wanted in this program with the best specialists in the field of Biomedical Image Analysis and Big Data in E-Health. For this, it has selected an excellent team that works directly in this field and also participates in research projects in bioengineering. Their extensive knowledge and human qualities have been determining factors for their inclusion in this program, which seeks to offer the most relevant and current information in this area of health.

An excellent team of specialists in Biomedicine, Biomechanics and Data Scientist will guide you to successfully achieve your goals of updating in the E-Health world"

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

04

Structure and Content

The syllabus of this Postgraduate Diploma in Biomedical Image Analysis and Big Data in E-Health has been developed by a team of professionals with extensive knowledge in the fields of medicine, genomics, biomechanics and artificial intelligence. This is reflected in a syllabus with advanced content complemented by multimedia pills, essential readings and case study simulations. In this way, the medical professional will be able to update their knowledge and access the program whenever and wherever they want.

Get an insight into the latest biomedical techniques used in image-guided interventions through engaging multimedia content"

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. IoT 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 Nano-Robots
  - 3.9.2.1. Assemblers. Applications
  - 3.9.2.2. Self-Replicating. 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.**

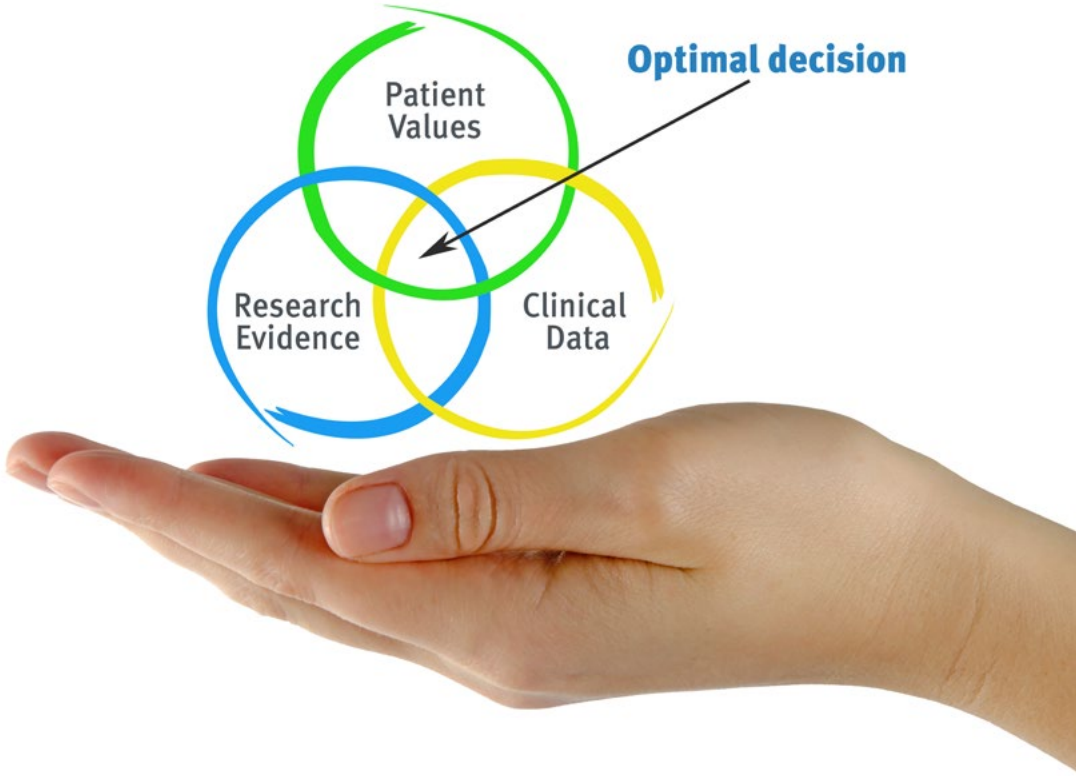
This teaching system is used, for example, in the most prestigious medical schools in the world, and major publications such as the **New England Journal of Medicine** have considered it to be one of the most effective.

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"

At TECH we use the Case Method

What should a professional do in a given situation? Throughout the program, students will face multiple simulated clinical cases, based on real patients, in which they will have to do research, establish hypotheses, and ultimately resolve the situation. There is an abundance of scientific evidence on the effectiveness of the method. Specialists learn better, faster, and more sustainably over time.

With TECH you will experience a way of learning that is shaking the foundations of traditional universities around the world.



According to Dr. Gérvas, the clinical case is the annotated presentation of a patient, or group of patients, which becomes a "case", an example or model that illustrates some peculiar clinical component, either because of its teaching power or because of its uniqueness or rarity. It is essential that the case is based on current professional life, trying to recreate the real conditions in the physician's professional practice.

Did you know that this method was developed in 1912, at Harvard, for law students? The case method consisted of presenting students with real-life, complex situations for them to make decisions and justify their decisions on how to solve them. In 1924, Harvard adopted it as a standard teaching method"

The effectiveness of the method is justified by four fundamental achievements:

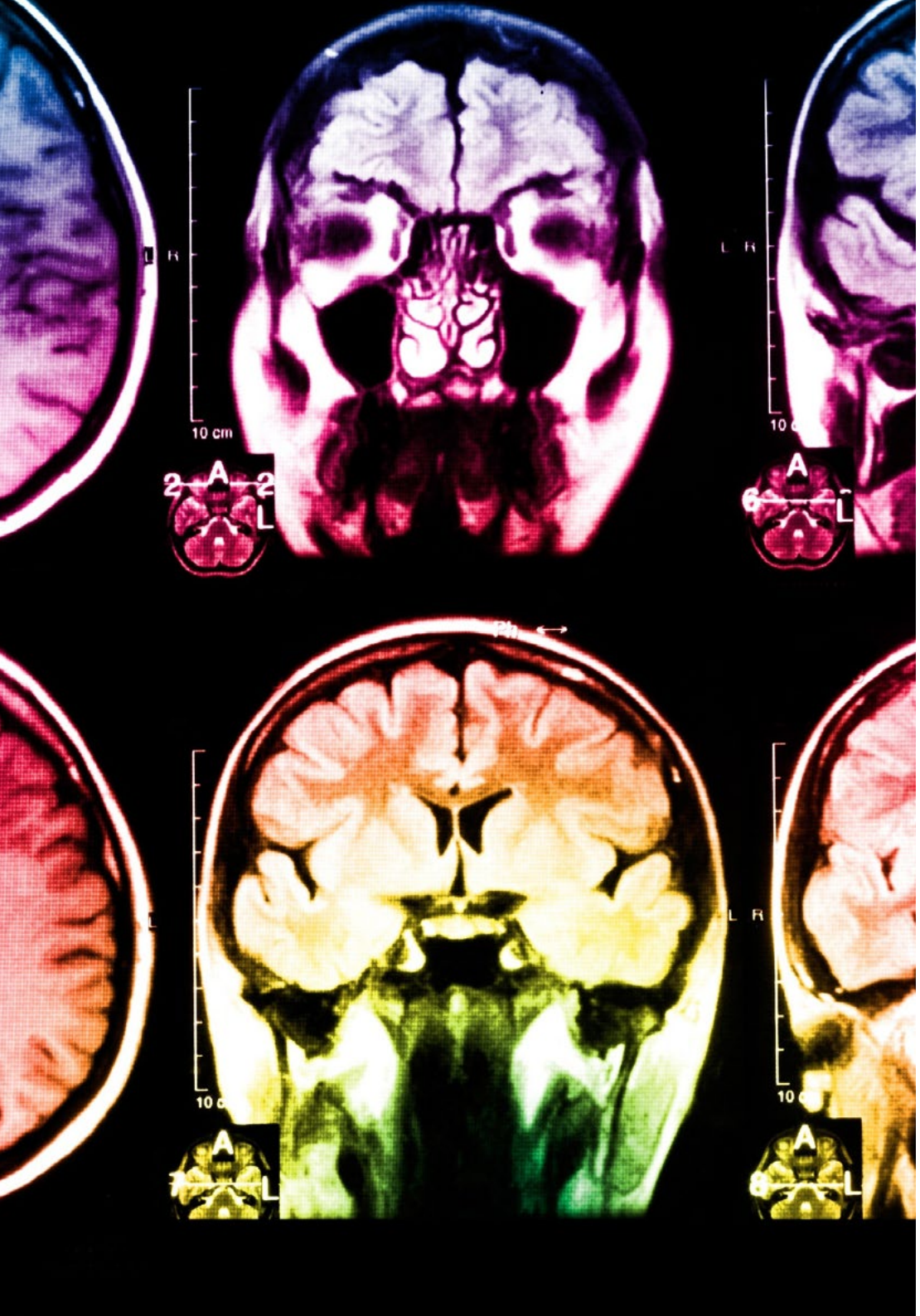
1. Students who follow this method not only achieve the assimilation of concepts, but also a development of their mental capacity, through exercises that evaluate real situations and the application of knowledge.
2. Learning is solidly translated into practical skills that allow the student to better 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.

Relearning Methodology

At TECH we enhance the case method with the best 100% online teaching methodology available: Relearning.

This university is the first in the world to combine the study of clinical cases with a 100% online learning system based on repetition, combining a minimum of 8 different elements in each lesson, a real revolution with respect to the mere study and analysis of cases.

Professionals will learn through real cases and by resolving complex situations in simulated learning environments. These simulations are developed using state-of-the-art software to facilitate immersive learning.



At the forefront of world teaching, the Relearning method has managed to improve the overall satisfaction levels of professionals who complete their studies, with respect to the quality indicators of the best online university (Columbia University).

With this methodology, more than 250,000 physicians have been trained with unprecedented success in all clinical specialties regardless of surgical load. Our pedagogical methodology is developed in a highly competitive environment, with a university student body with a strong socioeconomic profile and an average age of 43.5 years old.

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.

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.

The overall score obtained by TECH's learning system is 8.01, according to the highest international standards.

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.

Surgical Techniques and Procedures on Video

TECH introduces students to the latest techniques, the latest educational advances and to the forefront of current medical techniques. All of this in direct contact with students and explained in detail so as to aid their assimilation and understanding. And best of all, you can watch the videos as many times as you like.

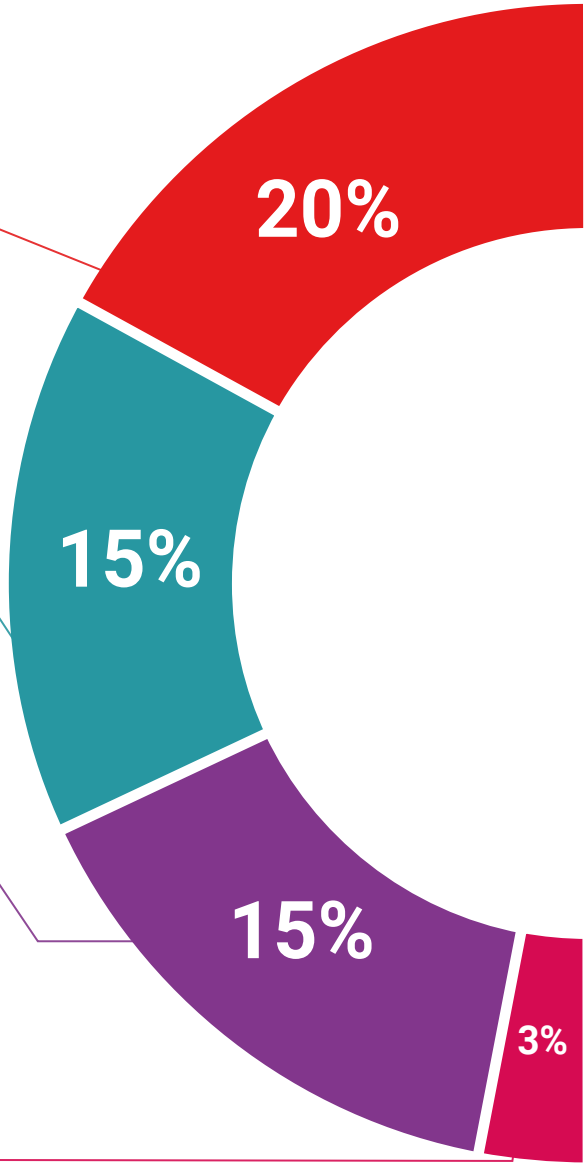
Interactive Summaries

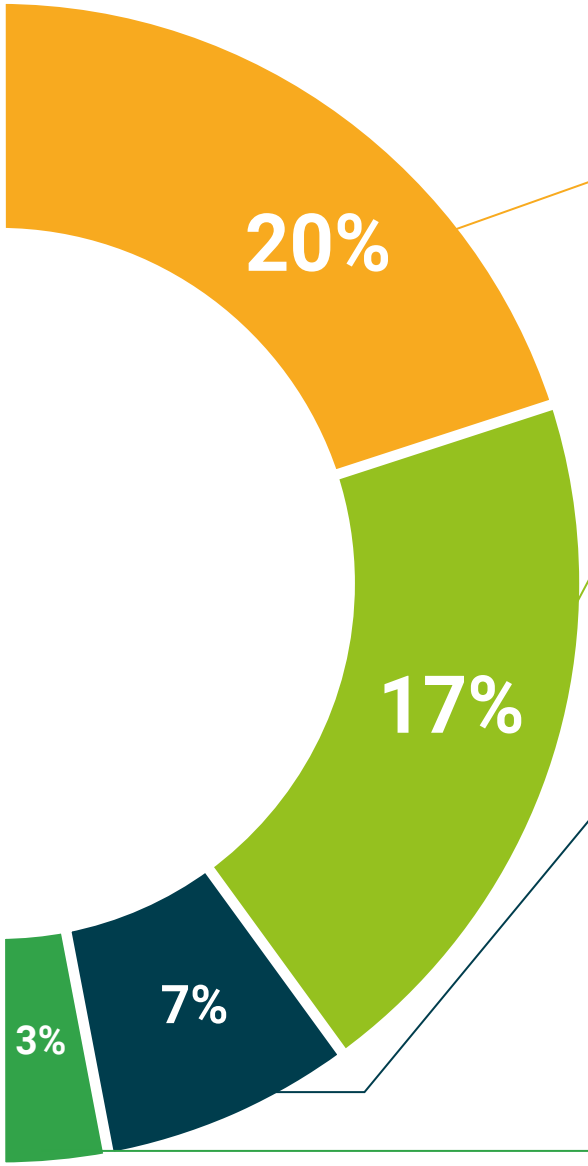
The TECH team presents the contents attractively and dynamically in multimedia lessons that include audio, videos, images, diagrams, and concept maps in order to reinforce knowledge.

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

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.





Expert-Led Case Studies and Case Analysis

Effective learning ought to be contextual. Therefore, TECH presents real cases in which the expert will guide students, focusing on and solving the different situations: a clear and direct way to achieve the highest degree of understanding.

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.

Classes

There is scientific evidence on the usefulness of learning by observing experts. The system known as Learning from an Expert strengthens knowledge and memory, and generates confidence in 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.

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"

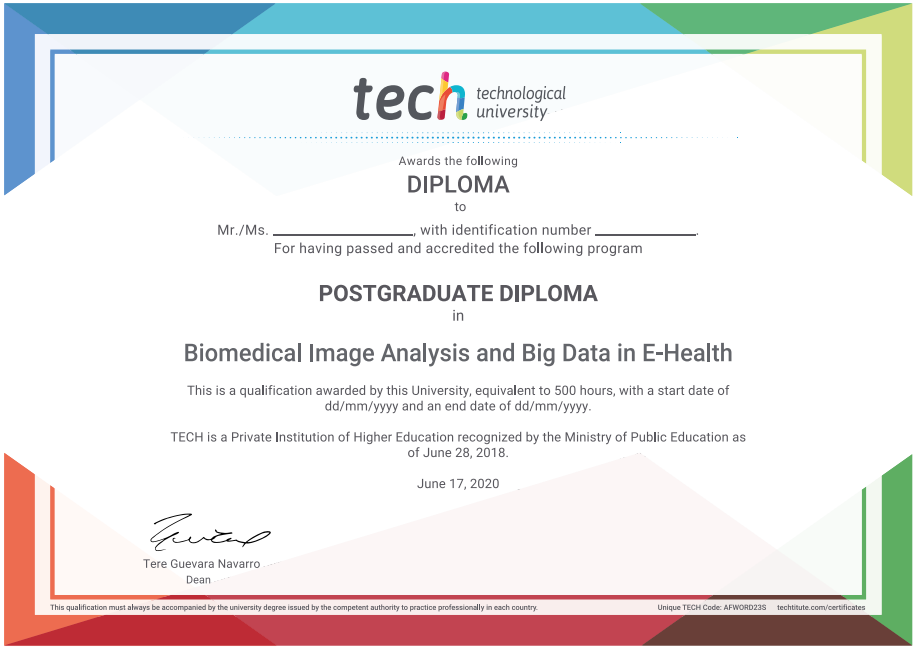
This **Postgraduate Diploma in Biomedical Image Analysis and Big Data in E-Health** contains the most complete and up-to-date scientific program on the market.

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

The diploma 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.**


tech technological university

Awards the following

DIPLOMA

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

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 diploma issued with an apostille, TECH EDUCATION will make the necessary arrangements to obtain it, at an additional cost.

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