PROJECT AI4CUAV

Innovative Al-framework to enable the detection, classification and tracking of killer-drone

The current Al-based algorithms on detection and classification algorithms based on radar signatures (i.e. signals and images) have shown a non-reliable solution in detecting and classifying small UAVs. A combined system with the EO/IR detection and classification based on Al-techniques could improve the required performances. Ai4CUAV intends to improve the Threat Evaluation Subsystem of a counter UAV (C-UAV) through Al-based algorithms. Supposing the anti-drones composed of multiple heterogeneous sensors, such as radars and EO/IR sensors, these algorithms "work" on radar signals and EO/IR images to enable the detection and classification of the killer-drones, as well as on drone trajectories to help to recognize a drone from another object. This project will build a shared database of RF and EO/IR

signatures of different drones which can be used as training data and test set, which allows to compare different detection and classification techniques. Ai4CUAV will investigate all the key SOTA of AI techniques from multiple sensor sources, including but not limited to, machine learning and deep learning. These techniques will be evaluated against the different use cases and scenarios, in order to assess the most adapted/promising ones. For the most promising techniques, algorithm prototyping and adaptation will be performed to assess preliminary performances through simulations. This project is a follow-on of the NATO SPS project n. G5633 "ANTI-DRONES - Innovative concept to detect, recognize and track killer-drones", involving the core partners CNIT-RASS (NPD) and MTU (Co-Director), that will be concluded in September 2022 with good results, focused on the development of a new concept of anti-drone system, based on mini-radar technology and signal processing, able to detect, recognize and track the killer-drones - mini/micro UAS - in

order to facilitate the neutralization of them minimizing the risk for people and assets. This Al-framework will be integrated in the ANTI-DRONES prototype, tested and evaluated by the enduser experts. Ai4CUAV project is a research project focused on a breakthrough innovation using Al. As such, it is expected to advance the accuracy of detection algorithms, and set forward Al-based solution of high complexity problems. From a prospect vision, Ai4CUAV would bring into market a novel and innovative AI application enabling intelligent ISR in complex situations.

Keywords: Drone detection, Al (Artificial Intelligence), Target classification, Target Motion Analysis (TMA)



Technical Sheet

Funding institution:

NATO-SPS

Project partners

IUS, MTU, GPI, UniLink, KhNUIA

Project duration

March 2024 – September 2026

Involved countries

Ukraine, Bosnia and Herzegovina, North Macedonia, Germany, Moldova, Italy



(a) Real Range-Doppler map of a drone



(b) Simulated Range-Doppler signature of a quadcopter using the same RF parameters of the real radar





(c) Hefesto drone shown in the real Range-Doppler map