

# An inexpensive, mobile system to detect interloping unmanned aerial vehicles

# Duke

## LICENSING & VENTURES

### Unmet Need

With the rise in popularity of drones, their use in anti-social activities has also proliferated. Nationwide police increasingly report the appearance of drones in unauthorized settings such as public gatherings and also in the delivery of contraband to prisons. Detection and classification of drones in such environments is very challenging from both visual and acoustic perspective. Visual detection of drones is challenging due to their small size. There may be cases where views are obstructed, lighting conditions are poor, the field of view is narrow, etc. In contrast, acoustic-based detection methods are omnidirectional, however, they are prone to errors due to possible noise in the signal. There is an ongoing need for improved low-cost detection and localization of unauthorized drones using audio features.

### Technology

Duke inventors have reported a method for detecting unmanned aerial vehicles (UAV) using sound. This is intended to be used for facilities that need aerial defense such as prisons and government buildings. This method predicts the presence (detection and classification) of a drone using a single microphone and other inexpensive computational devices. A deep learning algorithm classifies the spectral and temporal features of pre-segments generated using a sliding window for the audio signal. Additionally, spectral subtraction reconstructs the magnitude spectrum of drone sounds to reduce false alarms. To increase the accuracy of predictions, an added confidence script is proposed based on a queue-and-dump approach to make the system more robust. The microphone systems is connected to an Android-based app on a cell phone to alert users of an incoming threat. The proposed system has been tested in real time in a realistic environment with various drone models and flight characteristics.

### Advantages

- An inexpensive, mobile method for detecting drones using a blended acoustic/RFID detection method
- Units can be linked to provide extended coverage
- Cell-phone based app is complete
- Prototype has been tested in realistic environment

### Duke File (IDF) #

T-006394

### Inventor(s)

- Cummings, Mary
- Li, Ziyi "Ziyi"
- Mandal, Sayan
- Wang, Chung "Chunge"

### Links

- [Acoustic Detection of Drones through Real-time Audio Attribute Prediction \(AIAA SciTech, Orlando FL, 2020\)](#)
- [A Mobile Alerting Interface for Drone and Human Contraband Drops \(AIAA, 2019\)](#)
- [Operator Strategy Model Development in UAV Hacking Detection \(IEEE, 2018\)](#)

### College

Pratt School of Engineering

### For more information please contact

Chang Villacreses, David  
9196683401  
[david.chang@duke.edu](mailto:david.chang@duke.edu)

## **Publications**

- [From the lab of Dr. Mary Cummings](#)
- [An app for stopping drone deliveries over prison walls \(Duke Engineering News, 2019\)](#)
- [Deterring drones from ballparks and botanical gardens \(Duke Engineering News, 2017\)](#)