# PhD Position in Information and Communication Technologies Group (VAC-2021-25)

**Title of the PhD project:** Artificial intelligence tools to recognizing frequentation in natural spaces.



## INTRODUCTION:

The International Centre for Numerical Methods in Engineering (CIMNE, www.cimne.com) is a research centre, created in 1987 by consortium between the Catalan Government and the Universitat Politècnica de Catalunya (UPC-BarcelonaTech), devoted to the development and application of numerical methods to a wide range of areas in engineering. CIMNE has been selected as a Severo Ochoa Centre of Excellence for the period 2019-2023, the highest level of recognition of excellence and leadership awarded to a research centre in Spain.

## POSITION DETAILS

**Number of vacancies:** 1
**Category:** PhD (PHD2)
**Location:** Barcelona
**Yearly salary (gross):** 17.563,14 EUR
**Working hours:** Full time
**Duration:** 3 years
**Starting date:** No later than Sept 2021

## FUNCTIONS TO BE DEVELOPED BY THE APPLICANT

CIMNE is looking for a **PhD Researcher** to be part of the Research and Technical Development (RTD) Group on Information and Communication Technologies.

The functions assigned to the candidate will be:

- Complete a PhD in Artificial Intelligence at Universitat Politècnica de Catalunya – Barcelona Tech. The candidate is expected to complete the PhD thesis in a maximum of three years.
- Collaborate with various research groups within CIMNE and worldwide.
- To publish a minimum of two papers in JCR journals during the PhD period, author and co-author articles in high-impact international journals
- Carry out quality research, training and management.
- Participate on the dissemination and outreach activities associated with the project

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- Participate in international conferences presenting her/his work

## DESCRIPTION OF THE PDH PROJECT:

**Motivation**: The main objective of the PhD work is the research and development of a tool to improve knowledge about frequentation in natural spaces.

The Ph.D. work will focus on the development of two systems: (a) a system for recognizing frequentation in natural spaces with artificial intelligence (AI) and Deep Learning (DL) that allows the monitoring and registration of the frequentation based on images, sound records and IoT devices and (b) an early warning system, embedded in the same IoT devices, that allows two-way communication between users and managing body, using the mobile screen as the screen that any citizen carries in their pocket, but without having to download any phone application. This early warning system must include a Machine Learning (ML) tools to, depending on the environmental variables and pre-existing frequentation, modify the message of the communications to the users.

This Ph.D. work will be based on concepts gained from previous CIMNE frameworks developed in the framework of Hamelin project, and include software developed in IDL and compilation of varied data sources in a single GIS, computational models' repository.

**Expected outcomes are the following:**

(a) The development of a system for the recognition of frequentation in natural spaces based on artificial intelligence (AI) tools. The purpose of this objective is to quantify the frequentation (people and vehicles) through AI tools applied in-camera records, sound records of the natural environment, and through the use and interaction of people with the deployment of IoT devices.

(b) The development of an early warning and decision-making system based on machine learning (ML) tools for the analysis of information on the frequented route. The purpose of this objective is to provide useful information on the natural environment and possible effects on the user and to facilitate efficient decision-making in real-time in environmental management by the managing bodies responsible for the protection of natural environments.

**Others applications:**

Other possible areas of application of the technology developed could be the protection of the terrestrial and marine environment, the sustainable management of the territory, and in particular of natural resources, the maintenance of biodiversity and ecosystems, the sustainable management of agriculture, aquaculture, livestock, forest resources, integrated water management and technologies aimed at the efficiency of use in irrigation, rural, urban and industrial environments, the fight against desertification, the management of forest fires or the study of erosion .

**References**

J. C. S. Jacques, Jr., S. R. Musse, and C. R. Jung, "Crowd analysis using computer vision techniques," IEEE Signal Process. Mag., vol. 27, no. 5, pp. 66–77, Sep. 2010.

Arnau P., Oñate E., Jiménez J. and Piazzese J., Development and application of decision support systems for environmental monitoring, MAMERN11: 4th Int. Conf. on Approximation Methods and Numerical Modelling in Environment and Natural Resources, Saidia, Morocco, May 23-26, 2011

A. Guillén-Pérez and M. D. C. Baños, "A wifi-based method to count and locate pedestrians in urban traffic scenarios," in 2018 14th International Conference on Wireless and Mobile Computing, Networking and Communications (WiMob). IEEE, 2018, pp. 123–130.

## REQUIREMENTS

1. A bachelor and MSc degree (or equivalent) in ICT (Telecommunication/Computer engineering preferred), Mathematics, Civil Engineering, Geotechnics/Geographical, Physics/Geo, Earth Sciences (Biology, Sea scientist or similar) or any other science/engineering field.
2. Advanced knowledge of Programming and Software design (master level).
3. Solid knowledge of ML, DL and Computer Vision (CV) theory.
4. Proficiency using Python and DL frameworks such as PyTorch or TensorFlow.
5. High working knowledge of English and Catalan/Castilian (Minimum B2).

## EVALUATION OF CANDIDATES

The requirements and merits will be evaluated with a maximum mark of 100 points. Such maximum mark will be obtained by adding up the points obtained in the following items:

- Academic record (60%)
- Previous research and academic experience in the field of the position (20%)
- Programming skills (10%)
- Language skills (10%)

## HOW TO APPLY

Candidates must complete the "Application Form" form on our website, indicating the reference of the vacancy and attaching the following documents **in English**:

- Curriculum vitae
- A motivation letter
- Academic transcripts from all Undergraduate and MSc degrees
- Name and institutional contact information of two possible referees

The deadline for registration to the offer ends on 31st May, 2021 at 12 noon.

The shortlisted candidates may be called for an interview. They may also be required to provide further supporting documentation.

***CIMNE is an equal opportunity employer committed to diversity and inclusion. We are pleased to consider all qualified applicants for employment without regard to race, colour, religion, sex, sexual orientation, gender identity, national origin, age, disability or any other basis protected by applicable state or local law. CIMNE has been awarded the HRS4R label.***



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