



# ESTÁGIOS DE VERÃO

CANDIDATURAS ATÉ 15 DE MAIO

 INESC TEC

WE ARE SCIENCE.  
WE ARE TECHNOLOGY.  
WE ARE INNOVATION.  
**WE ARE INESC TEC.**

## Internship Topics

Apply to one of the internship topics we have for you this summer!

This year, INESC TEC is offering you 47 internship topics! The topics are organized into the following scientific domains:

- **AI - Artificial Intelligence**
- **BIO - Bioengineering**
- **COM - Communications**
- **CSE - Computer Science and Engineering**
- **PES - Power and Energy Systems**
- **ROB - Robotics**
- **SEM - Systems Engineering and Management**

Choose **up to 3 topics that most interest you** and fill in the [application form](#) indicating your order of preference. On the form, you should also **indicate the keywords that best characterize your research preferences**. If none of the topics you have chosen are available, you may be offered a topic within the same scientific area and aligned with your interests.

Each topic is identified by a reference, for example, **[AI01]**. Use these references to fill in the application form.

In addition to the title, supervisors and a brief description of what is required, you will also find an indication of the research center and the location where the internship will take place, as well as whether the scheme offered is "On-site", "Hybrid" or "Remote".

The information will be presented in the following format:

**Internship location:** [Center] [Specific location] **[Internship scheme]**

## ***Artificial Intelligence***

- Ref. [AI01] Overlay Information on Satellite Imagery
- Ref. [AI02] Building Detection and Footprint Segmentation
- Ref. [AI03] Image processing for analyzing grocery labels
- Ref. [AI04] Making Sense of Ordinal Images Without Labels
- Ref. [AI05] Creative Diffusion: Exploring Logo Design with Diffusion Models
- Ref. [AI06] Fine-Tuning of Large Language Models for Multi-modal Perception
- Ref. [AI07] Development of AI-Enabled UAV Inspection System for PV Plant Maintenance
- Ref. [AI08] Planning USV Navigation for Multiple Goals
- Ref. [AI09] ML image Identification in mobile devices

## ***Bioengineering***

- Ref. [BIO01] Artificial Intelligence for Computed Tomography-Based Cardiovascular Disease Screening
- Ref. [BIO02] Nitrogen, Phosphorus and Potassium (NPK) Assessment in Hydroponic Samples
- Ref. [BIO03] Digital Twins in Hydroponics
- Ref. [BIO04] Systems Biology in Hidroponics
- Ref. [BIO05] Biophotonics

## ***Communications***

- Ref. [COM01] Automated Drone Positioning through an LLM-based Interface in Flying Networks of the Future
- Ref. [COM02] Performance Evaluation of Semantic Underwater Wireless Communications
- Ref. [COM03] Obstacle-aware vision-based Positioning Algorithm for a Simple Scenario
- Ref. [COM04] Starlink Performance Evaluation
- Ref. [COM05] Comparative study of antenna characterisation systems from 30 to 300 GHz
- Ref. [COM06] Sensing through NFC-enabled smartphone

## ***Computer Science and Engineering***

- Ref. [CSE01] Visual Mapping of Source Code to Abstract Syntax Tree (AST)
- Ref. [CSE02] Recording the History of Source-to-Source Transformations
- Ref. [CSE03] MISRA-C Analyzer and Converter
- Ref. [CSE04] Towards a citizen science data curation workflow with (implicit) Human Computation
- Ref. [CSE05] WebTraceSense: A platform for visualising interaction data from web games
- Ref. [CSE06] Blue energy XR Immersive dashboard visualization tool
- Ref. [CSE07] From netcdf to virtual choreography
- Ref. [CSE08] From Virtual Choreographies Bathymetry to 3D model

Ref. [CSE09] From behaviors to Dashboards

Ref. [CSE10] VR Training a simple immersive tool

Ref. [CSE11] Exploring Virtual Choreographies in Extended Reality Environments

Ref. [CSE12] Web Visual Editor for Scientific Workflows

Ref. [CSE13] Data harmonization for drifting sensors using the Ocean Information Model

Ref. [CSE14] Exploring Eclipse Dataspace Components framework for sovereign, inter-organizational data sharing

### *Power and Energy Systems*

Ref. [PES01] SuperPowers - Graphical interface for interacting with electrical network simulation software

Ref. [PES02] Study of Electrical Vehicles DC Off-board Chargers for Hybrid AC/DC Inputs

Ref. [PES03] Enhanced fault level (short-circuit current) assessment in smart grids

Ref. [PES04] A data-driven approach to forecasting electricity demand in highly electrified seaports

### *Robotics*

Ref. [ROB01] Development of a Low Cost Control Lab

Ref. [ROB02] A Redundant System for Real-Time Data Exchange

Ref. [ROB03] Robots in the Fields: Simulating Agricultural Robots in Farming Simulator

Ref. [ROB04] Human-Robot Interaction using Voice Control Commands

Ref. [ROB05] Tethered Drone for application in agriculture

### *Systems Engineering and Management*

Ref. [SEM01] Benchmarking Business Models in AI and Open Source

Ref. [SEM02] Tool for Responsible Innovation

Ref. [SEM03] Articulating institutional and political strategies: what is the role of science, technology and innovation entities in a mission-oriented approach?

Ref. [SEM04] The Exploitation Plan in European Research Programs – An exploratory study

# Artificial Intelligence

## Ref. [AI01]

### Overlay Information on Satellite Imagery

In this project, we want to combine different data sources (imagery metadata, mapping APIs) to extract information from a dataset of satellite images with the objective of overlaying information about the built infrastructure on the images.

[\[more info\]](#)

**Internship location:** [CTM] [HQ INESC TEC, Porto] **[Hybrid]** (2 days per week in-person)

**Supervisors:** Paula Viana, Nuno Pereira

## Ref. [AI02]

### Building Detection and Footprint Segmentation

Satellite imagery is a powerful source of information for urban development, mapping, and first responders, and we are working on extracting information from these images. In this project, we want to explore a dataset of satellite images and test different building segmentation approaches on it.

[\[more info\]](#)

**Internship location:** [CTM] [HQ INESC TEC, Porto] **[Hybrid]** (2 days per week in-person)

**Supervisors:** Nuno Pereira, Pedro Carvalho

## Ref. [AI03]

### Image processing for analyzing grocery labels

Handling food products is part of everyday life, but understanding the information present is not always easy, especially for people with less training or with low levels of literacy. In this internship, the aim is to develop modules that can run on a smartphone, identify, and extract information present in labels using visual data in images or video. The theme of this internship is part of the European Watson project that is being developed.

[\[more info\]](#)

**Internship location:** [CTM] [HQ INESC TEC, Porto] **[Hybrid]** (2 days per week in-person)

**Supervisors:** Pedro Carvalho, Christina Mastralexi

## Ref. [AI04]

### Making Sense of Ordinal Images Without Labels

The internship consists of training a neural network classifier without requiring labels, and it consists of two stages: (Stage 1) applying one (or more) self-supervised learning methods to learn a latent representation for the image; (Stage 2) using a clustering method, such as k-means, to project the images onto groups. A particular emphasis is given to ordinal images –

these are images where the predictive variable is discrete,  $Y \in \{C_1, C_2, \dots, C_k\}$  with a well-defined ranking,  $C_1 < C_2 < \dots < C_k$ . (...)

[\[more info\]](#)

**Internship location:** [CTM] [HQ INESC TEC, Porto] **[Hybrid]** (2 days per week in-person)

**Supervisor:** Ricardo Cruz

**Ref. [AI05]**

### **Creative Diffusion: Exploring Logo Design with Diffusion Models**

The main objective of this internship is to explore logo design using text-to-image and image-to-image generative models for the creation of Logos representative of research projects with VCMI participation. We aim to explore pre-trained implementations of diffusion models, possibly complementing the results with known image-processing techniques such as edge enhancement and smoothing to create stunning displays for the VCMI projects. For this work, the student will explore frameworks like Pytorch and Diffusers for hands-on experience on a Machine Learning application with a direct impact on the VCMI website.

[\[more info\]](#)

**Internship location:** [CTM] [HQ INESC TEC] **[Hybrid]** (2 days per week in-person)

**Supervisors:** Rafael M. Mamede, Pedro C. Neto, Ana F. Sequeira

**Ref. [AI06]**

### **Fine-Tuning of Large Language Models for Multi-modal Perception**

Explore the feasibility of using multimodal LLMs to analyze and interpret channel state information (CSI), incorporating additional data sources like images and point clouds.

[\[more info\]](#)

**Internship location:** [CTM] [HQ INESC TEC, Porto] **[Hybrid]** (1 day per week in-person)

**Supervisors:** Francisco Manuel Ribeiro, Luís Manuel Pessoa

**Ref. [AI07]**

### **Development of AI-Enabled UAV Inspection System for PV Plant Maintenance**

The primary goal of this project is to develop and implement AI modules with a sole focus on detecting anomalies in photovoltaic (PV) plants using visual data gathered by UAVs (Unmanned Aerial Vehicles). In particular, the project will concentrate on the following key areas: the project will involve the design and optimization of AI algorithms specifically tailored for detecting anomalies present in visual data captured by UAV-mounted cameras. This includes the implementation of cutting-edge machine learning and computer vision techniques to identify and classify various types of anomalies such as panel defects, soiling, shading, and hotspots. Efforts will be directed towards refining AI models to achieve high detection accuracy while simultaneously minimizing occurrences of false positives and false negatives. This will entail the incorporation of adaptive thresholding, feature extraction, and anomaly localization techniques to enhance the precision and reliability of anomaly detection.

**Internship location:** [CRAS] [INESC TEC - FEUP, Porto] **[In-person]**

**Supervisor:** Andry Maykol Pinto

**Ref. [AI08]**

### **Planning USV Navigation for Multiple Goals**

The work is focused on developing a robust framework within the Robot Operating System (ROS) to facilitate the planning of navigation behaviors for multiple Unmanned Surface Vehicles (USVs). This framework will enable efficient coordination and collaboration among USVs to achieve various mission objectives simultaneously. By leveraging ROS, the subproject aims to integrate advanced algorithms for path planning and task allocation, allowing USVs to navigate autonomously while optimizing for multiple goals. Through this initiative, the project seeks to enhance the efficiency, reliability, and adaptability of USV operations in offshore environments, ultimately contributing to the advancement of autonomous maritime systems.

**Internship location:** [CRAS] [INESC TEC - FEUP, Porto] **[In-person]**

**Supervisor:** Daniel Campos

**Ref. [AI09]**

### **ML image Identification in mobile devices**

"Running machine learning image classification on mobile devices is a rapidly growing field due to the increasing computational power of these devices and the convenience they offer. It allows for real-time processing and classification of images directly on the device, without the need to send data to a remote server. This not only reduces latency but also enhances privacy as sensitive image data does not leave the device. However, some challenges associated exists due to limited computational resources when compared to server or desktop computers. Therefore, machine learning models need to be optimized for mobile devices through specific techniques. Despite these challenges, the benefits of mobile-based image classification, such as increased accessibility, real-time processing, and enhanced privacy, make it a promising area of research and application. It is intended in this internship to identify and study techniques to optimize image classification on mobile devices and develop a demonstrator."

**Internship location:** [HumanISE] [HQ INESC TEC, Porto] **[Hybrid]**

**Supervisor:** Marco Amaro Oliveira

## **Bioengineering**

**Ref. [BIO01]**

### **Artificial Intelligence for Computed Tomography-Based Cardiovascular Disease Screening**

Cardiovascular diseases are the leading cause of death worldwide. Medical imaging plays a leading role in the detection of cardiovascular diseases and several biomarkers are known to be associated to higher cardiovascular risk and disease. This project aims to develop artificial intelligence tools that can interpret cardiovascular imaging, namely computed tomography images, to extract known (or hereto unknown) clinical biomarkers for cardiovascular risk prediction and diagnosis. This involves the segmentation/detection of structures, radiomic

feature extraction and/or end-to-end risk prediction. The specific focus of the internship will be defined depending on and in agreement with the applicants' interests and competences.

**Internship location:** [CBER] [INESC TEC - FEUP, Porto] **[Hybrid]**

**Supervisor:** João Pedrosa

**Ref. [BIO02]**

### **Nitrogen, Phosphorus and Potassium (NPK) Assessment in Hydroponic Samples**

Measurement of nutrients in agriculture is a critical aspect of proper crop production. In hydroponic systems, it plays an even more important role, as plants are entirely dependent on the nutrient feed provided, and their growth will reflect the degree of control of the system. In this internship, the intern will collect fertigation samples from an ongoing hydroponic setup and analyze them using various laboratory techniques to assess their NPK concentration.

**Internship location:** [CRIIS] [HQ INESC TEC, Porto] **[In-person]**

**Supervisors:** Rui Costa Martins, Filipe Monteiro-Silva

**Ref. [BIO03]**

### **Digital Twins in Hydroponics**

Digital Twins are virtual representations of physical objects, systems, or processes that exist alongside their physical counterparts. The purpose of Digital Twins is to simulate real-world behaviour based on real-time data, with a continuous data flow between the digital and physical domains. In this internship, the intern will focus on creating reliable and dependable Digital Twins for hydroponic entities, such as plants and crops.

**Internship location:** [CRIIS] [HQ INESC TEC, Porto] **[Hybrid]**

**Supervisors:** Rui Costa Martins, Filipe Monteiro-Silva

**Ref. [BIO04]**

### **Systems Biology in Hydroponics**

"Systems Biology is a field of study that investigates the interactions and behaviours of individual components within larger biological systems. This approach is essential as the actions of a single entity can often lead to a chain of events that would not occur in its absence. During this internship, the intern will work on developing a Systems Biology model for a chemical network within a hydroponic system. This involves creating a high-resolution, holistic view of the hydroponic chemical networks that are established when a crop is fertilized using a predetermined fertilizer solution."

**Internship location:** [CRIIS] [HQ INESC TEC, Porto] **[Hybrid]**

**Supervisors:** Rui Costa Martins, Filipe Monteiro-Silva

## **Ref. [BIO05]**

### **Biophotonics**

The application of optical technologies in clinical practice has been growing in the past 30 years. In the present day there are various diagnostic, treatment or surgical methods that use light. The Biophotonics research is a worldwide reality nowadays and with strong growth, producing new applications with the combination of temporary transparency effects in tissues, or with artificial intelligence methods to produce reliable diagnosis. With this summer internship, it is our objective to describe the Biophotonics research that is being done at INESC TEC and stimulate the interest of graduation and master students for this field of research.

**Internship location:** [CTM] [INESC TEC, Porto] **[In-person]**

**Supervisor:** Luís Manuel Couto Oliveira

## **Communications**

## **Ref. [COM01]**

### **Automated Drone Positioning through an LLM-based Interface in Flying Networks of the Future**

The networks of the future, namely 6G Networks and the future Wi-Fi generations, are being designed to allow ever-increasing data rates and low latency requirements, as well as high reliability for a large number of connected devices. The main objective of this summer internship is to develop a framework that takes advantage of LLMs to automate the positioning of drones in flying networks. This work will benefit from an existing Application Programming Interface (API) to control the positioning of drones and an LLM-based interface previously created.

[\[more info\]](#)

**Internship location:** [CTM] [INESC TEC] **[Hybrid]** (2 days per week in-person)

**Supervisors:** Pedro Ribeiro, André Coelho, Rui Campos

## **Ref. [COM02]**

### **Performance Evaluation of Semantic Underwater Wireless Communications**

Semantic communications are an emerging paradigm that operate on the principle of “semantic-meaning passing”. At its essence, semantic communications involve extracting the inherent “meanings” embedded within transmitted information at the sender’s end. By leveraging a compatible knowledge base (KB) shared between the sender and the receiver, semantic information can be effectively “interpreted” at the receiver’s end. Thus, semantic communications can be a good addition to a underwater communications solution, for instance, running on the top of an acoustic or a radio channel, delivering information to the receiver when high data rate solutions are unavailable. This summer internship aims to evaluate the performance of semantics in an underwater wireless network, validating an existing algorithm through experimental tests.

[\[more info\]](#)



**Internship location:** [CTM] [INESC TEC] [**Hybrid**] (3 days per week in-person)

**Supervisors:** João P. Loureiro, Filipe B. Teixeira, Rui Campos

### **Ref. [COM03]**

#### **Obstacle-aware vision-based Positioning Algorithm for a Simple Scenario**

(Note: this topic requires English proficiency).

In this internship, we'll be tackling this challenge head-on by providing Line of Sight (LoS) to users through the use of UAVs. In the first phase of this work, we detect the position of the users by capturing photos or videos from the venue automatically. These photos or are captured by a camera installed on the UAV. Then coordinates information of user equipment are extracted using vision tools and utilized for the positioning approach. The performance of the proposed solution is evaluated using Network Simulator 3 (ns-3). With this positioning algorithm, we aim to provide wireless connectivity to all users, even in the most challenging scenarios. Together, we will be helping to ensure that people stay connected when it matters most.

[\[more info\]](#)

**Internship location:** [CTM] [INESC TEC] [**Hybrid**] (2 days per week in-person)

**Supervisor:** Kamran Shafafi

### **Ref. [COM04]**

#### **Starlink Performance Evaluation**

This internship is part of the OVERWATCH project, which addresses the development of a backup communications solution for emergency scenarios, complementary to existing communications infrastructure, and capable of supporting the operation of systems and emergency teams in case of failure of the primary communications due to malfunction, overload, or lack of network coverage in a given location. This communications solution is based on a Tethered Drone, consisting of aerial and terrestrial components, interconnected by an energy cable and optical fiber. (...) Since this technology is very recent and Starlink's infrastructure is constantly evolving, it will be important to characterize in detail the performance of this backhaul connection to understand the impact it can have on the quality of service (QoS) offered by the Tethered Drone. This work appears precisely in this context, having as main objective the evolution of a framework for the periodic evaluation of the network performance, which allows the statistical characterization of the connection based on different performance metrics such as bidirectional throughput, delay, and jitter.

[\[more info\]](#)

**Internship location:** [CTM] [INESC TEC] [**Hybrid**]

**Supervisors:** Helder Martins Fontes, Rúben Queirós, Rui Lopes Campos

### **Ref. [COM05]**

#### **Comparative study of antenna characterisation systems from 30 to 300 GHz**

6G brought the trend towards higher operating frequencies from millimeter waves up to the sub-THz, for both wireless communications and sensing applications, which recent research projects are currently addressing. In this context, it is important to be able to characterise

radiating systems such as antennas and antenna arrays (such as reconfigurable intelligent surfaces) operating in this frequency band. There are different types of measurement systems such as standard far-field, compact test range in the far-field, spherical, cylindric and planar near-field.

[\[more info\]](#)

**Internship location:** [CTM] [INESC TEC] [Hybrid]

**Supervisor:** Luis Pessoa

**Ref. [COM06]**

### **Sensing through NFC-enabled smartphone**

There has been recent progress in the field of battery-less NFC-enabled sensors, namely low cost commercially available NFC integrated circuits (ICs) that are compatible with standard smartphones (e.g. Silicon Craft SIC4340). Therefore, a simple battery-less tag can be transformed into a sensor that can be read through a smartphone, which in turn can be used as reader and at the same time as a potential interface to the cloud.

[\[more info\]](#)

**Internship location:** [CTM] [INESC TEC] [Hybrid]

**Supervisors:** Cândido Duarte, Luis Pessoa

## **Computer Science and Engineering**

**Ref. [CSE01]**

### **Visual Mapping of Source Code to Abstract Syntax Tree (AST)**

Clava is a source-to-source compiler, developed in the SPeCS group, which allows you to write analyses and transformations of C/C++ code using TypeScript. Underneath, it uses an Abstract Syntax Tree (AST) as a representation of the code. Currently we have the capability of displaying, as text, the current AST and the corresponding code, however beginners might have difficulty mapping one to another. The aim of this work is to enable side-by-side visualization of the AST and corresponding source code in an efficient way. You will work in a Node.js environment and produce a web interface that enables this visualization, so that when the a hovers over an AST node in the web interface, the corresponding code should be highlighted and vice-versa.

**Internship location:** [HumanISE] [INESC TEC-FEUP, Porto] [Hybrid]

**Supervisor:** João Bispo

**Ref. [CSE02]**

### **Recording the History of Source-to-Source Transformations**

Clava is a source-to-source compiler, developed in the SPeCS group, which allows you to write analyses and transformations of C/C++ code using TypeScript. Underneath, it uses an Abstract Syntax Tree (AST) as a representation of the code. When applying transformations to the

source code, it might not be immediately evident which part of the transformation script is responsible for what modifications in the source code. Also, if a transformation pass fails, the whole compilation process fails. The aim of this work is to record what part of the script changed what parts of the source code and enable rollbacks when exceptions are thrown.

**Internship location:** [HumanISE] [INESC TEC-FEUP, Porto] **[Hybrid]**

**Supervisor:** João Bispo

**Ref. [CSE03]**

### **MISRA-C Analyzer and Converter**

MISRA-C is a set of rules for developing C code that promote security, portability and reliability, particularly when developing embedded systems. It is a standard widely used in certain industry segments, such as the automotive industry. Clava is a source-to-source compiler, developed in the SPeCS group, which allows you to write analyses and transformations of C/C++ code using TypeScript. The aim of this work is to study the feasibility of implementing analyses using the Clava tool that check whether a given piece of C code follows the rules defined by the MISRA-C standard. It will be necessary to choose some rules from the standard and try to implement them as Clava analyzes in TypeScript. Additionally, we can also study the possibility of automatically modifying the code in certain situations so that the code respects the MISRA-C standard.

**Internship location:** [HumanISE] [INESC TEC\_FEUP, Porto] **[Hybrid]**

**Supervisor:** João Bispo

**Ref. [CSE04]**

### **Towards a citizen science data curation workflow with (implicit) Human Computation**

Citizen science has been a popular approach to engage the participation of citizens, non-experts, in scientific research. The popularity and success of citizen science is reflected in the growing number of projects. Moreover, citizen science is playing an important role in providing an equitable access to scientific data and information. One of the major contributions of citizen science is open research data that is made available to the scientific community. Raw citizens data contributions need to be curated making sure that the data is of high quality, accurate, and useful. Data curation is a core process in the citizen science projects and ensure their success. The resources required for the process also constrain the success and continuity of citizen science projects, as financial sustainability is not commonly ensured. Moreover, data curation of citizen science data restricts the open access of the data, constraining research activities. Access to curated research data associated with implicit work mechanisms could be a motivation factor for the engagement of experts in crowd validation processes. Expert crowds using a group of experts to collect, organize, and analyze scientific data will be recruited to ensure the data curation and an implicit work mechanism will be integrated to ensure the continuity of the project. To demonstrate the concept, a prototype will be implemented, allowing experts to access to specific data by passing through a set of implicit work tasks, following the same model already implemented by reCAPTCHA. The demonstrator will use the jellyfish recognition use case, allowing the access to curated jellyfish datasets to the researchers after passing through a set of jellyfish recognition and validation. In the scope of the GelAvista project, we have access to a repository of curated data with more than 10,000 sighting records of gelatinous species that include images and metadata of the sightings. In the

past these data were used to train a neural network to be used in species identification through Machine Learning techniques. The objective of this project is to develop a tool for expert crowds that to categorise gelatinous images to be used in AI learning processes.

**Internship location:** [HumanISE] [INESC TEC, Porto ou INESC TEC-UTAD, Vila Real **[to be decided]**]

**Supervisor:** Hugo Paredes

### **Ref. [CSE05]**

#### **WebTraceSense: A platform for visualising interaction data from web games**

Currently there is a significant increase in the creation of web games, which emphasises the importance of taking players' individual preferences into account. An innovative approach to improving these games involves analysing the interaction data recorded by browsers, such as the number of mouse clicks and keystrokes. This data provides valuable insight into user behaviour, enabling effective personalisation of games. The WebTraceSense project proposes building a web platform to help customise the visualisation of interaction data from games.

**Internship location:** [HumanISE] [INESC TEC, Porto or INESC TEC-UTAD, Vila Real **[To be decided]**]

**Supervisor:** Hugo Paredes

### **Ref. [CSE06]**

#### **Blue energy XR Immersive dashboard visualization tool**

Blue renewable energy sources such as offshore (floating) wind, floating solar (FPV), waves, tides and currents have a high and still unused potential to be explored. The proposed Blue Energy Offshore Installation Accelerator (BLUE-X) European project will contribute to the Green Deal objectives and its related policies, in particular with regard to increasing the EU's climate ambition for 2030 and 2050. BLUE-X is an innovative Copernicus based solution for optimising and accelerating decision making for blue renewable energy projects in all phases, from planning to construction, operation and decommissioning. Under the scope of this project we are developing an eXtendend Reality (XR) platform, using the Oculus Vive 3, from meta company, to create an immersive dashboard visualization tool, using virtual choreographies approach, to support the decision-making process as well as monitoring the production workflow. Virtual choreographies are "sets of behaviors, interactions, and associated events that occur in a given time and space, with well-defined objectives and rules". This type of approach can be used to represent and analyse various phenomena, such as learning activities, office users' behaviors, and immersive authoring scenarios. Virtual choreographies can also be applied to different domains, such as education, energy and industry.

**Internship location:** [HumanISE] [HQ INESC TEC, Porto] **Remote** (except minimum attendance)

**Supervisor:** Fernando Cassola Marques

**Ref. [CSE07]****From netcdf to virtual choreography**

This proposal occurs under the scope of the ILIAD Project. That is an EU-funded research project that aims to create an interoperable, data-intensive, and cost-effective Digital Twin of the Ocean, which is a virtual representation of the ocean that can simulate and predict its behaviour and interactions. The purpose of creating a Digital Twin of the Ocean is to provide a comprehensive and accurate representation of the ocean's past, present, and future states, and to enable various applications and scenarios that can benefit from ocean knowledge. Under this project we are actually developing an immersive environment to represent ocean scenarios. Although we are developing a new interoperable approach to represent and visualize ocean data, such as oil spill use cases. As you imagine there are several challenges that emerge from that new interoperable approach. One of them is how can we use netCDF files and convert them to virtual choreographies files that can be used on the immersive platform. Virtual choreographies are "sets of behaviors, interactions, and associated events that occur in a given time and space, with well-defined objectives and rules". This type of approach can be used to represent and analyse various phenomena, such as learning activities, office users' behaviors, and immersive authoring scenarios. Virtual choreographies can also be applied to different domains, such as education, energy and industry.

**Internship location:** [HumanISE] [HQ INESC TEC, Porto] **Remote** (except minimum attendance)

**Supervisor:** Fernando Cassola Marques

**Ref. [CSE08]****From Virtual Choreographies Bathymetry to 3D model**

This proposal occurs under the scope of the ILIAD Project. That is an EU-funded research project that aims to create an interoperable, data-intensive, and cost-effective Digital Twin of the Ocean, which is a virtual representation of the ocean that can simulate and predict its behaviour and interactions. The purpose of creating a Digital Twin of the Ocean is to provide a comprehensive and accurate representation of the ocean's past, present, and future states, and to enable various applications and scenarios that can benefit from ocean knowledge. Under this project we are actually developing an immersive environment to represent ocean scenarios. Although we are developing a new interoperable approach to represent and visualize ocean data, such as oil spill use cases. As you imagine there are several challenges that emerge from that new interoperable approach. One of them is how can we insert the ocean bathymetry data of a certain georeferenced location on the 3D immersive platform, using the virtual choreographies method. Virtual choreographies are "sets of behaviors, interactions, and associated events that occur in a given time and space, with well-defined objectives and rules". This type of approach can be used to represent and analyse various phenomena, such as learning activities, office users' behaviors, and immersive authoring scenarios. Virtual choreographies can also be applied to different domains, such as education, energy and industry.

**Internship location:** [HumanISE] [HQ INESC TEC, Porto] **Remote** (except minimum attendance)

**Supervisor:** Fernando Cassola Marques

### **Ref. [CSE09]**

#### **From behaviors to Dashboards**

In this project we pretend to use the virtual choreographies approach to produce meaningful information in order to show them in dashboards. So, this project pretends to gather the following goals: (1) Transform the data collected on the learning platforms (moodle), into virtual choreographies, to support decision-making with certain rules/policies. (2) Monitor student performance in the classroom and in the field for correlation, (3) Show in a dashboard the most relevant behaviors.

**Internship location:** [HumanISE] [HQ INESC TEC, Porto] **Remote** (except minimum attendance)

**Supervisor:** Fernando Cassola Marques

### **Ref. [CSE10]**

#### **VR Training a simple immersive tool**

INESC TEC 's VRTrainingIndustry 4.0 project is an innovative combination of Digital Twin and Virtual Reality (VR). It aims to provide high-quality immersive training in a safe, controlled, repeatable and accessible way. Here are the details of the scientific internship project proposal. Overview:The project proposes an immersive VR authoring tool for trainers to create engaging courses.Trainers can structure training scenarios in virtual environments, such as industrial machines, and add descriptive information.The aim is to create a training system based on virtual choreographies.

**Internship location:** [HumanISE] [HQ INESC TEC, Porto] **Remote** (except minimum attendance)

**Supervisor:** Fernando Cassola Marques

### **Ref. [CSE11]**

#### **Exploring Virtual Choreographies in Extended Reality Environments**

Virtual choreographies combine elements of movement, interaction, and narrative in extended reality (XR) environments. This scientific internship project aims to explore how virtual choreographies can be applied to improve the user experience in immersive environments for training platforms used to generate blue energy.

Objectives:

1. Research and Analysis:

- Investigate the definitions and applications of virtual choreographies in XR.
- Analyze how choreographies can guide users within virtual scenarios.

2. Prototype Development:

- Create an XR application prototype that utilizes virtual choreographies.
- Implement intuitive interactions based on movement, gestures, and choreographed narratives.

Expected Outcomes:

- A functional XR application demonstrating effective use of virtual choreographies.
- Insights into how choreographies can enhance immersion and user understanding in XR environments.

**Internship location:** [HumanISE] [HQ INESC TEC, Porto] **Remote** (except minimum attendance)

**Supervisor:** Fernando Cassola Marques

**Ref. [CSE12]**

### **Web Visual Editor for Scientific Workflows**

A Web Visual Editor Scientific workflows is a tool that allows scientists and researchers to create, manage, and execute complex scientific workflows in a visual, user-friendly environment. A editor provides a graphical interface for designing workflows, making it easier to understand and modify its structure. Users can drag and drop different tools, represented as nodes, and connect them to define the sequence of operations. Each node represents a step in the workflow, which could be a data processing task, a machine learning model, a data visualization task, or any other computational task. The Common Workflow Language (CWL) is a specification for describing analysis workflows in a way that makes them portable and scalable across a variety of software and hardware environments, from workstations to cluster, cloud, and high-performance computing (HPC) environments. It is intended in this internship to study the Common Workflow Language and develop a Web Visual Editor capable of helping to generate CWL workflows

**Internship location:** [HumanISE] [HQ INESC TEC, Porto] **[Hybrid]**

**Supervisor:** Marco Amaro Oliveira

**Ref. [CSE13]**

### **Data harmonization for drifting sensors using the Ocean Information Model**

Data harmonization is a critical process in oceanography and marine science. Drifting sensors collect a wealth of data from the ocean's surface and subsurface, leading to spatial and temporal variability in the data they collect. Data harmonization involves adjusting this data to account for the drift and ensure that the data from different sensors, times, and locations can be accurately compared and integrated. The Ocean Information Model (OIM) plays a crucial role in this process. The OIM is a comprehensive framework for representing and managing oceanographic data. It provides a standardized structure and semantics for ocean data, facilitating data integration, sharing, and interoperability. By using the OIM, data from drifting sensors can be harmonized into a consistent format, making it easier to analyze and interpret. This not only enhances the accuracy and reliability of oceanographic studies but also promotes collaboration and data reuse among researchers. It is intended in this internship to study the Ocean Information Model and propose and develop a demonstrator for harmonizing drifter observed data.

**Internship location:** [HumanISE] [HQ INESC TEC, Porto] **[Hybrid]**

**Supervisor:** Marco Amaro Oliveira

**Ref. [CSE14]**

### **Exploring Eclipse Dataspace Components framework for sovereign, inter-organizational data sharing**

The Eclipse Dataspace Components (EDC) is a framework that enables sovereign, inter-organizational data sharing. It is designed to facilitate the secure and controlled exchange of data between different organizations while respecting data sovereignty principles. The EDC provides a set of core capabilities, including data transfer, policy enforcement, and identity management, which can be extended and customized to meet specific use cases. It supports various protocols and standards for data exchange, making it a versatile tool for building data spaces. Exploring the EDC framework opens up new possibilities for inter-organizational data sharing. It allows organizations to create a shared data space where data can be exchanged in a controlled manner, with clear rules and policies governing who can access the data and how it can be used. This ensures that data sovereignty is maintained, with data owners retaining control over their data. Furthermore, the EDC framework is designed to be flexible and extensible, allowing it to be adapted to a wide range of scenarios and requirements. This makes it a powerful tool for enabling data sharing and collaboration between organizations, while ensuring data protection and privacy. It is intended in this internship to study the EDC and its Connectors, and develop a demonstrator for a dataspace.

**Internship location:** [HumanISE] [HQ INESC TEC, Porto] [Hybrid]

**Supervisor:** Marco Amaro Oliveira

## Power and Energy Systems

**Ref. [PES01]**

### **SuperPowers - Graphical interface for interacting with electrical network simulation software**

The Center for Power and Energy Systems of INESC TEC has algorithms (C/C++) for simulating electrical networks, resulting from collaborations with industrial partners. A new graphical interface, inspired by software such as "PowerWorld Simulator" and "DigSILENT Power Factory," has been created with Qt (C++) aiming to facilitate interaction with these algorithms. The internship\*\* involves integrating improvements in user experience, adding format conversion functionalities for compatibility with other software, and integrating existing algorithms. Three students can be accepted!

**Internship location:** [CPES] [HQ INESC TEC, Porto] [Hybrid]

**Supervisor:** Gil Sampaio

**Ref. [PES02]**

### **Study of Electrical Vehicles DC Off-board Chargers for Hybrid AC/DC Inputs**

The sales of electric vehicles (EVs) are growing from year to year, and EV off-board chargers play a significant role in keeping the vehicles on the road. Therefore, the laboratory of SGEVL is working on standards to ensure compliance in the charging process. During this summer internship, the student will conduct a theoretical study of EV DC off-board chargers available in the market, focusing on their communication standards (such as IEC61851-1, ISO15118, OCPP) and power flow standards (IEC61851-22 and IEC61851-23). Additionally, while conventional chargers are typically powered by AC networks, there has been increasing research on DC networks in recent years, particularly as photovoltaic panels and batteries



operate on DC voltage. Consequently, the study will place greater emphasis on hybrid inputs, enabling chargers to interact with both AC and DC networks.

**Internship location:** [CPES] [HQ INESC TEC, Porto] **[To be decided]**

**Supervisor:** José Pedro Martins da Silva

**Ref. [PES03]**

### **Enhanced fault level (short-circuit current) assessment in smart grids**

Typical strengths, short-circuit fault levels and network supply impedances will be analysed for the study of quality of supply in medium-to-low voltage distribution systems. Considering the disparity in distribution network design, this study will be based on a comprehensive database containing typical arrangements and equipment in EU systems, as well as on fully documented generic network models (both in PSS/E and Simulink) supplying different load subsectors, i.e. from metropolitan to rural areas. The objective is to assess the gradient of fault level variation according to diverse feeder structures, as well as to identify alternative methods for determining the dependency in time of (short-circuit) fault levels to electricity demand.

**Internship location:** [CPES] [HQ INESC TEC, Porto] **[Hybrid]**

**Supervisor:** Ignacio Hernando Gil

**Ref. [PES04]**

### **A data-driven approach to forecasting electricity demand in highly electrified seaports**

Currently, seaports are experiencing an unprecedented energy transition, shifting away from direct use of fossil fuels and undergoing major electrification processes. In this new scenario, one of the main concerns is to be able to accurately forecast ports' electricity demand. The objective of the internship is to research feasible data-driven approaches for forecasting electricity demand in those ports where historical data is available. To fully accomplish this objective, several steps will be needed: developing an efficient data collection and storage system, energy consumption breakdown and statistical analysis, implementation of a data-driven approach to forecast electricity demand and final validation. All these tasks should be accomplished by the student during the internship, by using a high-level open-source programming language.

**Internship location:** [CPES] [HQ INESC TEC, Porto] **[Hybrid]**

**Supervisor:** Adrian Galvez

## **Robotics**

**Ref. [ROB01]**

### **Development of a Low Cost Control Lab**

The intention is to develop a low-cost control laboratory based on the Arduino platform in communication with Octave/Matlab or Python. The objective of this laboratory is to

demonstrate practical concepts of modeling and control using materials that allow students to conduct experiments at home. A RC circuit will be used as a benchmark. Experiments will be conducted to observe the response of this system to step and ramp inputs, and to see the effects of PWM and staircase approximations. Additionally, controllers aiming to mimic real control systems will be implemented. The controllers to be implemented will be proportional (P), proportional integral (PI), proportional derivative (PD), and proportional integral derivative (PID). Experiments will be designed to observe the performance of these controllers in reference tracking and disturbance rejection. The developed platform will serve as training for CRAS researchers in the field of control systems. It may also be used to collect data for testing estimation algorithms.

**Internship location:** [CRAS] [INESC TEC-FEUP, Porto] **[In-person]**

**Supervisor:** Paulo Lopes dos Santos

### **Ref. [ROB02]**

#### **A Redundant System for Real-Time Data Exchange**

This study proposes creating a backup communication system for gathering real-time data from autonomous surface vehicles (ASV) and autonomous underwater vehicles (AUV). It combines GPS with three extra communication tools—Wi-Fi, LoRa, and Iridium—to ensure a reliable link, even over distances over 5 kilometers. The main goal is to develop code, preferably in Python or C++, on a Raspberry Pi or similar single-board computer (SBC) to manage communication between the SBC and the peripheral devices. This means choosing the best communication method at any given time for stable and fast data transfer. While the hardware is already sorted, the internship focuses on software development. Students will gain practical experience in SBC programming, working with peripheral devices, and writing code for real-world applications. They'll also get to apply their academic knowledge to solve practical problems and test solutions with actual robots. Mentorship and examples will be provided to support a blended learning approach.

**Internship location:** [CRAS] [INESC TEC-FEUP, Porto] **[Hybrid]**

**Supervisor:** André Filipe Sousa Pinto

### **Ref. [ROB03]**

#### **Robots in the Fields: Simulating Agricultural Robots in Farming Simulator**

The internship aims to explore the integration of existing agricultural robotics into the virtual landscape of Farming Simulator. Through this integration, the focus is on creating a realistic portrayal of modern farming practices augmented by robotic technologies. By bridging the gap between virtual simulation and real-world agricultural automation, the project seeks to offer insights into the potential benefits and challenges of deploying robotic solutions in farming practices.

**Internship location:** [CRIIS] [INESC TEC-FEUP, Porto] **[Hybrid]**

**Supervisor:** Luís Santos

**Ref. [ROB04]****Human-Robot Interaction using Voice Control Commands**

The internship aims to initiate research and development of voice control commands to actuate agricultural robots developed at the TRIBE Laboratory of the INESC TEC. The main goal is to test voice interpreter systems to be deployed in the robotic platforms and interconnected with the robots' supervision systems.

**Internship location:** [CRIIS] [HQ INESC TEC, Porto] [Hybrid]

**Supervisor:** André Silva Aguiar

**Ref. [ROB05]****Tethered Drone for application in agriculture**

Aerial perspectives in agriculture are essential not only for identifying key crop zones but also for detecting areas that are invisible to ground-based robots. This project aims to develop a tethered drone that will operate in conjunction with a ground vehicle, focusing on its design and the integration of control systems. This dual-system approach will enhance precision in agricultural operations, providing a comprehensive monitoring solution that improves crop management and yields.

**Internship location:** [CRIIS] [INESC TEC-FEUP, Porto] [In-person]

**Supervisor:** Filipe Neves dos Santos

## Systems Engineering and Management

**Ref. [SEM01]****Benchmarking Business Models in AI and Open Source**

(Research fields: Business Models; Technology Management; Strategy; Artificial Intelligence)

The primary objective of this internship is to conduct a comprehensive benchmarking study to identify patterns of business models, including business models adopted by organisations involved in open-source software development, in the field of Artificial Intelligence (AI). Tasks:

- (1) Conduct a thorough literature review on existing business models in AI and open source.
- (2) Identify key features and patterns that contribute to the success of these business models.
- (3) Prepare a detailed report presenting the findings and insights from the benchmarking study.

At the end of this internship, the intern is expected to deliver a comprehensive report detailing the patterns of business models in AI and open source.

**Internship location:** [CITE] [HQ INESC TEC, Porto] [Hybrid]

**Supervisor:** Sara Neves

**Ref. [SEM02]****Tool for Responsible Innovation**

This project aims to develop a mobile application for Android and iOS operating systems to help identify and map responsible innovation practices. The application will allow each organization to assess its responsible innovation practices by answering a multidimensional

questionnaire. The application should, in a second phase, also act as a decision support system by indicating areas for improvement in responsible innovation practices using the history of assessments carried out and artificial intelligence models that gather information on the best scientific practices in the field.

**Internship location:** [CITE] [HQ INESC TEC, Porto] **[Hybrid]**

**Supervisor:** Cristina Machado Guimarães

**Ref. [SEM03]**

**Articulating institutional and political strategies: what is the role of science, technology and innovation entities in a mission-oriented approach?**

(Key Interest Areas: Public Policy, Governance, Economy, Management). Different science, technology, and innovation (STI) institutions worldwide have been dealing with how they should act to address the technical and institutional complexity of reaching grand market, societal, and environmental objectives and challenges. Face these challenges jointly raises concerns from STI policy and economy to combine technological, organisational and institutional advances to drive and enable transformations of sociotechnical systems. General objectives: the investigation of the role of innovation entities in designing, coordinating, and developing capabilities in the mission-oriented context and; the development of a methodological framework for innovation entities from co-creating strategies and co-building measures. Outcome: a framework to support the framing and study ties between innovation entities, policy strategies, entrepreneurial and research projects, and funding opportunities to respond to a grand challenge, especially in Portugal.

**Internship location:** [CITE] [HQ INESC TEC, Porto] **[Hybrid]**

**Supervisor:** Manuel Victor Matos

**Ref. [SEM04]**

**The Exploitation Plan in European Research Programs – An exploratory study**

European research programs are increasingly prioritizing the application of their research results to tackle societal challenges, inform policymaking, and drive commercial endeavours. Therefore, exploitation plans have become mandatory for research projects in these programs. The proposal aims to gather, systematize, and evaluate publicly available exploitation plans from current and recent European programs, such as Horizon Europe, to identify the best practices in their design. By participating in this internship, undergraduate students will gain practical experience in research assessment and technology management and provide valuable insights to enhance the impact of future research projects.

**Internship location:** [CITE] [HQ INESC TEC, Porto] **[Hybrid]**

**Supervisor:** Alípio Torre