LITERATURE SURVEY:

# Experimental Research of Multistatic Passive Radar With a Single Antenna for Drone Detection

**Abstract:**

Digital television signals are attractive illuminations of opportunity for the passive radars in the field of low altitude and slow speed target detection. The digital television standard permits reconstruction of a reference signal using the received signal in surveillance channel, which enables a single-antenna digital television based passive radar (SDPR) processing. This paper investigates the practical feasibility of a multistatic SDPR (MSDPR) for the drone detection. First, the detection range of the SDPR is analyzed in terms of signal processing procedures involving multipath energy, extracted reference signal purity, and receiving antenna. Second, according to the characteristics of the SDPR, the reference signal extraction is analyzed. In addition, considering that the SDPR cannot locate and track the detected target, a novel MSDPR processing method is proposed. The core idea of this method is to use the optimal reference signal extracted from the receiving station with the least interference as the shared reference signal in MSDPR, which can greatly improve the system detection capability. Finally, the small drone detection experiments using the MSDPR are presented. The theoretical considerations are demonstrated using the experimental data.

AUTHOR:2021

YEAR:2021

# 2. TIB-Net: Drone Detection Network With Tiny Iterative Backbone

**Abstract:**

With the widespread application of drone in commercial and industrial fields, drone detection has received increasing attention in public safety and others. However, due to various appearance of small-size drones, changeable and complex environments, and limited memory resources of edge computing devices, drone detection remains a challenging task nowadays. Although deep convolutional neural network (CNN) has shown powerful performance in object detection in recent years, most existing CNN-based methods cannot balance detection performance and model size well. To solve the problem, we develop a drone detection network with tiny iterative backbone named TIB-Net. In this network, we propose a structure called cyclic pathway, which enhances the capability to extract effective features of small object, and integrate it into existing efficient method Extremely Tiny Face Detector (EXTD). This method not only significantly improves the accuracy of drone detection, but also keeps the model size at an acceptable level. Furthermore, we integrate spatial attention module into our network backbone to emphasize information of small object, which can better locate small-size drone and further improve detection performance. In addition, we present massive manual annotations of object bounding boxes for our collected 2860 drone images as a drone benchmark dataset, which is now publicly available 1 . In this work, we conduct a series of experiments on our collected dataset to evaluate TIB-Net, and the result shows that our proposed method achieves mean average precision of 89.2% with model size of 697.0KB, which achieves the state-of-the-art results compared with existing methods.

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YEAR:2021

# Combined RF-Based Drone Detection and Classification

**Abstract:**

Despite several beneficial applications, unfortunately, drones are also being used for illicit activities such as drug trafficking, firearm smuggling or to impose threats to security-sensitive places like airports and nuclear power plants. The existing drone localization and neutralization technologies work on the assumption that the drone has already been detected and classified. Although we have observed a tremendous advancement in the sensor industry in this decade, there is no robust drone detection and classification method proposed in the literature yet. This paper focuses on radio frequency (RF) based drone detection and classification using the frequency signature of the transmitted signal. We have created a novel drone RF dataset using commercial drones and presented a detailed comparison between a two-stage and combined detection and classification framework. The detection and classification performance of both frameworks are presented for a single-signal and simultaneous multi-signal scenario. With detailed analysis, we show that You Only Look Once (YOLO) framework provides better detection performance compared to the Goodness-of-Fit (GoF) spectrum sensing for a simultaneous multi-signal scenario and good classification performance comparable to Deep Residual Neural Network (DRNN) framework.

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YEAR:2019

# Real World Object Detection Dataset for Quadcopter Unmanned Aerial Vehicle Detection

**Abstract:**

Recent years have shown a noticeable rise in the number of incidents with drones, related to both civilian and military installations. While drone neutralization techniques have become increasingly effective, detection most often relies on professional equipment, which is too expensive to be used for all critical nodes and applications. Therefore, there is a need for drone detection systems that could work on low performance hardware. Its critical component consists of an object detection system. In this article, we introduce a new object detection dataset, built entirely to train computer vision based object detection machine learning algorithms for a task of binary object detection to enable automated, industrial camera based detection of multiple drone objects using camera feed. The dataset expands existing multiclass image classification and object detection datasets (ImageNet, MS-COCO, PASCAL VOC, anti-UAV) with a diversified dataset of drone images. In order to maximize the effectiveness of the model, real world footage was utilized, transformed into images and hand-labelled to create a custom set of 56821 images and 55539 bounding boxes. Additionally, semi-automated labelling was proposed, tested and proved to be very useful for object detection applications. The dataset was divided into train and test subsets for further processing and used to generate 603 easily deployable Haar Cascades as well as 819 high performing Deep Neural Networks based models. They were used to test different object detection methods to determine the long term feasibility of a large scale drone detection system utilizing machine learning algorithms. The study has shown that Haar Cascade can be used as the Minimum Viable Product model for mediocre performance but fails to scale up effectively for a larger dataset compared to the Deep Neural Network model.

AUTHOR:2019

YEAR:2020