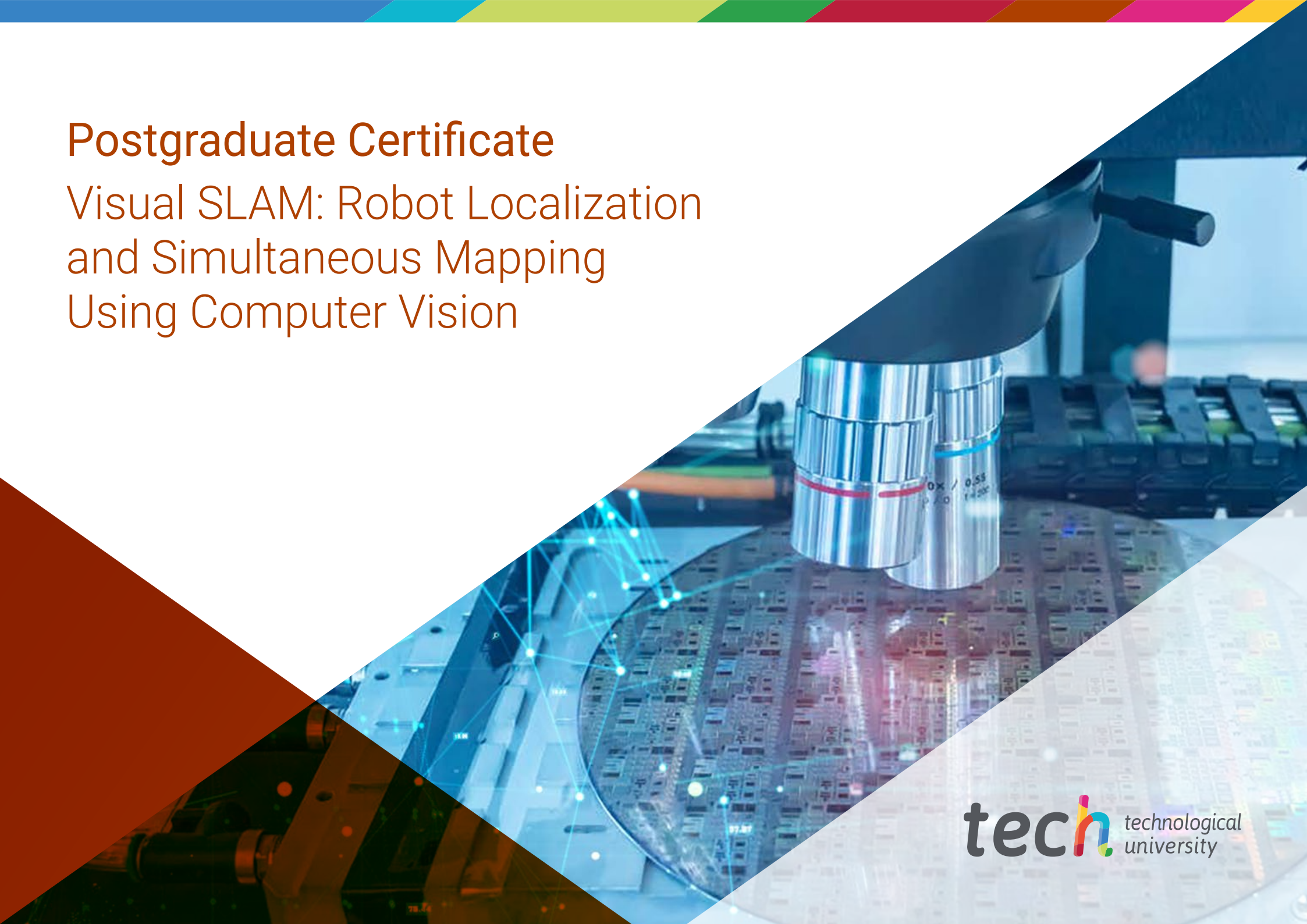
Postgraduate Certificate

Visual SLAM: Robot Localization and Simultaneous Mapping Using Computer Vision



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Postgraduate Certificate

Visual SLAM: Robot Localization and Simultaneous Mapping Using Computer Vision

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

Website: **www.techtitute.com/pk/engineering/postgraduate-certificate/visual-slam-robot-localization-simultaneous-mapping-using-computer-vision**

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01

Introduction

Virtual Reality, Augmented Reality or the localization of systems in unknown environments would not have reached a great development without the application of the so-called SLAM. An advanced technology that enables accurate map generation. An advance that has led to a boom in an industry that increasingly calls for more qualified professionals. This is the reason for the creation of this fully online program, which offers engineers the opportunity to advance in their careers. A program with updated multimedia content, which includes the most commonly used techniques and tools in the sector, thanks to the contribution of the teaching team specialized in Robotics, which makes up this program.

A 100% university program that allows you to combine your personal responsibilities with quality education. Enroll now"

In the quest for robot autonomy, professionals are faced with the problem of movement and localization. SLAM allows the implementation of systems, from the simplest to the most complex, to obtain high accuracy in map generation and localization. This Postgraduate Certificate, aimed at engineering professionals, provides advanced knowledge in this field from a highly qualified teaching team with experience in the field of robotics.

A 100% online program in which students will delve into this technology in the algorithms developed in different theoretical frameworks such as Gaussian Filters, Graphs, Optimization, which will allow students to develop those systems that best align with their knowledge. In addition, the faculty will provide the tools currently in use that will enable the engineering professional to decide which of the visual SLAM approaches will work best in different environments and circumstances. For this purpose, different theoretical frameworks, parameterizations and sensors will be analyzed. In addition, real case studies will provide students with a basis for direct application in their day-to-day work in the robotics sector.

A good opportunity for the professional looking to progress in an industry that has shown significant growth in recent years, due to the benefits it brings to commercial or financial sectors. Thus, this Postgraduate Certificate allows you not only to grow, but also to combine your personal responsibilities with quality teaching, with multimedia content that can be accessed at any time of the day and with a device with an Internet connection.

This **Postgraduate Certificate in Visual SLAM: Robot Localization and Simultaneous Mapping using Computer Vision** contains the most complete and up-to-date program on the market. The most important features include:

- Case studies presented by experts in robotic 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 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

A university program that allows you to learn about the limits and capabilities of visual SLAM from experts in the field of Robotics”

An online teaching that will allow you to configure visual SLAM algorithms in a simple way thanks to multimedia content"

Deepen in an agile way in this Postgraduate Certificate in the basis of projective and epipolar geometry.

Access the resource library and the complete syllabus of this program from day one.

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 during the academic year For this purpose, the students will be assisted by an innovative interactive video system created by renowned and experienced experts.

02

Objectives

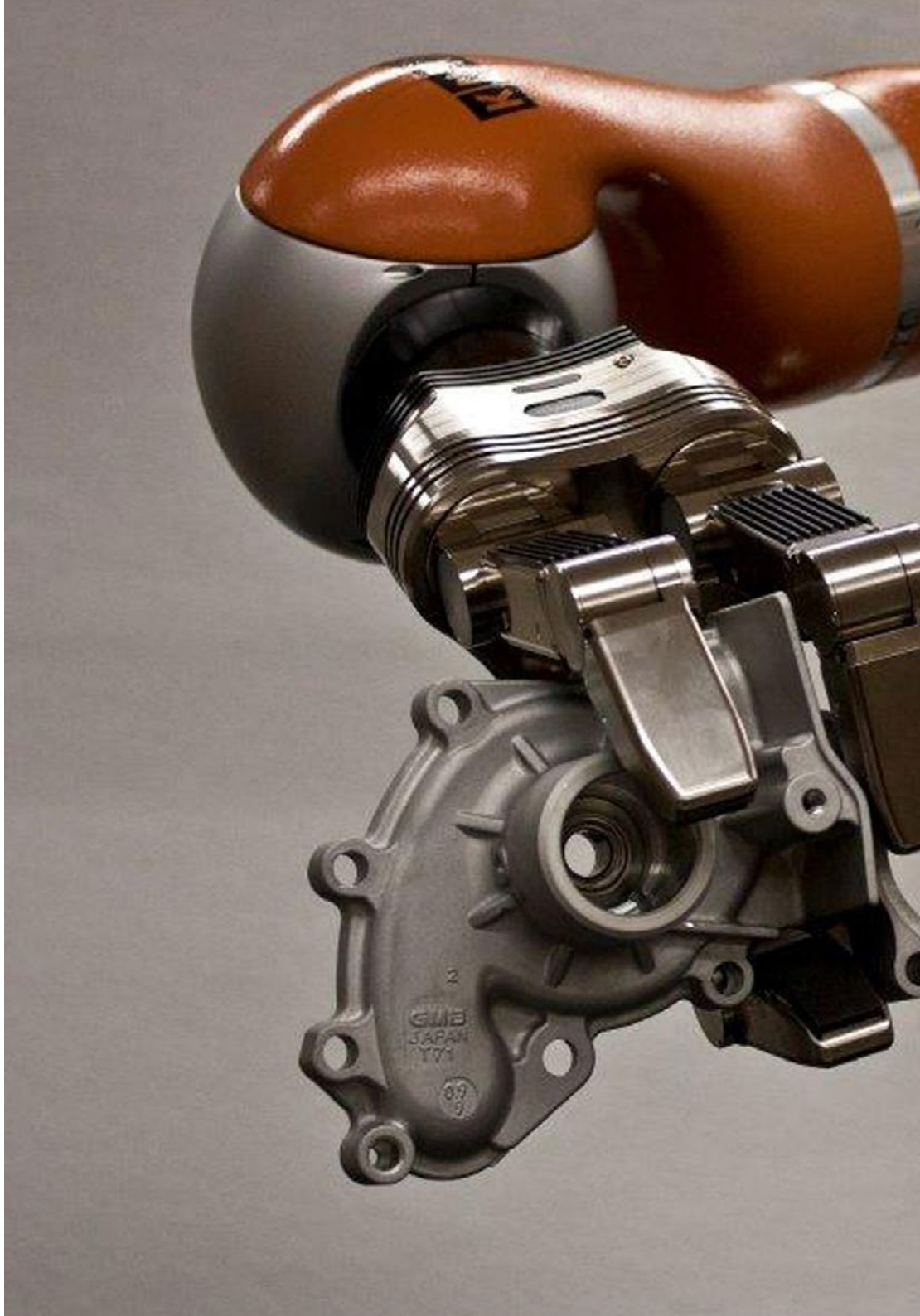
This Postgraduate Certificate aims to enable students to thrive in an up-and-coming robotics sector. Thus, the engineering professional at the end of this program will be able to know in detail the operation of the main visual SLAM algorithms, make adjustments and parameterization, which will allow him to create his own projects from scratch. All this with a Relearning learning system, based on the reiteration of content, which allows you to advance naturally and progressively in this program.

Acquire advanced learning in simultaneous mapping and advance your career in the field of Robotics"

General Objectives

- Develop the theoretical and practical foundations necessary to carry out a robot design and modeling project
- Provide the graduates with an exhaustive knowledge of the automation of industrial processes that will allow them to develop their own strategies
- Acquire the professional skills of an expert in automatic control systems in Robotics

Access the most advanced knowledge in Gaussian filter settings and parameterization and improve object detection"



Specific Objectives

- Specify the basic structure of a Simultaneous Localization and Mapping (SLAM) system
- Identify the basic sensors used in Simultaneous Localization and Mapping (visual SLAM)
- Establish the boundaries and capabilities of visual SLAM
- Compile the basic notions of projective and epipolar geometry to understand imaging projection processes
- Identify the main visual SLAM technologies: Gaussian filtering, Optimization and loop closure detection
- Describe in detail the operation of the main visual SLAM algorithms
- Analyze how to carry out the tuning and parameterization of SLAM algorithms

03

Course Management

TECH remains committed to offering students an elite and affordable education. To this end, it rigorously selects the faculty that teaches the programs. On this occasion, the engineering professional has a management and teaching team with extensive experience in the robotics sector and in teaching at the highest level. Their proximity and human quality will allow students to count on specialists who will answer any questions they may have about the syllabus of this Postgraduate Certificate.

A teaching team specialized in Robotics will show you the recent advances in localization and mapping with Artificial Vision"

Management

Dr. Felipe Ramón Fabresse

- Senior Software Engineer at Acurable
- NLP Software Engineer at Intel Corporation
- Software Engineer in CATEC, Indisys
- Researcher in Aerial Robotics at the University of Seville
- PhD Cum Laude in Robotics, Autonomous Systems and Telerobotics at the University of Seville
- Degree in Computer Engineering at the University of Seville
- Master's Degree in Robotics, Automation and Telematics at the University of Seville

Professors

Dr. Caballero Benítez, Fernando

- Researcher in the European projects COMETS, AWARE, ARCAS and SIAR
- Degree in Telecommunications Engineering from the University of Seville
- PhD in Telecommunications Engineering at the University of Seville
- Full Professor of Systems Engineering and Automatics at the University of Seville
- Associate editor of the journal Robotics and Automation Letters

04

Structure and Content

This Postgraduate Certificate consists of 150 teaching hours in which students will find an updated syllabus that gives them the opportunity to progress in their professional career. A curriculum consisting of video summaries, specialized readings and real case examples will provide you with advanced knowledge in the field of simultaneous localization and mapping, the most commonly used techniques and the most direct applications of Visual SLAM today. This educational material can be accessed at any time of the day, without fixed schedules, and from a laptop or tablet with an internet connection.

This Postgraduate Certificate will deepen the analysis of the Direct Visual SLAM Algorithm with the most updated content"

Module 1. Visual SLAM. Robot Localization and Simultaneous Mapping Using Computer Vision Techniques

1.1. Simultaneous Localization and Mapping (SLAM)
- 1.1.1. Simultaneous Localization and Mapping. SLAM
- 1.1.2. SLAM Applications
- 1.1.3. SLAM Operation

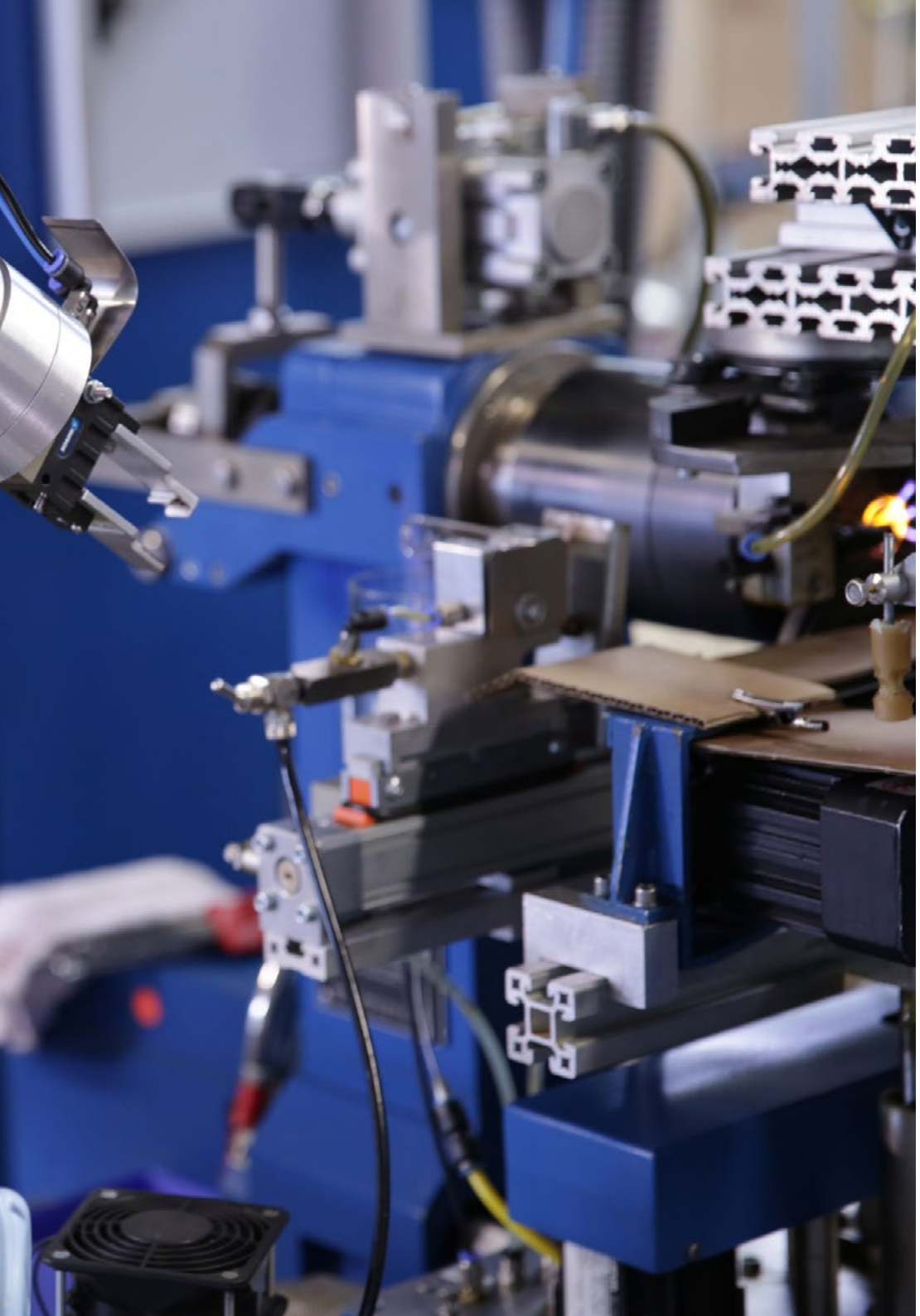
1.2. Projective Geometry
- 1.2.1. Pin-Hole Model
- 1.2.2. Estimation of Intrinsic Parameters of a Chamber
- 1.2.3. Homography, Basic Principles and Estimation
- 1.2.4. Fundamental Matrix, Principles and Estimation

1.3. Gaussian Filters
- 1.3.1. Kalman Filter
- 1.3.2. Information Filter
- 1.3.3. Adjustment and Parameterization of Gaussian Filters

1.4. Stereo EKF-SLAM
- 1.4.1. Stereo Camera Geometry
- 1.4.2. Feature Extraction and Search
- 1.4.3. Kalman Filter for Stereo SLAM
- 1.4.4. Stereo EKF-SLAM Parameter Setting

1.5. Monocular EKF-SLAM
- 1.5.1. EKF-SLAM Landmark Parameterization
- 1.5.2. Kalman Filter for Monocular SLAM
- 1.5.3. Monocular EKF-SLAM Parameter Tuning

1.6. Loop Closure Detection
- 1.6.1. Brute Force Algorithm
- 1.6.2. FABMAP
- 1.6.3. Abstraction Using GIST and HOG
- 1.6.4. Deep Learning Detection



1.7. Graph-SLAM
  1.7.1. Graph-SLAM
  1.7.2. RGBD-SLAM
  1.7.3. ORB-SLAM
1.8. Direct Visual SLAM
  1.8.1. Analysis of the Direct Visual SLAM Algorithm
  1.8.2. LSD-SLAM
  1.8.3. SVO
1.9. Visual Inertial SLAM
  1.9.1. Integration of Inertial Measurements
  1.9.2. Low Coupling: SOFT-SLAM
  1.9.3. High Coupling: Vins-Mono
1.10. Other SLAM Technologies
  1.10.1. Applications Beyond Visual SLAM
  1.10.2. Lidar-SLAM
  1.10.2. Range-only SLAM

A Postgraduate Certificate that will show you the different existing applications of visual SLAM. Click and find out"

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

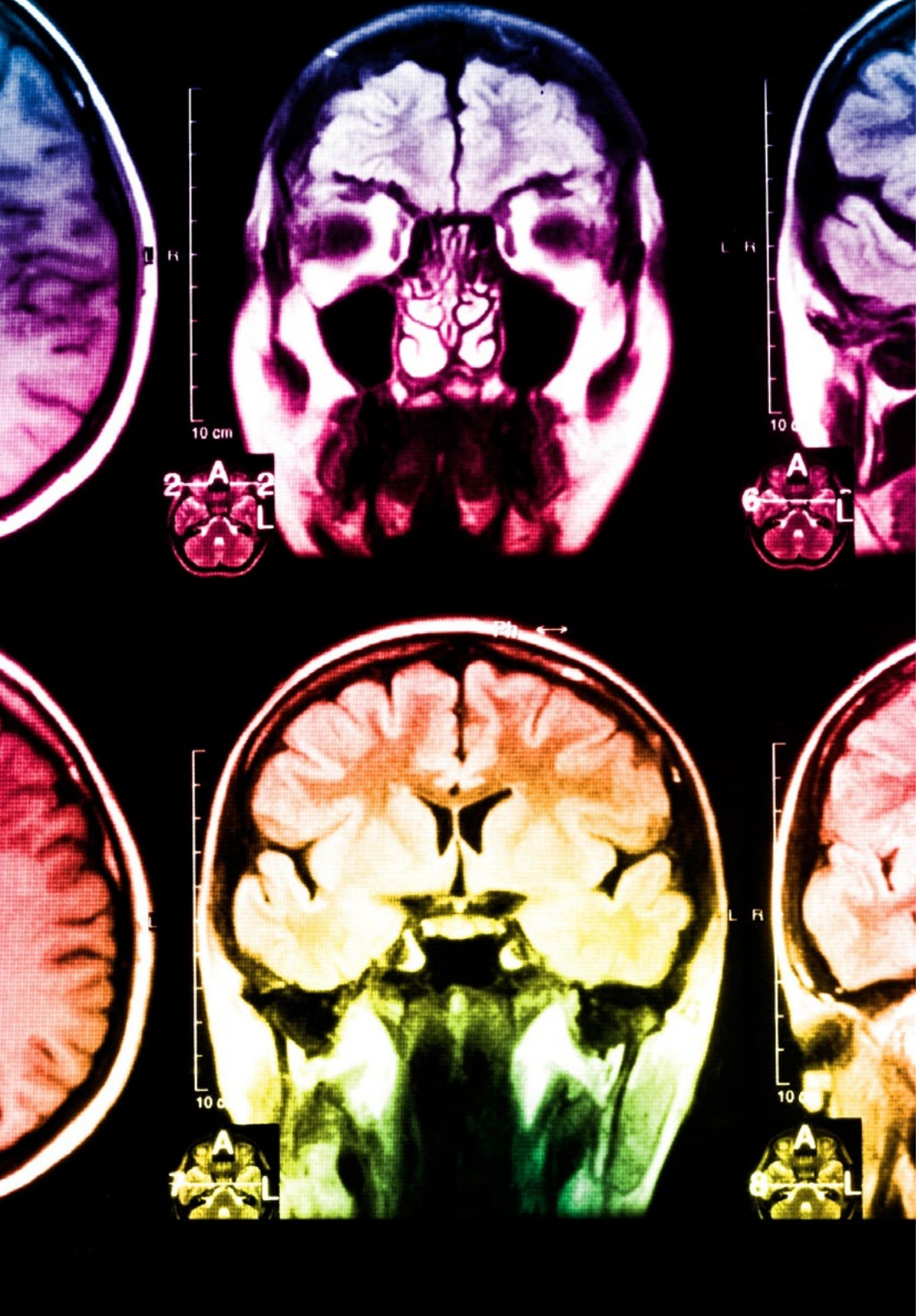
TECH effectively combines the Case Study methodology with a 100% online learning system based on repetition, which combines 8 different teaching elements in each lesson.

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.

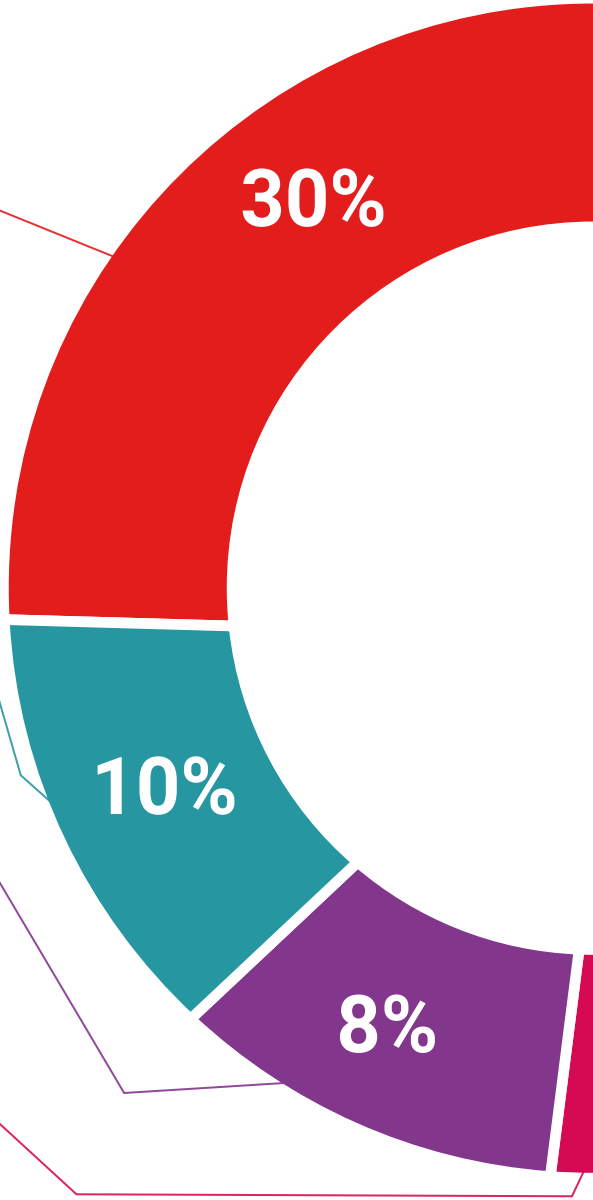
Learning from an Expert strengthens knowledge and memory, and generates confidence in future difficult decisions.

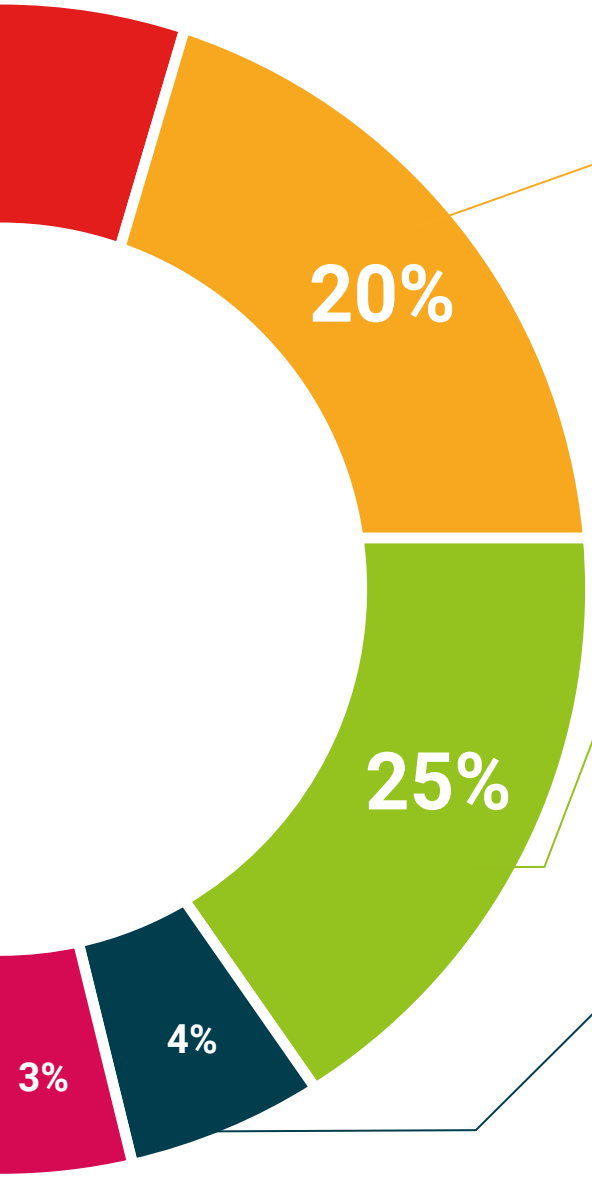
Practising Skills and Abilities

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 Certificate in Visual SLAM: Robot Localization and Simultaneous Mapping Using Computer Vision guarantees students, in addition to the most rigorous and up-to-date education, access to a Postgraduate Certificate 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 Certificate in Visual SLAM: Robot Localization and Simultaneous Mapping Using Computer Vision** 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 Certificate** issued by **TECH Technological University** via tracked delivery*.

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

Title: **Postgraduate Certificate in Visual SLAM: Robot Localization and Simultaneous Mapping Using Computer Vision**

Official Nº of Hours: **150 h.**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Awards the following

CERTIFICATE

to

Mr./Ms. _____, with identification number _____.

For having passed and accredited the following program

POSTGRADUATE CERTIFICATE

in

Visual SLAM: Robot Localization and Simultaneous Mapping Using Computer Vision

This is a qualification awarded by this University, equivalent to 150 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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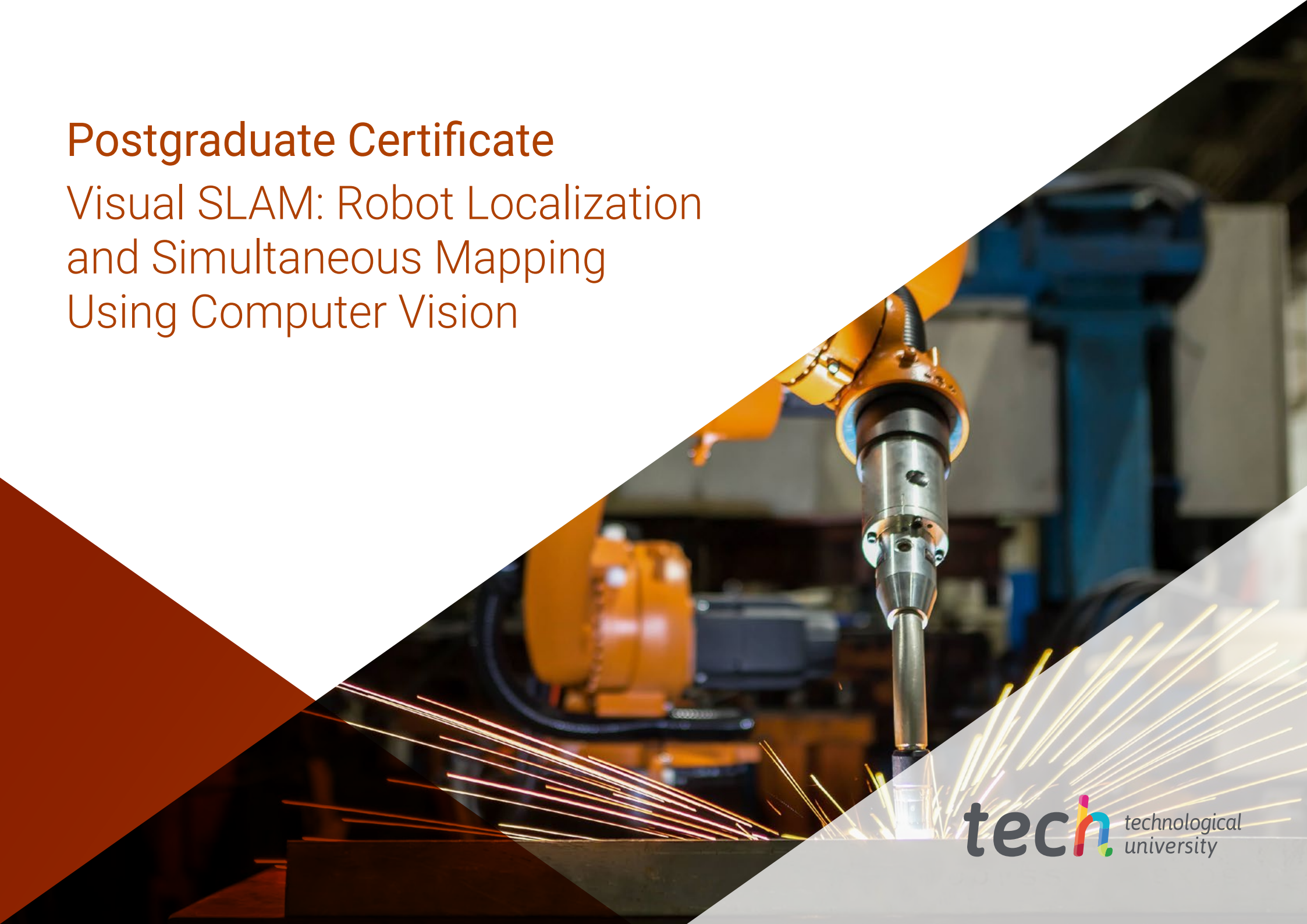

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