Postgraduate Diploma

Deep Learning Applied to Computer Vision

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Postgraduate Diploma
Deep Learning Applied to Computer Vision

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

Website: **www.techtitute.com/pk/artificial-intelligence/postgraduate-diploma/postgraduate-diploma-deep-learning-applied-computer-vision**

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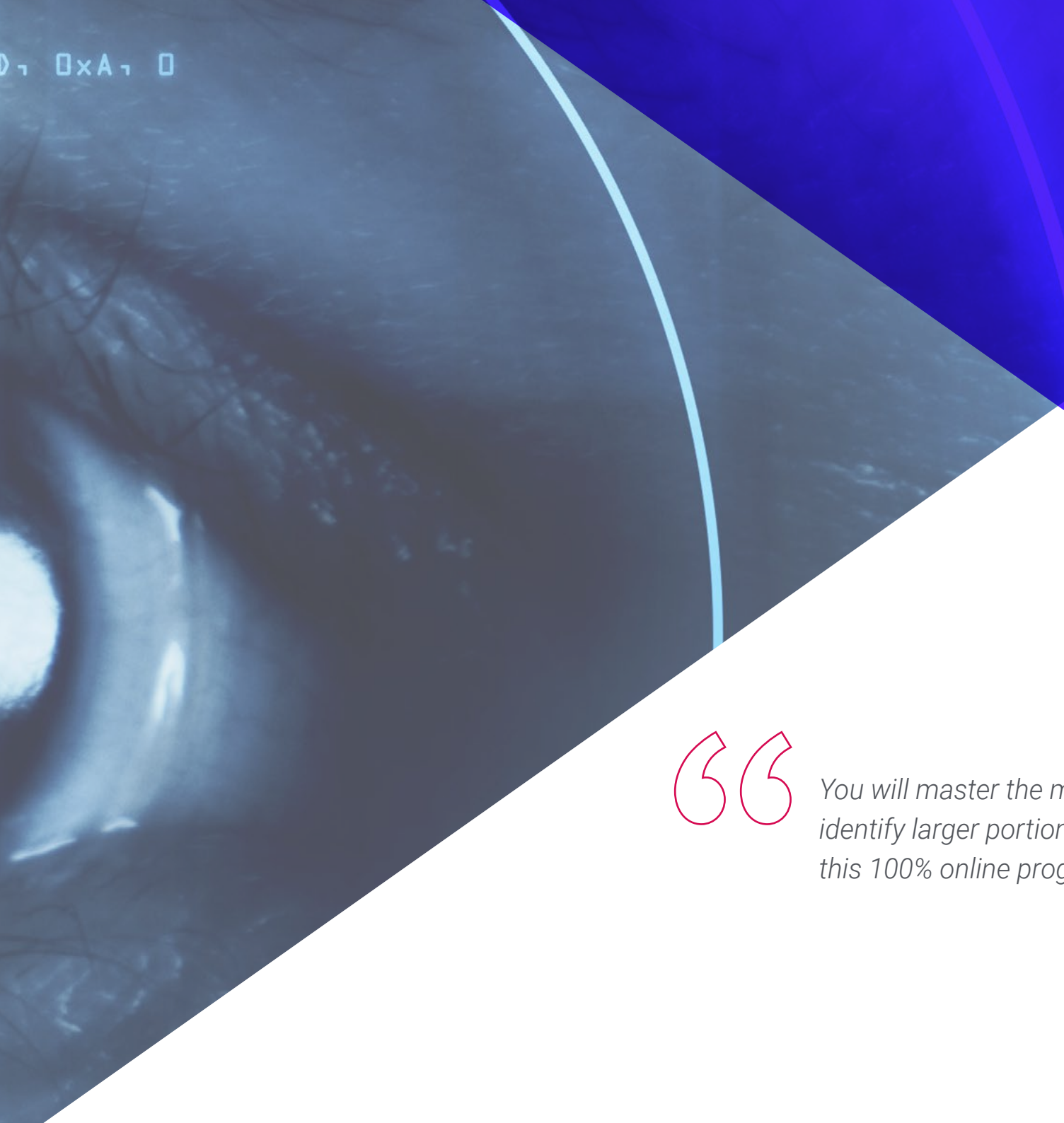
01

Introduction

Deep Learning has completely revolutionized the field of Artificial Intelligence (AI), allowing all kinds of devices to automate complex tasks. One example of this is Computer Vision, which contributes to the early detection of diseases from medical images, as well as to the monitoring of patients' health and even to assisting in minimal surgery. Aware of the relevance of this branch of Machine Learning, TECH creates a university program that will deal in detail with Convolutional Networks and Image Classification. It should be noted that it is taught 100% online, so that students can combine their studies with the rest of their daily responsibilities.



You will master the main types of CNN layers and identify larger portions of the images thanks to this 100% online program"

Convolutional Networks have established themselves as a versatile tool in the field of Computer Vision. Its importance lies in its ability to analyze, understand and process images or videos in an automated and efficient way. Among the diversity of its applications, it stands out its relevance in Biomedical Authentication by analyzing unique facial characteristics of a person and comparing them with a database to verify their identity. This is indispensable in aspects such as airport security or access control in buildings, among others.

In this context, TECH is developing a Postgraduate Diploma that will comprehensively address Deep Learning Applied to Computer Vision. The curriculum will delve into the use of Machine learning, given its importance to recognize patterns and perform specific analysis tasks. Likewise, the syllabus will address the whole cycle of creation of a Neural Network, paying careful attention to its learning and validation. On the other hand, students will learn the most advanced strategies for Object Detection and Tracking. In line with this, they will implement cutting-edge evaluation metrics, including the Intersection Over Union or Confidence Score.

On the other hand, to strengthen the mastery of the contents, this university program applies the revolutionary *Relearning* system. TECH is a pioneer in the use of this teaching model, which promotes the assimilation of complex concepts through their natural and progressive reiteration. In this way, students do not have to resort to complex techniques such as traditional memorization. In this line, the program also uses materials in various formats such as infographics, interactive summaries or explanatory videos. All this in a convenient 100% online mode, which allows students to adjust their schedules according to their responsibilities and personal circumstances.

This **Postgraduate Diploma in Deep Learning Applied to Computer Vision** contains the most complete and up-to-date program on the market. The most important features include:

- The development of case studies presented by experts in Deep Learning, computer science and computer vision
- 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

Delve deeper into the Evaluation Metrics of Tracking Algorithms thanks to TECH, the world's best digital university according to Forbes"

Do you want to become a Machine Learning expert? Achieve it in only 6 months with this innovative program"

Update your knowledge in Object Detection through innovative multimedia content.

Forget about memorizing! With the Relearning system you will integrate the concepts in a natural and progressive way.

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

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

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

02

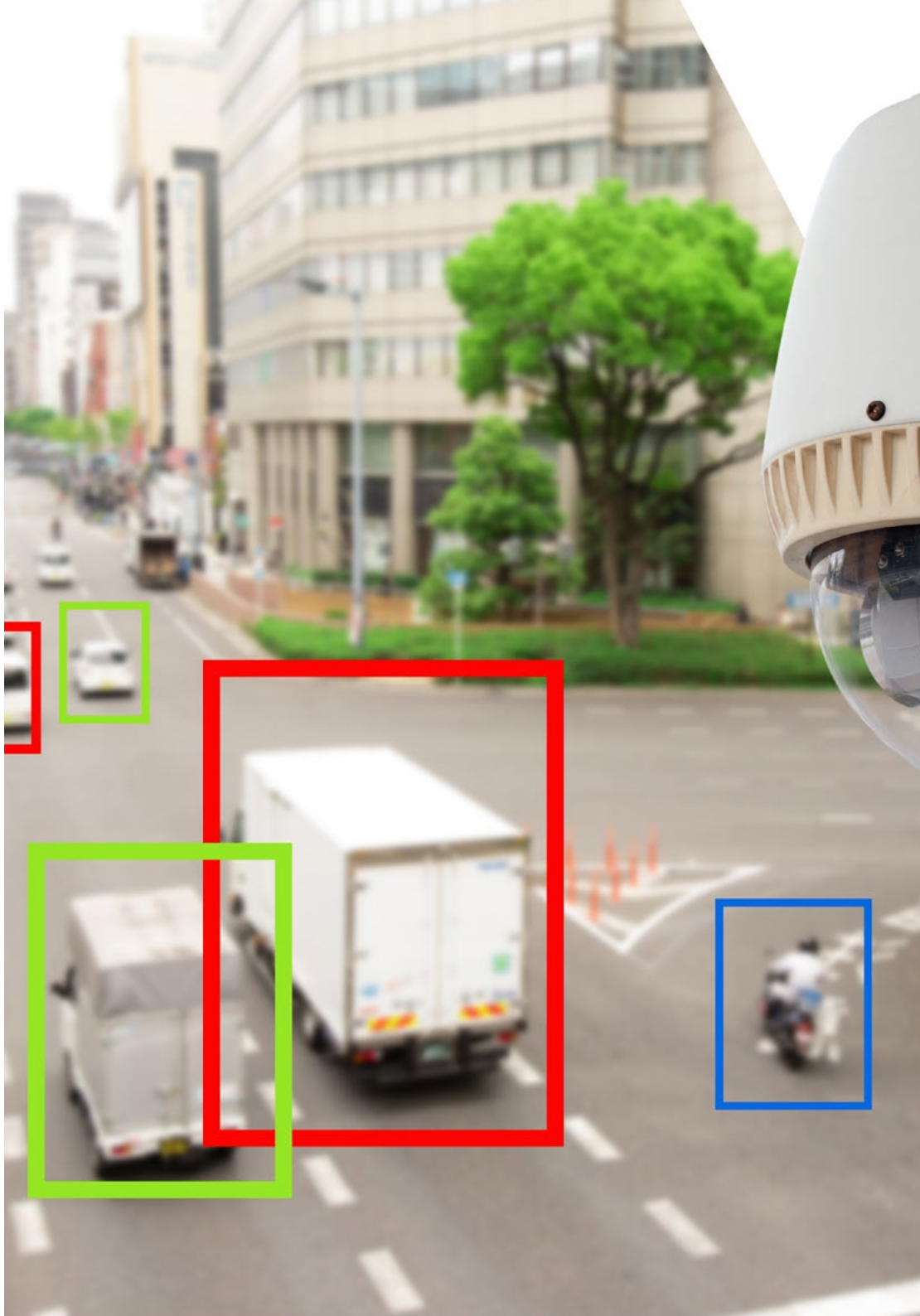
Objectives

The main objective of this Postgraduate Diploma is to provide the students with a comprehensive vision of Deep Learning Applied to Computer Vision. Upon completion of this university program, graduates will have at their disposal the most cutting-edge tools in this field, in order to face their professional practice with the best techniques. In this way, professionals will be able to develop new and exclusive Computer Vision projects based on Deep Learning. In this way, they will be able to differentiate themselves from their competitors and become authentic references in Machine Learning.

With the highest rated learning assistance methods in online teaching, this Postgraduate Diploma will allow you to learn smoothly, steadily and effectively"

General Objectives

- Generate specialized knowledge about *Deep Learning*
- Introduce neural networks and examine how they work
- Analyze metrics for proper learning
- Understanding the mathematics behind neural networks
- Develop convolutional neural networks
- Analyze existing metrics and tools
- Examine the pipeline of an image classification network
- Propose inference methods
- Generate specialized knowledge about object detection neural networks and their metrics
- Identify the different architectures
- Establish use cases
- Examine tracking algorithms and their metrics



Specific Objectives

Module 1. Deep Learning

- Analyze the families that make up the artificial intelligence world
- Compile the main *Frameworks* of *Deep Learning*
- Define neural networks
- Present the learning methods of neural networks
- Fundamentals of cost functions
- Establish the most important activation functions
- Examine regularization and normalization techniques
- Develop optimization methods
- Introduce initialization methods

Module 2. Convolutional Neural Networks and Image Classification

- Generate specialized knowledge on convolutional neural networks
- Establish evaluation metrics
- Analyze the performance of CNNs for image classification
- Evaluate Data Augmentation
- Propose techniques to avoid Overfitting
- Examine different architectures
- Compile inference methods

Module 3. Object Detection

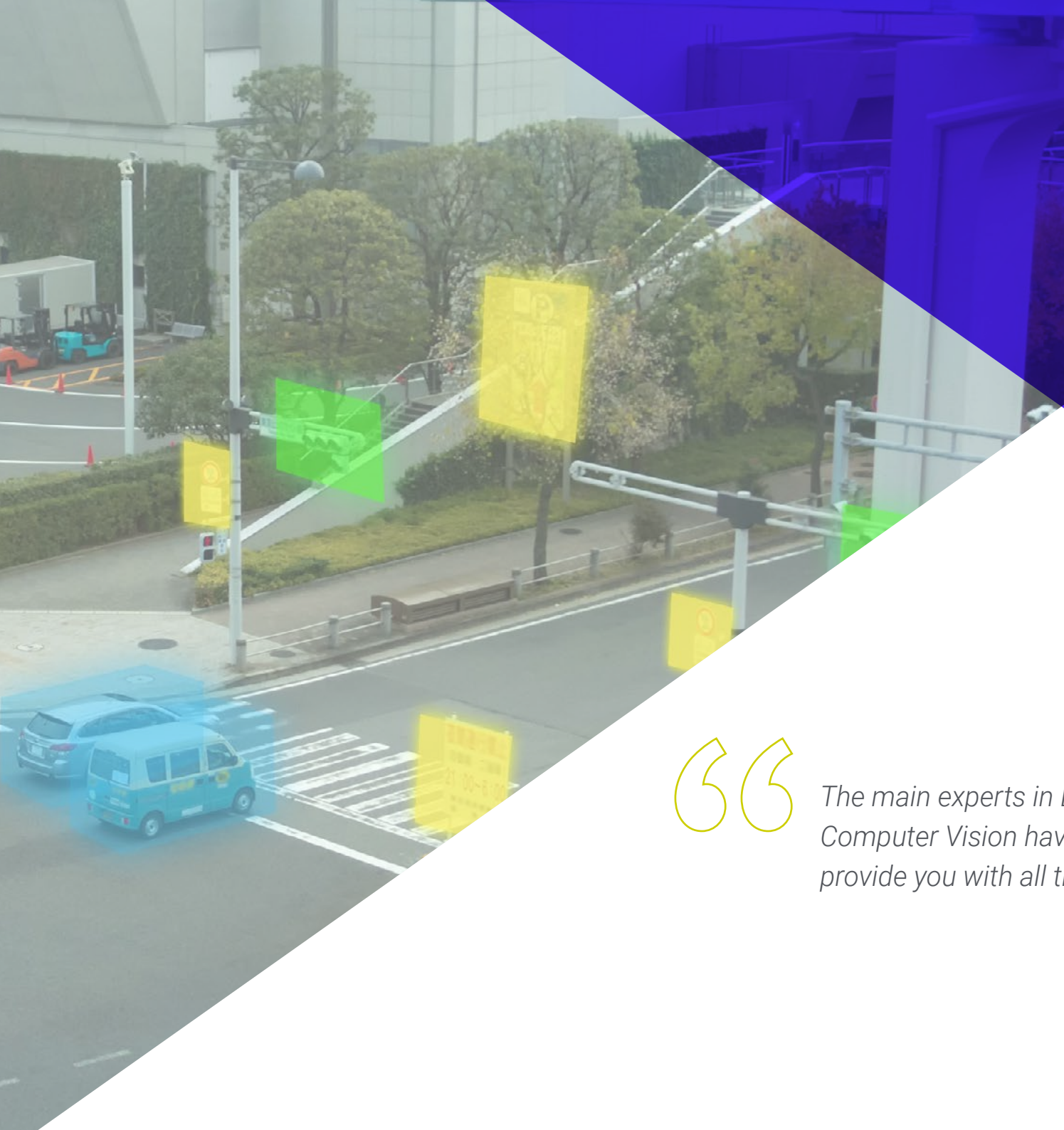
- Analyze how object detection networks work
- Examine traditional methods
- Determine evaluation metrics
- Identify the main datasets used in the marketplace
- Propose architectures of the Two Stage Object Detector type
- Analyze Fine Tuning Methods
- Examine different Single Shoot type architectures
- Establish object tracking algorithms
- Apply detection and tracking of people

TECH adapts to your schedule, that's why it has designed a flexible and 100% online program"

03

Course Management

In to its commitment to offer the highest quality education, TECH has a teaching faculty of the highest level. These professionals have a broad professional background in the field of Deep Learning Applied to Computer Vision. In this way, they have provided innovative solutions to renowned organizations and have kept abreast of the advances that have occurred in this field of specialization. Thanks to this, together with their in-depth knowledge, students have the guarantees they demand to specialize at an international level in an industry that offers multiple job opportunities.



The main experts in Deep Learning Applied to Computer Vision have joined forces in this program to provide you with all their knowledge in this field"

Management

Mr. Redondo Cabanillas, Sergio

- Machine Vision Research and Development Specialist at BCN Vision
- Development and *Backoffice* Team Leader at BCN Vision
- Project Manager and development of computer vision solutions
- Sound Technician at Media Arts Studio
- Specialization in Image and Sound by the Polytechnic University of Catalonia
- Graduate in Political Science and Industry from the Autonomous University of Barcelona
- Higher Level Training Cycle in Sound Villar CP

Professors

Ms. Riera i Marín, Meritxell

- Deep Learning Systems Developer at Sycai Medical
- Researcher at Centre National de la Recherche Scientifique(CNRS), France
- Software engineer at Zhilabs
- IT Technician, Mobile World Congress
- Software engineer at Avanade
- Telecommunications Engineering from the Polytechnic University of Catalonia
- Master of Science: Spécialité Signal, image, systèmes embarqués, automatique (SISEA) at IMT Atlantique, France
- Professional Master's Degree in Telecommunications Engineering from the Polytechnic University of Catalonia

Mr. Felipe Higón Martínez

- Electronics, telecommunications and computer engineer
- Validation and prototyping engineer
- Applications Engineer
- Support Engineer
- Master's Degree in Advanced and Applied Artificial Intelligence by IA3
- Technical Engineer in Telecommunications
- Degree in Electronic Engineering from the University of Valencia

Mr. Delgado Gonzalo, Guillem

- Computer Vision and Artificial Intelligence Researcher at Vicomtech
- Computer Vision and Artificial Intelligence Engineer at Gestoos
- Junior Engineer at Sogeti
- Graduated in Audiovisual Systems Engineering at the Polytechnic University of Catalonia
- MSc in Computer Vision at Universitat Autónoma de Barcelona
- Graduate in Computer Science at Aalto University
- Graduate in Audiovisual Systems. UPC - ETSETB Telecos BCN

Mr. Solé Gómez, Àlex

- Researcher at Vicomtech in the Intelligent Security Video Analytics department
- MSc. in Telecommunications Engineering, mention in Audiovisual Systems, by the Polytechnic University of Catalonia
- BSc in Telecommunications Technologies and Services Engineering, mention in Audiovisual Systems by the Polytechnic University of Catalonia

04

Structure and Content

This study plan consists of 3 complete modules, designed by true specialists in Artificial Intelligence. Therefore, the didactic materials will offer the latest innovations in Neural Network evaluation metrics, types of CNN layers and training with regularization. In addition, students will acquire new skills to effectively handle the most advanced tools in object detection. The program will include the analysis of real cases and resolution of complex situations in simulated learning environments." Graduates will be prepared to overcome any challenge that may arise during their activities.

A specialist syllabus and top-level teaching materials are the key to a successful career"

Module 1. Deep Learning

1.1. Artificial Intelligence
- 1.1.1. Machine Learning
- 1.1.2. Deep Learning
- 1.1.3. The Explosion of Deep Learning Why Now

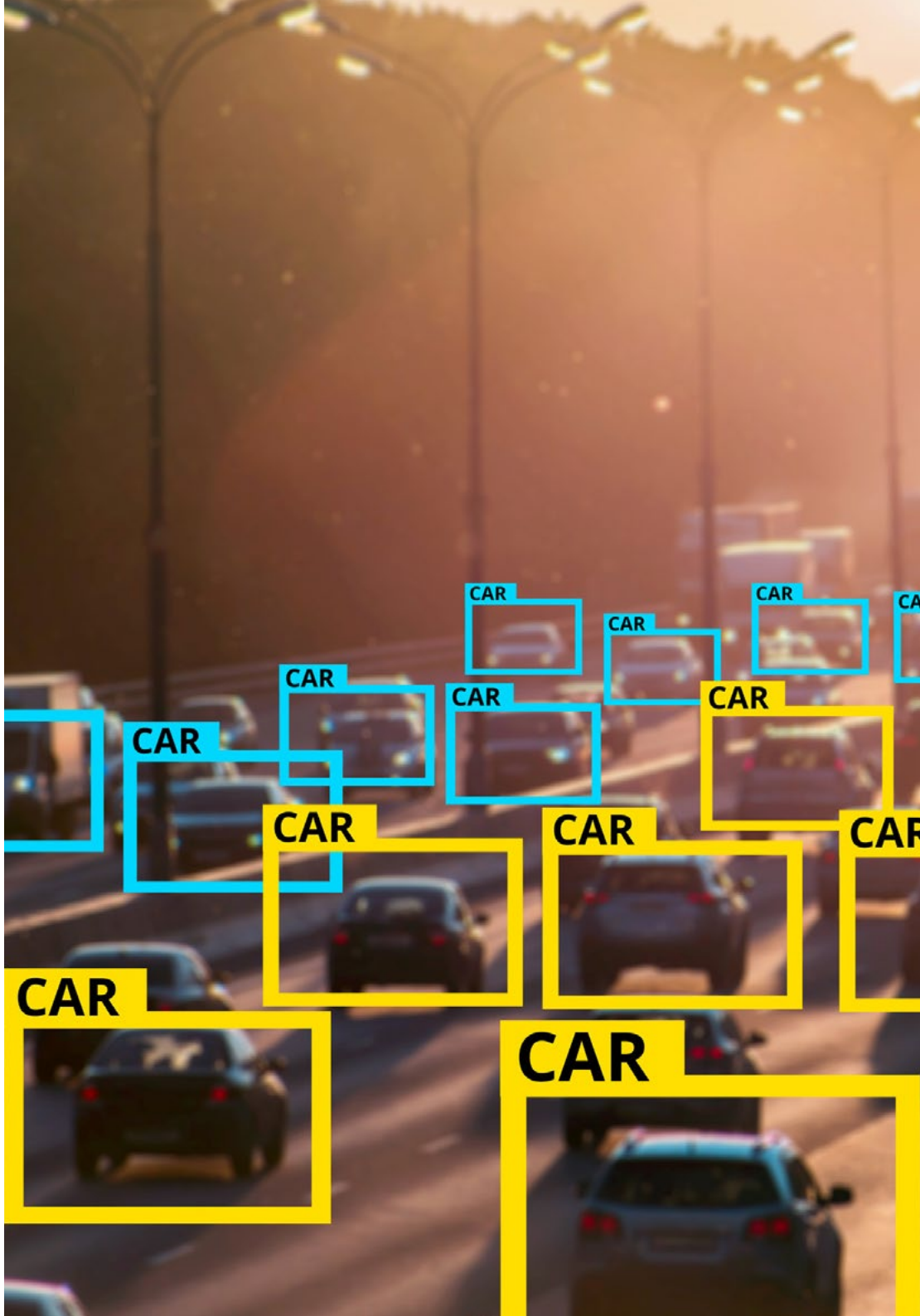
1.2. Neural Networks
- 1.2.1. The Neural Network
- 1.2.2. Uses of Neural Networks
- 1.2.3. Linear Regression and Perceptron
- 1.2.4. Forward Propagation
- 1.2.5. Backpropagation
- 1.2.6. Feature Vectors

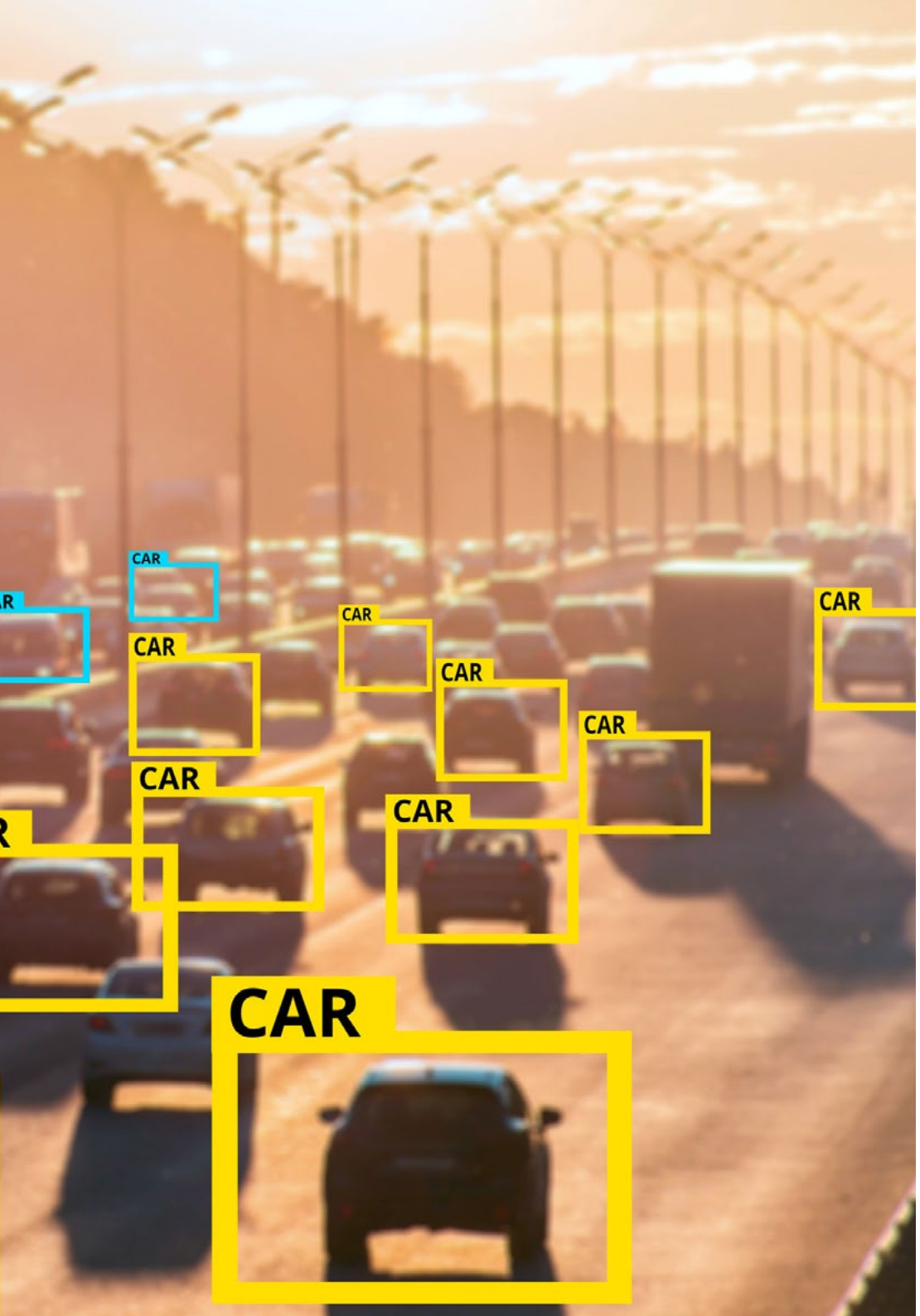
1.3. Loss Functions
- 1.3.1. Loss Functions
- 1.3.2. Types of Loss Functions
- 1.3.3. Choice of Loss Functions

1.4. Activation Functions
- 1.4.1. Activation Function
- 1.4.2. Linear Functions
- 1.4.3. Non-Linear Functions
- 1.4.4. Output vs. Hidden Layer Activation Functions

1.5. Regularization and Normalization
- 1.5.1. Regularization and Normalization
- 1.5.2. Overfitting and Data Augmentation
- 1.5.3. Regularization Methods: L1, L2 and Dropout
- 1.5.4. Normalization Methods: Batch, Weight, Layer

1.6. Optimization
- 1.6.1. Gradient Descent
- 1.6.2. Stochastic Gradient Descent
- 1.6.3. Mini Batch Gradient Descent
- 1.6.4. Momentum
- 1.6.5. Adam





1.7. Hyperparameter Tuning and Weights
- 1.7.1. Hyperparameters
- 1.7.2. Batch Size vs Learning Rate vs Step Decay
- 1.7.3. Weights

1.8. Evaluation Metrics of a Neural Network
- 1.8.1. Accuracy
- 1.8.2. Dice Coefficient
- 1.8.3. Sensitivity vs Specificity / Recall vs precision
- 1.8.4. ROC Curve (AUC)
- 1.8.5. F1-Score
- 1.8.6. Matrix Confusion
- 1.8.7. Cross-Validation

1.9. Frameworks and Hardware
- 1.9.1. Tensor Flow
- 1.9.2. Pytorch
- 1.9.3. Caffe
- 1.9.4. Keras
- 1.9.5. Hardware for the Training Phase

1.10. Creation of a Neural Network– Training and Validation
- 1.10.1. Dataset
- 1.10.2. Network Construction
- 1.10.3. Education
- 1.10.4. Visualization of Results

Module 2. Convolutional Neural Networks and Image Classification

2.1. Convolutional Neural Networks
- 2.1.1. Introduction
- 2.1.2. Convolution
- 2.1.3. CNN Building Blocks

2.2. Types of CNN Layers
- 2.2.1. Convolutional
- 2.2.2. Activation
- 2.2.3. Batch Normalization
- 2.2.4. Polling
- 2.2.5. Fully Connected

2.3. Metrics
- 2.3.1. Matrix Confusion
- 2.3.2. Accuracy
- 2.3.3. Precision
- 2.3.4. Recall
- 2.3.5. F1 Score
- 2.3.6. ROC Curve
- 2.3.7. AUC

2.4. Main Architectures
- 2.4.1. AlexNet
- 2.4.2. VGG
- 2.4.3. Resnet
- 2.4.4. GoogleLeNet

2.5. Image Classification
- 2.5.1. Introduction
- 2.5.2. Analysis of Data
- 2.5.3. Data Preparation
- 2.5.4. Model Training
- 2.5.5. Model Validation

2.6. Practical Considerations for CNN Training
- 2.6.1. Optimizer Selection
- 2.6.2. Learning Rate Scheduler
- 2.6.3. Check Training Pipeline
- 2.6.4. Training with Regularization

2.7. Best Practices in Deep Learning
- 2.7.1. Transfer Learning
- 2.7.2. Fine Tuning
- 2.7.3. Data Augmentation

2.8. Statistical Data Evaluation
- 2.8.1. Number of Datasets
- 2.8.2. Number of Labels
- 2.8.3. Number of Images
- 2.8.4. Data Balancing

2.9. Deployment
- 2.9.1. Saving and Loading Models
- 2.9.2. Onnx
- 2.9.3. Inference

2.10. Case Study: Image Classification
- 2.10.1. Data Analysis and Preparation
- 2.10.2. Testing the Training Pipeline
- 2.10.3. Model Training
- 2.10.4. Model Validation

Module 3. Object Detection

3.1. Object Detection and Tracking
- 3.1.1. Object Detection
- 3.1.2. Case Uses
- 3.1.3. Object Tracking
- 3.1.4. Case Uses
- 3.1.5. Occlusions, Rigid and Non-Rigid Poses

3.2. Assessment Metrics
- 3.2.1. IOU-Intersection Over Union
- 3.2.2. Confidence Score
- 3.2.3. Recall
- 3.2.4. Precision
- 3.2.5. Recall–Precision Curve
- 3.2.6. Mean Average Precision (mAP)

3.3. Traditional Methods
- 3.3.1. Sliding Window
- 3.3.2. Viola Detector
- 3.3.3. HOG
- 3.3.4. Non-Maximal Suppresion (NMS)

3.4. Datasets
- 3.4.1. Pascal VC
- 3.4.2. MS Coco
- 3.4.3. ImageNet (2014)
- 3.4.4. MOTAChallenge

3.5. Two Shot Object Detector
- 3.5.1. R-CNN
- 3.5.2. Fast R-CNN
- 3.5.3. Faster R-CNN
- 3.5.4. Mask R-CNN

3.6. Single Shot Object Detector
- 3.6.1. SSD
- 3.6.2. YOLO
- 3.6.3. RetinaNet
- 3.6.4. CenterNet
- 3.6.5. EfficientDet

3.7. Backbones
- 3.7.1. VGG
- 3.7.2. ResNet
- 3.7.3. Mobilenet
- 3.7.4. Shufflenet
- 3.7.5. Darknet

3.8. Object Tracking
- 3.8.1. Classical Approaches
- 3.8.2. Particulate Filters
- 3.8.3. Kalman
- 3.8.4. Sort Tracker
- 3.8.5. Deep Sort

3.9. Deployment
- 3.9.1. Computing Platform
- 3.9.2. Choice of Backbone
- 3.9.3. Choice of Framework
- 3.9.4. Model Optimization
- 3.9.5. Model Versioning

3.10. Study: People Detection and Tracking
- 3.10.1. Detection of People
- 3.10.2. Monitoring of People
- 3.10.3. Re-Identification
- 3.10.4. Counting People in Crowds

A training program that is characterized by its flexibility, freedom of schedules and 24-hour availability. Enroll now!"

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

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

Relearning Methodology

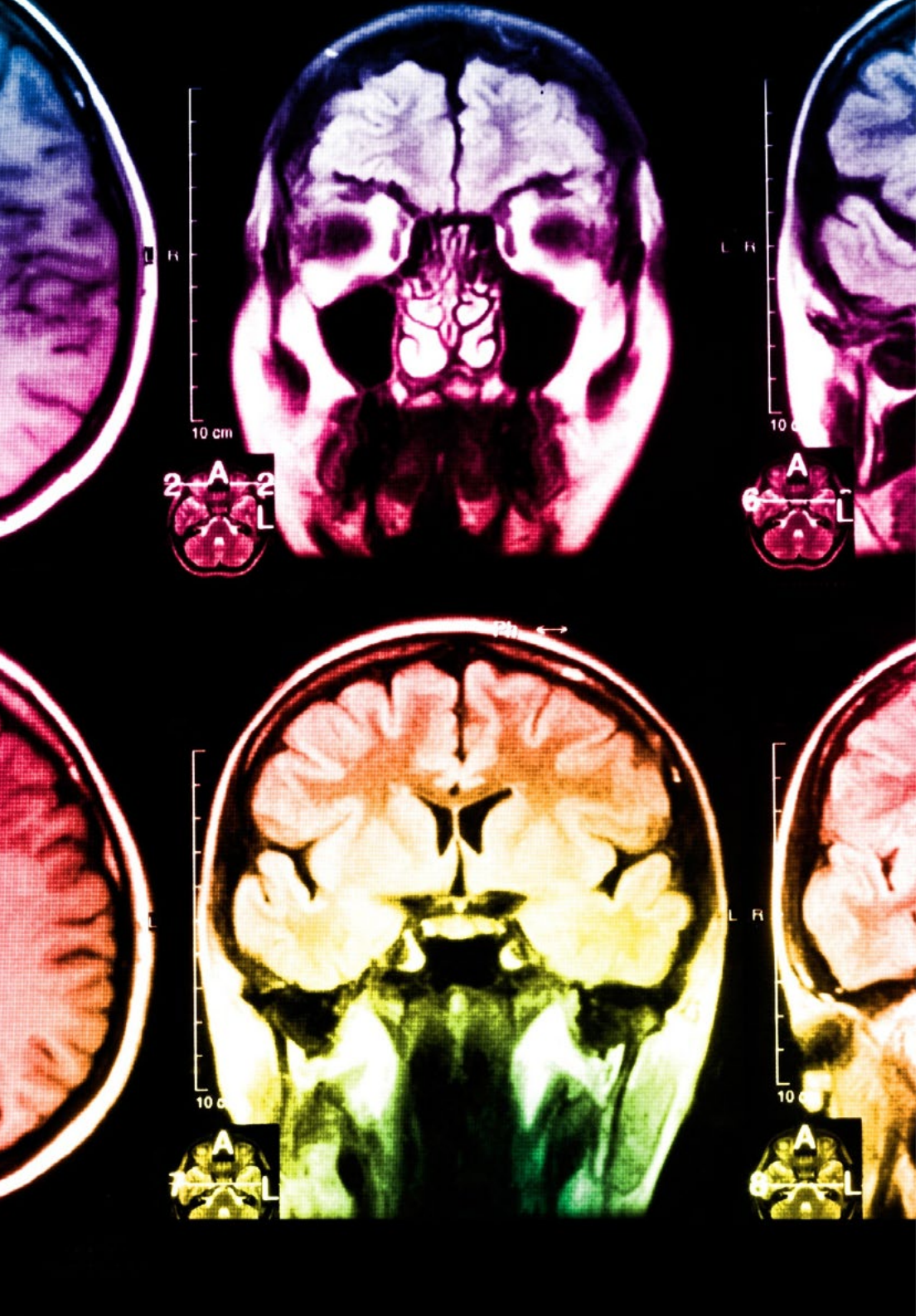
TECH effectively combines the Case Study methodology with a 100% online learning system based on repetition, which combines different teaching elements in each lesson.

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

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

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

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



In our program, learning is not a linear process, but rather a spiral (learn, unlearn, forget, and re-learn). Therefore, we combine each of these elements concentrically. This methodology has trained more than 650,000 university graduates with unprecedented success in fields as diverse as biochemistry, genetics, surgery, international law, management skills, sports science, philosophy, law, engineering, journalism, history, and financial markets and instruments. All this in a highly demanding environment, where the students have a strong socio-economic profile and an average age of 43.5 years.

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

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

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

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

Study Material

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

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

Classes

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

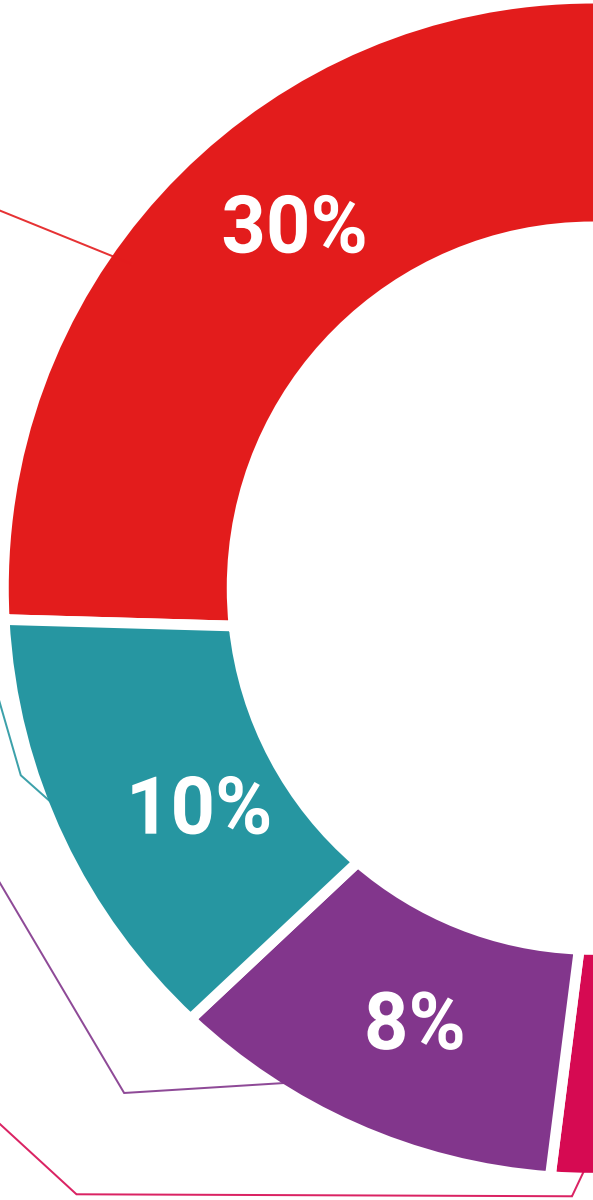
Learning from an Expert strengthens knowledge and memory, and generates confidence in future difficult decisions.

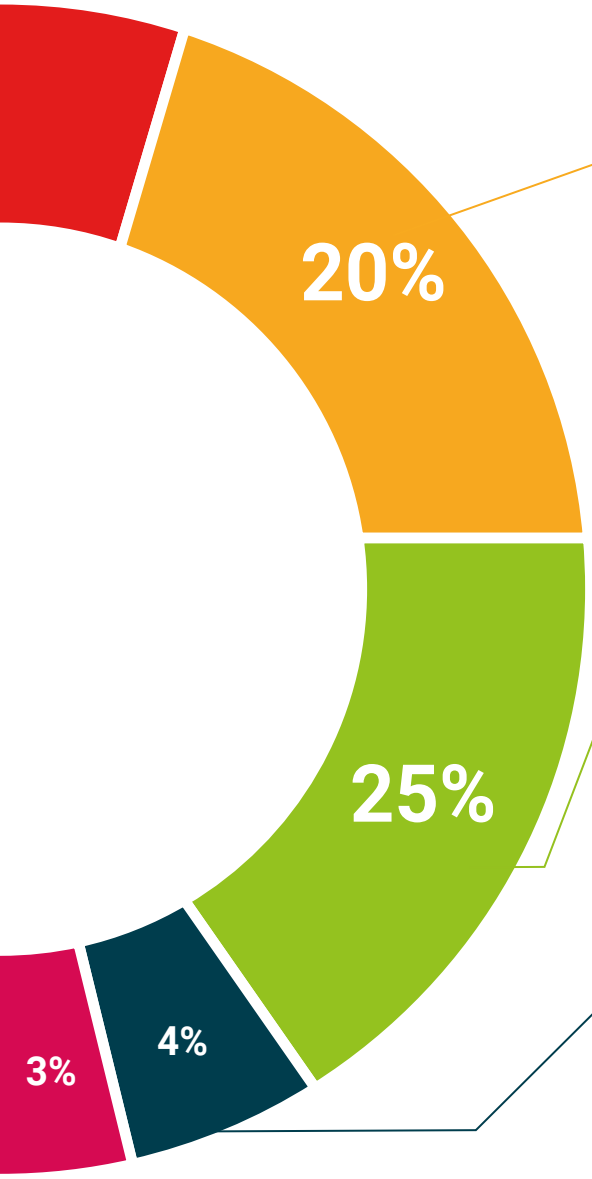
Practising Skills and Abilities

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

Additional Reading

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





Case Studies

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

Interactive Summaries

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

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

Testing & Retesting

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

06

Certificate

The Postgraduate Diploma in Deep Learning Applied to Computer Vision 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 Deep Learning Applied to 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 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 Deep Learning Applied to Computer Vision**

Official Nº of Hours: **450 h.**


tech technological university

Awards the following

CERTIFICATE

to

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

For having passed and accredited the following program

POSTGRADUATE DIPLOMA

in

Deep Learning Applied to Computer Vision

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

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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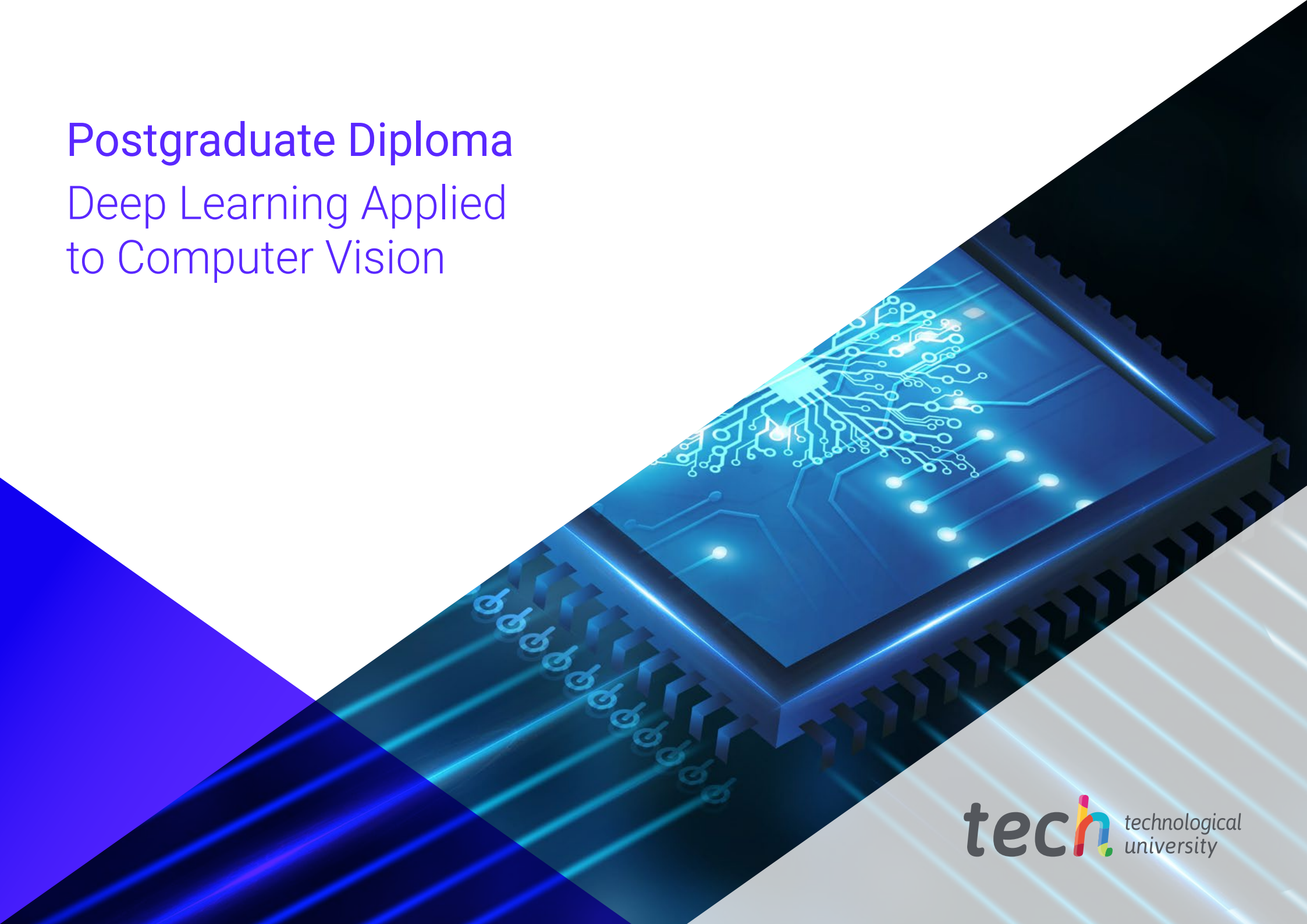

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