

The project aims to develop advanced Artificial Intelligence (AI) algorithms integrated into a cognitive Synthetic Aperture Radar (SAR) system designed for monitoring and reconnaissance of critical scenarios such as landslides, earthquakes, floods, and civil security events.

The first objective is to create AI models capable of identifying the type of scenario being observed through automated classification and image understanding.

The second objective focuses on enabling the radar to autonomously adjust key acquisition parameters—such as frequency, instantaneous bandwidth, and PRI—according to the detected scenario and the operational functions required.

A further key goal is the design and construction of an airborne, multi-frequency SAR demonstrator to validate the technologies and methods developed throughout the project. The initial phase involves defining the relevant use cases and the technical requirements of both the radar system and the AI algorithms. This is followed by data collection and dataset preparation, which includes designing preprocessing methods and implementing AI-based image segmentation techniques to build a comprehensive training dataset representing different scenario classes.

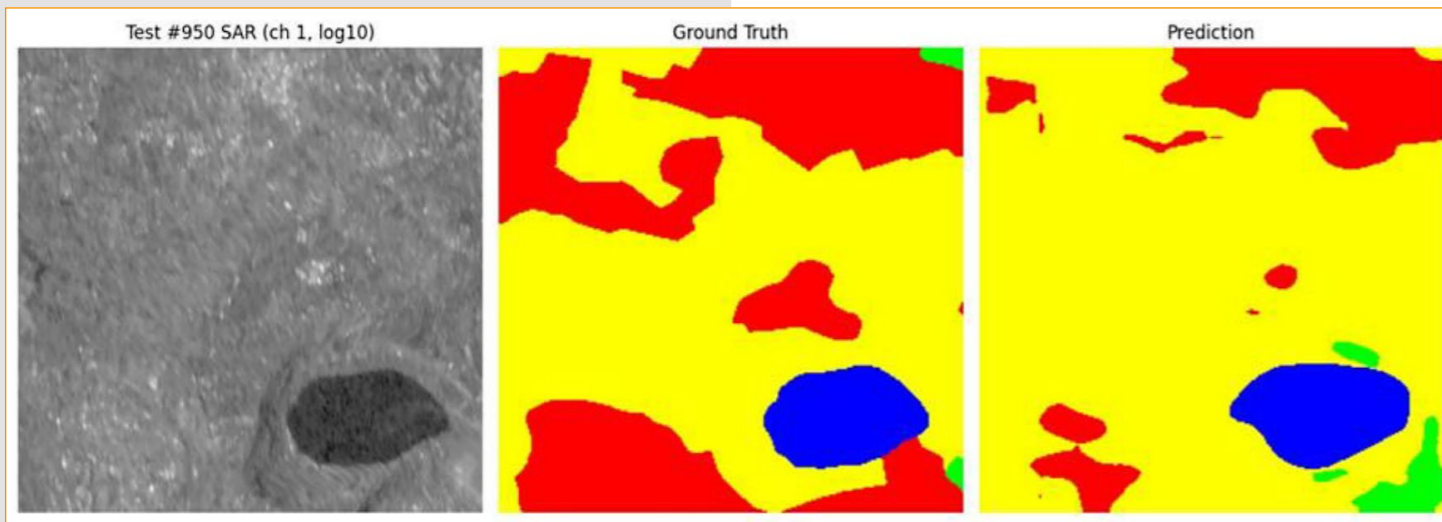
During model training and testing, various AI approaches — including those inspired by other application domains — will be explored to meet mission-specific performance needs, with particular attention to scalability, output quality, and computational efficiency. The project will then define the architecture of a cognitive, multi-band SAR sensor and analyse operational modes that allow the system to adapt dynamically to diverse observation conditions.

The resulting AI models will be embedded in a closed-loop framework capable of simulating a fully autonomous cognitive radar.

The final phase consists of an extensive measurement campaign to acquire additional data, validate the developed algorithms, and demonstrate the effectiveness of the purpose-built cognitive SAR system.

Keywords: Artificial Intelligence (AI), Synthetic Aperture Radar (SAR), Cognitive radar

Technical Sheet	
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Involved countries	<i>Italy</i>



(a) Very preliminary test of one of the AI-based segmentation techniques.

