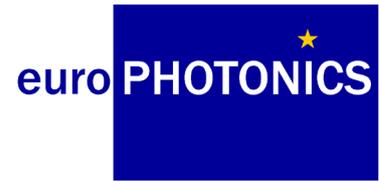




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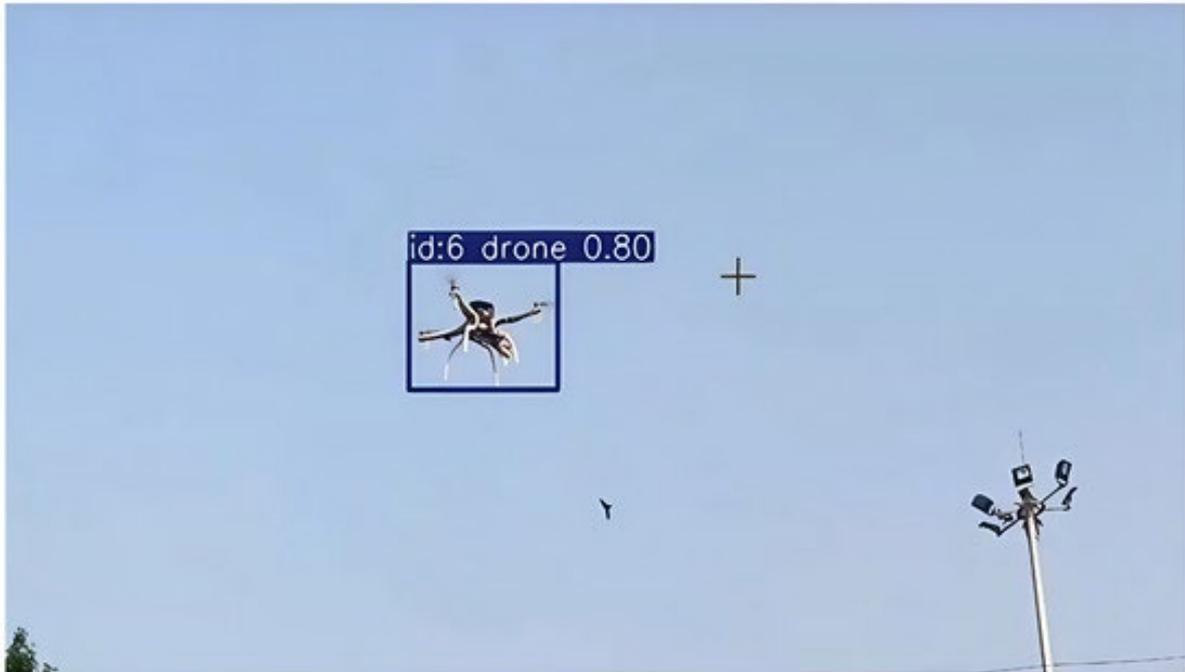
## **PHOTONICS - EUROPHOTONICS MASTER COURSE** **PROPOSAL FOR A MASTER THESIS**

**Dates: February 1<sup>st</sup>, 2026 – September 30<sup>th</sup>, 2026**

**Laboratory: Centre for Sensors, Instrumentation and systems Development (UPC-CD6)**  
**City, Country: Terrassa, Spain**

**Title of the master thesis:**

**IMAGING-BASED DRONE DETECTION USING DEEP LEARNING**



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## Summary of the subject (maximum 1 page):

The increasing availability of low-cost drones, has created new challenges in critical infrastructure protection, airspace safety, and surveillance. Reliable drone detection and identification systems are therefore becoming essential in both civil and industrial contexts. Among the different sensing technologies, vision-based detection using Artificial Intelligence has emerged as a flexible solution, especially when combined with real-time object detection networks.

This master's thesis will focus on the development of an AI-based drone detection and identification system using state-of-the-art deep learning architectures such as YOLO (You Only Look Once). The objective is to design, train, and optimize a neural network capable of detecting drones in complex outdoor environments and, if possible, classifying them into different categories depending on their type or shape.

The workflow will involve training the network using several publicly available datasets, followed by fine-tuning and evaluation using CD6's dataset acquired in real operational conditions. A major challenge addressed in this project will be the discrimination between drones and visually similar objects, particularly birds, which remains an open and difficult problem in the current state of the art.

The student will join a multidisciplinary research team with expertise in computer vision, optical sensing systems, artificial intelligence, and system integration. Technical guidance and access to computational resources will be provided throughout the project. The thesis will be structured around four main tasks

1. **Technology background:** Understanding the fundamentals of deep learning for object detection and the architecture of YOLO-based networks applied to aerial object detection.
2. **State-of-the-art review:** Analyzing existing drone detection and bird–drone discrimination approaches, identifying limitations and optimization opportunities.
3. **Model training and dataset integration:** Training the neural network using multiple datasets, and adapting it to CD6's own dataset through fine-tuning and domain adaptation strategies.
4. **Validation and performance evaluation:** Testing the system under realistic conditions, assessing detection accuracy, false alarm rates, and robustness against real-world challenges.
5. **(Optional) 2D–3D data fusion:** If time allows, exploring the integration of 3D sensing data (e.g., LiDAR or depth information) with 2D vision-based detection to improve drone detection reliability and bird–drone discrimination.

This project will contribute to the development of intelligent detection solutions for airspace monitoring and critical infrastructure protection.

**Keywords:** Drone detection, computer vision, YOLO, deep learning, object detection, artificial intelligence, surveillance, UAV detection

### Additional information :

\* Amount of the monthly allowance (if it is the case):  
To be discussed depending on the value of candidate.

\* Required skills:

Strong interest in artificial intelligence and computer vision.

Basic knowledge of machine learning and neural networks.

Programming skills in Python (experience with PyTorch or TensorFlow desirable).

Self-motivated, problem-solving oriented, and able to work both autonomously and in team environments. Self-motivated, objective-driven, capable of autonomous working within a multidisciplinary team.

\* Miscellaneous:

International team with several years of experience in the topic proposed.

Access to high-performance computing infrastructures and real datasets.

Multidisciplinary environment with electronics and mechanics workshops, and specialists and technicians in metrology, optics, mechatronics, and electronics.

Possibility of joining the Centre for a PhD/Project Manager career in case of common interest.

Early incorporation welcome.