Drones Classification with Convolutional Neural Networks

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With recent advances in technology, drones pose an increasing threat against security. Their small size and highly manoeuvrability makes detection and classification of drones a challenging problem. In particular, reliable classification of the vehicle is crucial to assessing the threat posted by the detected aircraft. Existing approaches for identifying air targets such as micro-Doppler signatures, are less effective due to the structure and materials found in drones.

This work draws inspiration from recent developments in machine learning. It has been demonstrated that deep convolutional neural networks (CNN) can lead to very high classification performance in many applications, such as natural and medical images. This work uses CNNs to classify the drones based on their radar returns. Specifically, spectrograms from multiple drones are formed and used as input images to train CNNs. The trained networks are then used to classify the returns.

In 2020, DST Group conducted a trial to collect the returns from a variety of drones, performing a range of activities, such as hovering and moving along planned paths. Multiple radars were used to simultaneously capture the returns across several bands. Experiments conducted on the trial data shows the CNN architectures capable of classifying the drone with good accuracy. As expected, ensuring a representative training set was found to be crucial for high classification performance. This presentation will discuss the results in detail and offers some suggestions for further improvements.