A Decentralised Cognitive System for Radar Signal Recognition

Project Case Study

Project Partners

DEWC Systems and the Institute for Intelligent Systems Research and Innovation (IISRII), Deakin University.

Project Overview

Project P2-20 is a collaboration between DEWC Systems and the Institute for Intelligent Systems Research and Innovation (IISRII), Deakin University.

The project has been established to leverage artificial intelligence (AI) advancements to develop cutting edge radar monitoring capabilities in Australia. This initial collaboration is part of a multi-phase AI-driven RF monitoring system roadmap led by DEWC Systems to advance sovereign Australian RF technologies and capabilities, along with support from SmartSat CRC.

AI algorithms and in particular deep learning (DL) have shown promising capabilities for large data-driven analysis but there is a lack of AI research applied to RF spectrum analysis. This collaboration aims to fill this research gap by exploring state-of-the-art DL models such as convolutional neural networks (CNNs) to effectively detect and classify conventional and low-probability-of-intercept (LPI) radar signals.

The eight-month duration Phase 1 of the project has resulted in a proof-of-concept DL-based framework capable of detecting and classifying synthetic RF signals tested in a lab environment with simulated input noise.

This collaboration has yielded exceptional initial results, as shown in the graph. Initial CNN models have been evaluated with varying signal-to-noise ratios (SNR) to mimic the detection and classification of radar signals in synthetic noisy environments. The obtained accuracy for all different scenarios is very close to perfect accuracy, demonstrating the competency of the proposed RF detection framework.

The research team plans to extend the research in a future phase using real-time RF data sources in conjunction with satellite prototypes and technologies under-development at DEWC systems.

Utilisation

The full commercialisation of the project-derived technology will require additional phases, however, DEWC Systems already intends to use the research outputs to inform the development of the radio frequency (RF) sensor in the Miniaturised Orbital Electronic Warfare Sensor Systems (MOESS), a Defence Innovation Hub funded project. MOESS is a space-based tactical sensor system to provide persistent, resilient and adaptable situational awareness.

In the longer term DEWC Systems intends to integrate the AI system as a radar classification tool for a new satellite constellation that acts as a distributed system for sensing radar signals.

Collaboration

The project concept was developed by industry partner DEWC Systems, together with the SmartSat CRC's Theme Leader for AI, professor Clinton Fookes. The concept was made available to SmartSat researchers for a response, and Deakin University were selected as the academic partner. They were assessed to be a strong team with expertise in the Machine Learning area.

The research is being conducted by a team from IISRII at Deakin University. DEWC Systems is providing industry input and guidance to the researchers, management of the project milestones, as well as review/evaluation and feedback on reports, software and Machine Learning models.

Thanks to the assistance of the SmartSat CRC we were able to identify the IISRII at Deakin University as an academic partner for this important research. Working with IISRII has been pleasure and the collaborative approached displayed by both teams has been beneficial.

Graham Priestnall, General Manager, DEWC Systems

It is exciting to see how the close collaboration between academia and industry can lead to the development of novel and solid intelligent solutions for undertaking challenging real-world problems that will bring tangible benefits to advance the space industry of Australia.

Abbas Khosravi, Associate Professor,
Project Lead at Deakin University