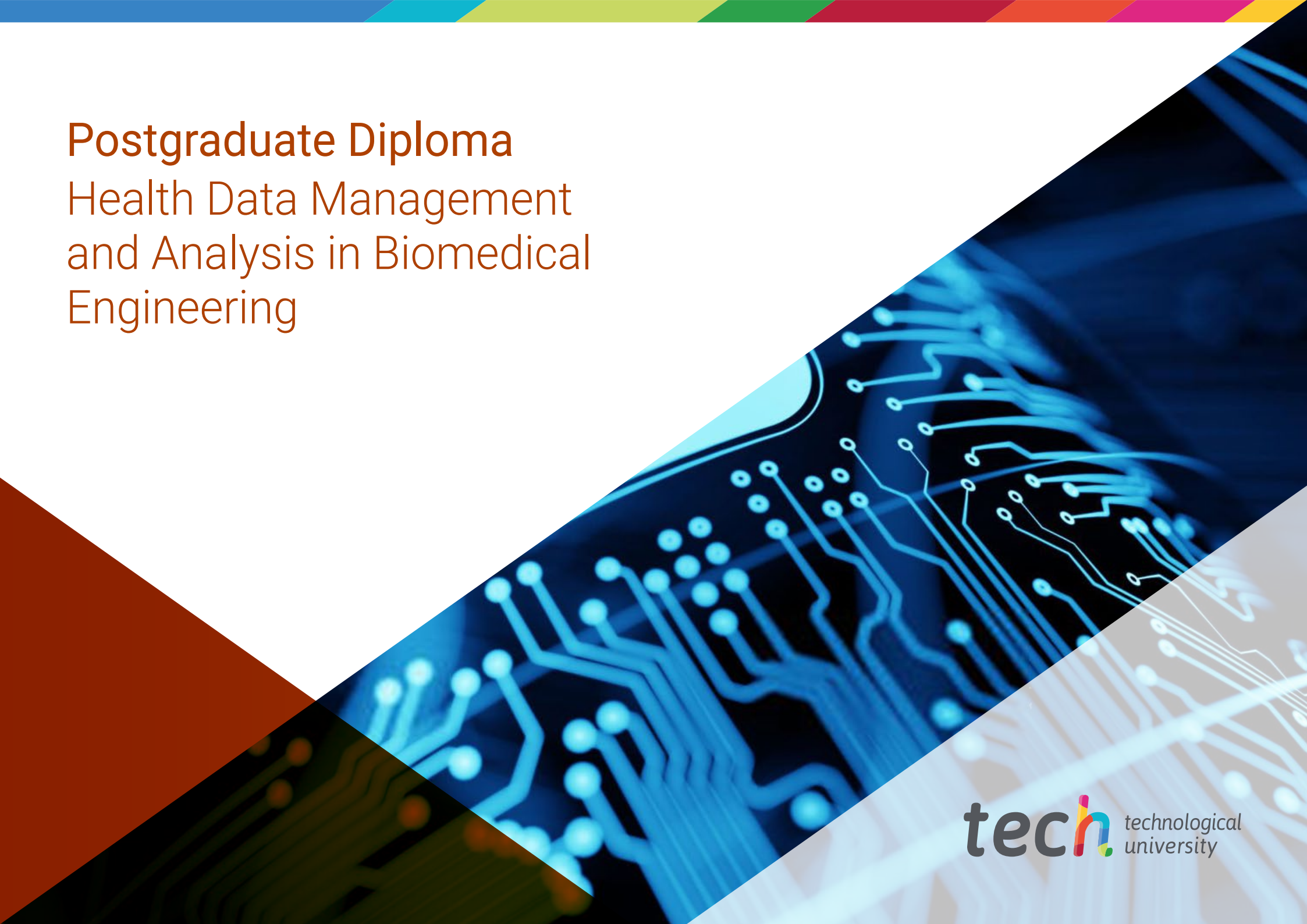
Postgraduate Diploma

Health Data Management and Analysis in Biomedical Engineering



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Postgraduate Diploma
Health Data Management and Analysis in Biomedical Engineering

- 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-health-data-management-analysis-biomedical-engineering**

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01

Introduction

The management, storage and analysis of medical data is one of the focal points of today's medical practice. Building efficient databases can improve not only clinical decision-making, but also the practice of personalized medicine and telemedicine. For this reason, and being aware of the growing importance of data analysis, this university presents this program in which the professional will go through all the necessary steps to carry out an efficient management of medical data: from the capture of Biomedical Signals, through the use of bioinformatics tools for scientific computation, to the storage and analysis of these data. All of which makes this program the most comprehensive academic option on the current university scene since, in addition to being taught 100% online, it is totally flexible and compatible with other daily activities.

Data analysis is crucial to the future of medical practice. Specialize in this exciting field and be part of the change towards excellence in clinical decision making, promoting more personalized medicine"

In the last few decades, data storage, analysis and management has become a fundamental task for many disciplines. The medical field is no exception, and the analysis of so-called Biomedical Signals has undoubtedly marked a milestone that made possible the beginning of a new era in medical diagnostic techniques, fostering the greater inclusion of technology in healthcare. Since then, more and more electronic equipment is capable of revolutionizing the techniques used in routine clinical practice, improving diagnosis, treatment and, ultimately, patient care.

As such, Biomedical Signals, as well as their acquisition, processing and analysis, make up one of the most important branches of Biomedical Engineering, where numerous branches of knowledge converge: Medicine, Biology, Physics, Electronics or Computer Science, in addition to many others.

Therefore, this Postgraduate Diploma will address the physical and mathematical principles that govern Biomedical Signals. It will develop in the student specific knowledge on how the different signals that the body can emit are acquired, and what they are used for at a clinical level. Thanks to this, the student will learn to interpret these signals and even process them, acquiring extensive skills in this field of Biomedical Engineering.

Following this same line, and once the data have been stored, this program will provide the latest developments in methodology and educational resources for the use of bioinformatics tools for scientific computing. All this, in order to obtain, analyze, organize and interpret biological information for medicine, encouraging the student to incorporate bioinformatics to their research tasks and, potentially, to their professional life.

And finally, this program will address a growing field: the storage, analysis and study of data. Data processing is essential for the development of Telemedicine Systems that can be integrated into the day to day running of hospitals, as well as for developing Artificial Intelligence tools to aid clinical decision making. Building databases that protect patient privacy and contain information that can be analyzed effectively is one of the cornerstones of personalized medicine. For all these reasons, this program will address the design of databases according to technical criteria and patient needs, as well as the tools for their construction.

The **Postgraduate Diploma in Health Data Management and Analysis in Biomedical Engineering** contains the most complete and up-to-date educational program on the market. The most important features include:

- The development of case studies presented by experts in Biomedical Engineering
- The graphic, schematic, and practical contents with which they are created, provide scientific and practical information on the disciplines that are essential for professional practice
- Practical exercises where 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

Thanks to this program, you will learn about the latest software and equipment that are revolutionizing medical practice thanks to their ability to analyze and store clinical data"

The analysis and management of Biomedical Signals requires highly specialized professionals who are up to date with the latest developments in the profession. If you want to be one of them, then do not hesitate and start this Postgraduate Diploma today"

Delve into biomedical signals and their applications, and position yourself as an engineer in high demand by numerous health services.

In just 6 months of intensive online study you will learn everything you need to process and compute medical data efficiently and effectively.

The program's teaching staff includes professionals from 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 the professional with situated and contextual learning, i.e., a simulated environment that will provide immersive training programmed to train 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

Data analysis and management is undoubtedly the future of Biomedical Engineering. For this reason, TECH presents this program with the main objective of providing students with the latest and most specialized knowledge in the field of Biomedical Signal acquisition, and subsequent processing and analysis. In this way, and thanks to this new knowledge, the student will not only give a boost to their professional career, but will also be one step closer to positions of greater responsibility in the process of computerization of medicine.

If your goal is to grow in the Biomedical sector, and become a key player in clinical data management then welcome, this program is for you"

General Objectives

- Generate specialized knowledge on the main types of biomedical signals and their uses
- Develop the physical and mathematical knowledge underlying biomedical signals
- Deepen the analysis and processing of biomedical signals
- Fundamentals of the principles governing signal analysis and processing systems
- Analyze the main applications, trends and lines of research and development in the field of biomedical signals
- Utilize computer hardware and software tools for genomic analysis
- Analyze programming languages used for DNA sequence analysis
- Apply the concepts of artificial intelligence and big data for use in prevention, diagnosis and medical therapy
- Make use of the workflows that bioinformaticians have in their research and professional fields
- Analyze the different data and database systems
- Determine the importance of data in health
- Building a hospital database
- Establishing how clinical needs are translated into data
- Develop the fundamentals of data analysis

Specific Objectives

Module 1. Biomedical Signals

- Distinguish the different types of biomedical signals
- Determine how biomedical signals are acquired, interpreted, analyzed and processed
- Analyze the clinical applicability of biomedical signals through practical case studies
- Apply mathematical and physical knowledge to analyze signals
- Examine the most common signal filtering techniques and how to apply them
- Develop fundamental engineering knowledge of signals and systems
- Understand the operation of a biomedical signal processing system
- Identify the main components of a digital signal processing system

Module 2. Medical Bioinformatics

- Develop a reference framework for medical bioinformatics
- Examine computer hardware and software required in medical bioinformatics
- Generate specialized knowledge on data mining techniques in Bioinformatics
- Analyze artificial intelligence and Big Data techniques in medical bioinformatics
- Establish the applications of bioinformatics for prevention, diagnosis and clinical therapies
- Delve into the methodology and medical bioinformatics workflow
- Assess the factors associated with sustainable bioinformatics applications and future trends

Module 3. Biomedical and Healthcare Databases

- Data Structure
- Analyze Relational Systems
- Develop conceptual data modeling
- Designing and standardizing a relational database
- Examine functional dependencies between data
- Generate specialized knowledge on big data
- Deepen understanding of the ODMS architecture
- Learn about data integration in medical record systems
- Analyze the bases and restrictions

You will have the most complete, up to date and effective academic program on the international university scene"

03

Course Management

For this Postgraduate Diploma, TECH has brought together the most complete and specialized teaching staff on the international teaching scene. Active professionals who carry out their professional, research and academic activity in internationally renowned centers and who will put all their knowledge at the student's service to offer the most complete program on the academic market. In addition, and thanks to TECH's unbeatable teaching methodology, students can access this faculty without having to travel to the classrooms, allowing them to learn from their experience at any time, moment and place.

Learning from professionals with this experience and prestige is a luxury that only TECH can offer you"

Management

Mr. Ruiz Díez, Carlos

- Researcher at the National Microelectronics Center of the CSIC
- Researcher. Composting Research Group of the Department of Chemical, Biological and Environmental Engineering of the UAB
- Founder and product development at NoTime Ecobrand, a fashion and recycling brand
- Development cooperation project manager for the NGO Future Child Africa in Zimbabwe
- Graduate in Industrial Technologies Engineering from Pontificia de Comillas University ICAI
- Master's Degree in Biological and Environmental Engineering from the Autonomous University of Barcelona
- Master's Degree in Environmental Management from the Universidad Española a Distancia (Spanish Open University)

Professors

Ms. Travesí Bugallo, Blanca

- U4Impact University Coordinator
- Marketing at GIANTHEALTH EVENT
- Degree in Biomedical Engineering from the Polytechnic University of Madrid
- Master's Degree in Biomedical Engineering from the Polytechnic University of Madrid
- Master's Degree in Health Technology Innovation by Sorbonne Université
- Coordinator of the Bioengineering course at the Technological Campus of ICAI

Mr. Rodríguez Arjona, Antonio

- Project Manager, Technical Manager and Expert in the Regulation of Medical Devices at Omologic, Homologation and CE Marking
- Development of the Smart Stent project in collaboration with the TIC-178 research group of the University of Seville
- Technical Engineer in the Logistics Department of Docriluc, S.L.
- Digitization Manager at Ear Protech, the in-ear experience
- Computer Technician at the Centro Asociado María Zambrano of the Universidad Nacional de Educación a Distancia (National University of Distance Education)
- Graduate in Health Engineering with a major in Biomedical Engineering from the University of Malaga
- Master's Degree in Biomedical Engineering and Digital Health from the University of Seville

Dr. Vásquez Cevallos, Leonel

- Advisor in the preventive and corrective maintenance and sale of medical equipment and software. Received medical imaging equipment maintenance training, Seoul, South Korea. Director of the Telemedicine Cayapas research project. Knowledge transfer and management manager. Officegolden
- PhD's Degree in Biomedical Engineering from the Polytechnic University of Madrid
- Master's Degree in Telemedicine and of Bioengineering from the Polytechnic University of Madrid
- Engineer/Graduate in Electronics and Telecommunications from the ESPOL University. Academic Training in Ecuador
- Teachers at Polytechnic University of Madrid
- Teacher at Escuela Superior Politécnica del Litoral. Equator
- Lecturer at the University of Guayaquil
- Lecturer at Technological University of Business in Guayaquil

04

Structure and Content

TECH's teaching experience in the creation of highly efficient and specialized university programs has made it possible to organize the contents in a way that is highly efficient in terms of reinforcing learning. As a result, the student will have 3 theoretical modules with an eminently practical approach in which they will learn the most effective way to analyze, manage and store biomedical data. All this, in addition, through innovative learning tools such as videos of real cases, interactive summaries and action guides that will enhance and enrich the study process.

This Postgraduate Diploma is designed to be the most comprehensive and specialized option on the current educational scene, and has the most effective syllabus to help you get to the top, making it a simple task"

Module 1. Biomedical Signals

1.1. Biomedical Signals
- 1.1.1. Origin of Biomedical Signals
- 1.1.2. Biomedical Signals
  - 1.1.2.1. Amplitude
  - 1.1.2.2. Period
  - 1.1.2.3. Frequency (F)
  - 1.1.2.4. Wave Length
  - 1.1.2.5. Phase

1.2. Classification and Examples of Biomedical Signals
- 1.2.1. Types of Biomedical Signals Electrocardiography, Electroencephalography and Magnetoencephalography
  - 1.2.1.1. Electrocardiography (ECG)
  - 1.2.1.2. Electroencephalography (EEG)
  - 1.2.1.3. Magnetoencephalography (MEG)

1.3. Types of Biomedical Signals Electroneurography and Electromyography
- 1.3.1. Electroneurography (ENG)
- 1.3.2. Electromyography (EMG)
- 1.3.3. Event-Related Potentials (ERPs)
- 1.3.4. Other Types

1.4. Signals and Systems
- 1.4.1. Signals and Systems
- 1.4.2. Continuous and Discrete Signals: Analog vs. Digital
- 1.4.3. Systems in the Time Domain
- 1.4.4. Systems in the Frequency Domain Spectral Method

1.5. Fundamentals of Signals and Systems
- 1.5.1. Sampling: Nyquist
- 1.5.2. The Fourier Transform DFT
- 1.5.3. Stochastic Processes
  - 1.5.3.1. Deterministic vs. Random Signals
  - 1.5.3.2. Types of Stochastic Processes
  - 1.5.3.3. Stationarity
  - 1.5.3.4. Ergodicity
  - 1.5.3.5. Relationships Between Signals
- 1.5.4. Power Spectral Density

1.6. Processing of Biomedical Signals
- 1.6.1. Processing of Signals
- 1.6.2. Objectives and Processing Steps
- 1.6.3. Key Elements of a Digital Processing System
- 1.6.4. Applications. Trends

1.7. Filtering: Artifact Removal
- 1.7.1. Motivation. Types of Filtering
- 1.7.2. Time Domain Filtering
- 1.7.3. Frequency Domain Filtering
- 1.7.4. Applications and Examples

1.8. Time-Frequency Analysis
- 1.8.1. Motivation
- 1.8.2. Time-Frequency Plane
- 1.8.3. Short-Time Fourier Transform (STFT)
- 1.8.4. Wavelet Transform
- 1.8.5. Applications and Examples

1.9. Event Detection
- 1.9.1. Case Study I: ECG
- 1.9.2. Case Study II: EEG
- 1.9.3. Evaluation of Detection

1.10. Software for Biomedical Signal Processing
- 1.10.1. Applications, Environments and Programming Languages
- 1.10.2. Libraries and Tools
- 1.10.3. Practical Applications: Basic Biomedical Signal Processing System

Module 2. Medical Bioinformatics

2.1. Medical Bioinformatics
- 2.1.1. Computing in Medical Biology
- 2.1.2. Medical Bioinformatics
  - 2.1.2.1. Bioinformatic Applications
  - 2.1.2.2. Computer Systems, Networks and Medical Databases
  - 2.1.2.3. Applications of Medical Bioinformatics in Human Health

2.2. Computer Equipment and Software Required in Bioinformatics
- 2.2.1. Scientific Computing in Biological Sciences
- 2.2.3. The Computer
- 2.2.4. Hardware, Software and Operating Systems
- 2.2.5. Workstations and Personal Computers
- 2.2.6. High-Performance Computing Platforms and Virtual Environments
- 2.2.7. Linux Operating System
  - 2.2.7.1. Linux Installation
  - 2.2.7.2. Using the Linux Command Line Interface

2.3. Data Analysis Using R Programming Language
- 2.3.1. Language R Statistical Programming
- 2.3.2. Installation and Uses of R
- 2.3.3. Data Analysis Methods With R
- 2.3.4. R Applications in Medical Bioinformatics

2.4. Data Analysis Using R Programming Language
- 2.4.1. Multipurpose Programming Language Python
- 2.4.2. Installation and Uses of Python
- 2.4.3. Data Analysis Methods with Python
- 2.4.4. Python Applications in Medical Bioinformatics

2.5. Methods of Human Genetic Sequence Analysis
- 2.5.1. Human Genetics
- 2.5.2. Techniques and Methods for Sequencing Analysis of Genomic Data
- 2.5.3. Sequence Alignments
- 2.5.4. Tools for Detection, Comparison and Modeling of Genomes

2.6. Data Mining in Bioinformatics
- 2.6.1. Phases of Knowledge Discovery in Databases, KDD
- 2.6.2. Processing Techniques
- 2.6.3. Knowledge Discovery in Biomedical Databases
- 2.6.4. Human Genomics Data Analysis

2.7. Artificial Intelligence and Big Data Techniques in Medical Bioinformatics
- 2.7.1. Machine Learning for Medical Bioinformatics
  - 2.7.1.1. Supervised Learning Regression and Classification
  - 2.7.1.2. Unsupervised Learning Clustering and Association Rules
- 2.7.2. Big Data
- 2.7.3. Computing Platforms and Development Environments

2.8. Applications of Bioinformatics for Prevention, Diagnosis and Clinical Therapies
- 2.8.1. Disease-Causing Gene Identification Procedures
- 2.8.2. Procedure to Analyze and Interpret the Genome for Medical Therapies
- 2.8.3. Procedures to Assess Genetic Predispositions of Patients for Prevention and Early Diagnosis

2.9. Medical Bioinformatics Workflow and Methodology
- 2.9.1. Creation of Workflows to Analyze Data
- 2.9.2. Application Programming Interfaces, APIs
  - 2.9.2.1. R and Python Libraries for Bioinformatics Analysis
  - 2.9.2.2. Bioconductor: Installation and Uses
- 2.9.3. Uses of Bioinformatics Workflows in Cloud Services

2.10. Factors Associated with Sustainable Bioinformatics Applications and Future Trends
- 2.10.1. Legal and Regulatory Framework
- 2.10.2. Best Practices in the Development of Medical Bioinformatics Projects
- 2.10.3. Future Trends in Bioinformatics Applications

Module 3. Biomedical and Healthcare Databases

3.1. Hospital Databases
- 3.1.1. Data Bases
- 3.1.2. The Importance of Data
- 3.1.3. Data in a Clinical Context

3.2. Conceptual Modeling
- 3.2.1. Data Structure
- 3.2.2. Systematic Data Model
- 3.2.3. Data Standardization

3.3. Relational Data Model
- 3.3.1. Advantages and Disadvantages.
- 3.3.2. Formal Languages

3.4. Designing from Relational Databases
- 3.4.1. Functional Dependence
- 3.4.2. Relational Forms
- 3.4.3. Standardization

3.5. SQL Language
- 3.5.1. Relational Model
- 3.5.2. Object-Relationship Model
- 3.5.3. XML-Object-Relationship Model

3.6. NoSQL
- 3.6.1. JSON
- 3.6.2. NoSQL
- 3.6.3. Differential Amplifiers
- 3.6.4. Integrators and Differentiators

3.7. MongoDB
- 3.7.1. ODMS Architecture
- 3.7.2. NodeJS
- 3.7.3. Mongoose
- 3.7.4. Aggregation

3.8. Data Analysis
- 3.8.1. Data Analysis
- 3.8.2. Qualitative Analysis
- 3.8.3. Quantitative Analysis

3.9. Legal Foundations and Regulatory Standards
- 3.9.1. General Data Protection Regulation
- 3.9.2. Cybersecurity Considerations
- 3.9.3. Regulations Applied to Health Data

3.10. Integration of Databases in Medical Records
- 3.10.1. Medical History
- 3.10.2. HIS Systems
- 3.10.3. HIS Data

You can only find the best syllabus at the best university: enroll at TECH today and start to see your dreams and goals materialize"

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

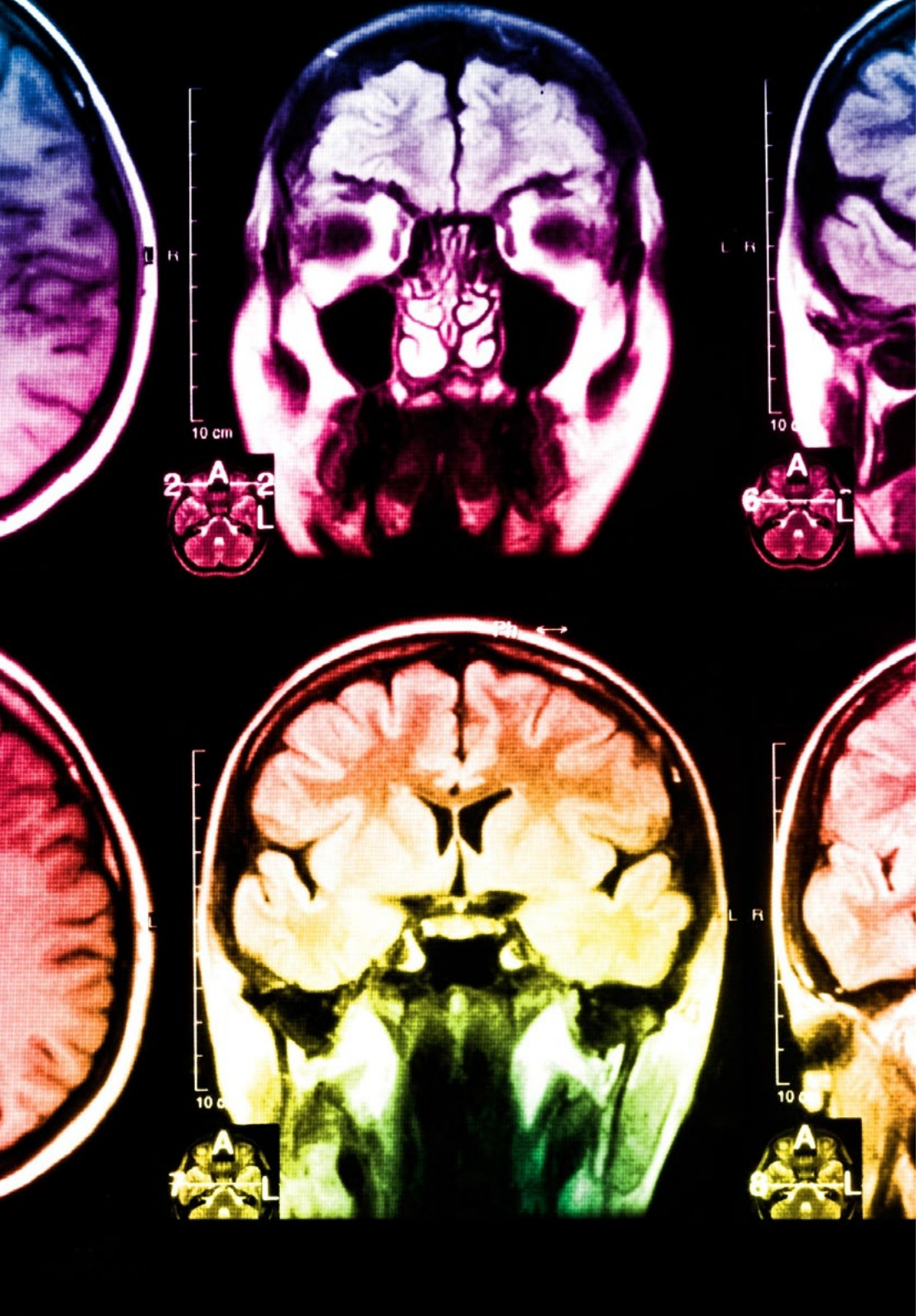
TECH effectively combines the Case Study methodology with a 100% online learning system based on repetition, which combines 8 different teaching elements in each lesson.

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.

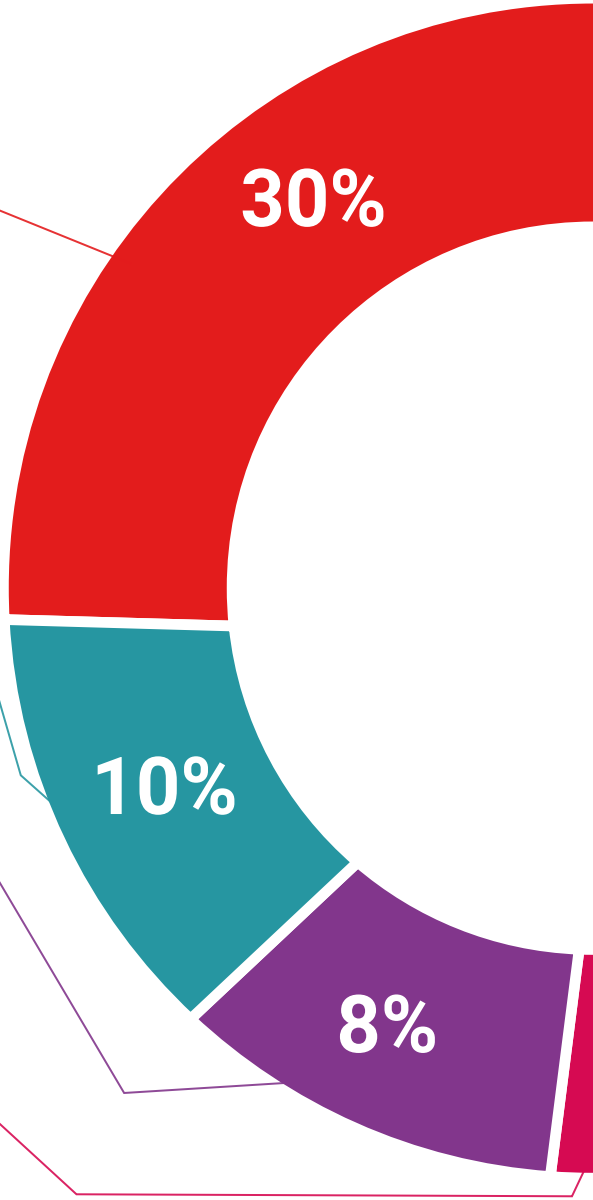
Learning from an Expert strengthens knowledge and memory, and generates confidence in future difficult decisions.

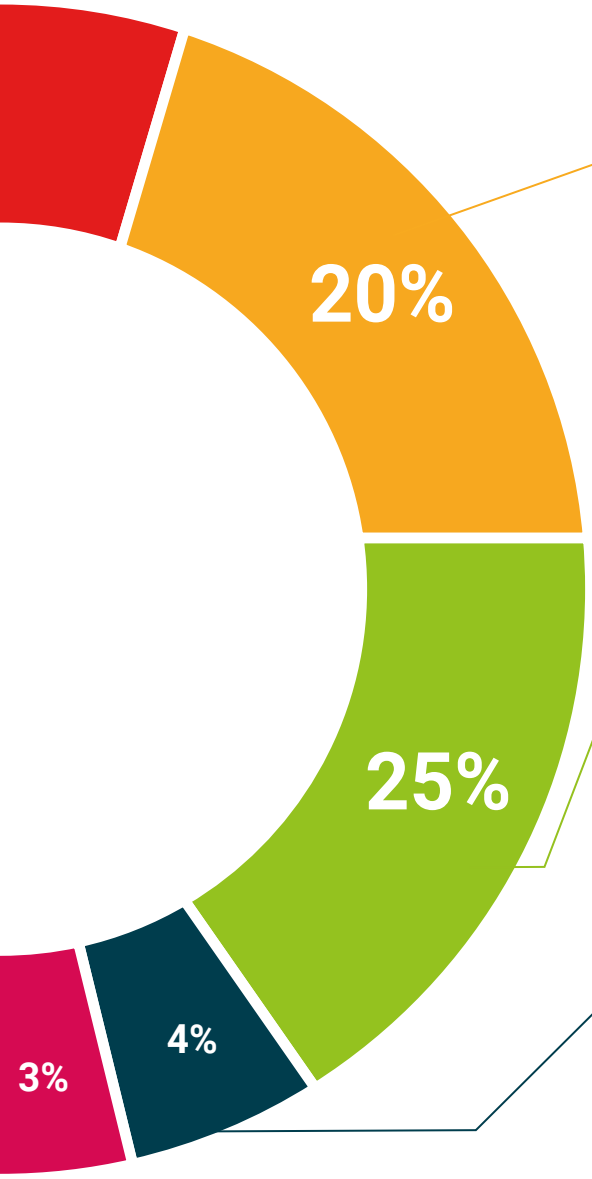
Practising Skills and Abilities

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 Health Data Management and Analysis in Biomedical Engineering guarantees students, in addition to the most rigorous and up to date education, access to a qualification issued by TECH Technological University.

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

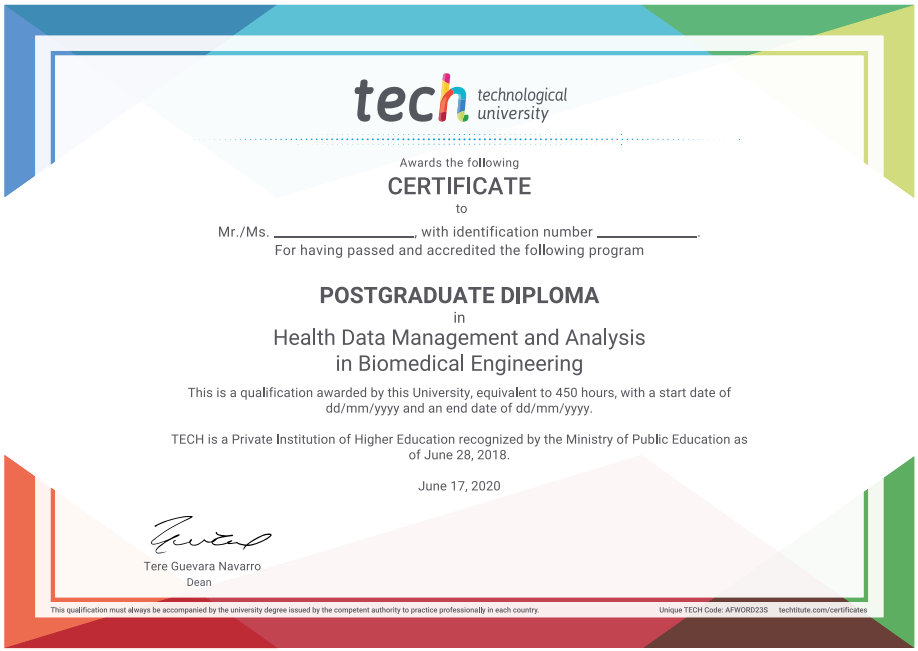
This **Postgraduate Diploma in Health Data Management and Analysis in Biomedical Engineering** contains the most complete and up to date program on the market.

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 Health Data Management and Analysis in Biomedical Engineering**

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

Health Data Management and Analysis in Biomedical Engineering

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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