HACETTEPE UNIVERSITY - ELECTRICAL & ELECTRONICS ENGINEERING

ACOUSTIC DETECTION OF DRONES USING MACHINE LEARNING

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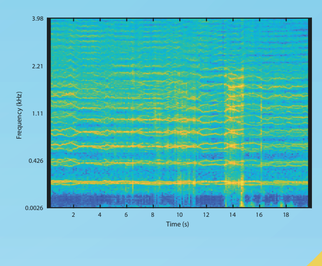
INTRODUCTION

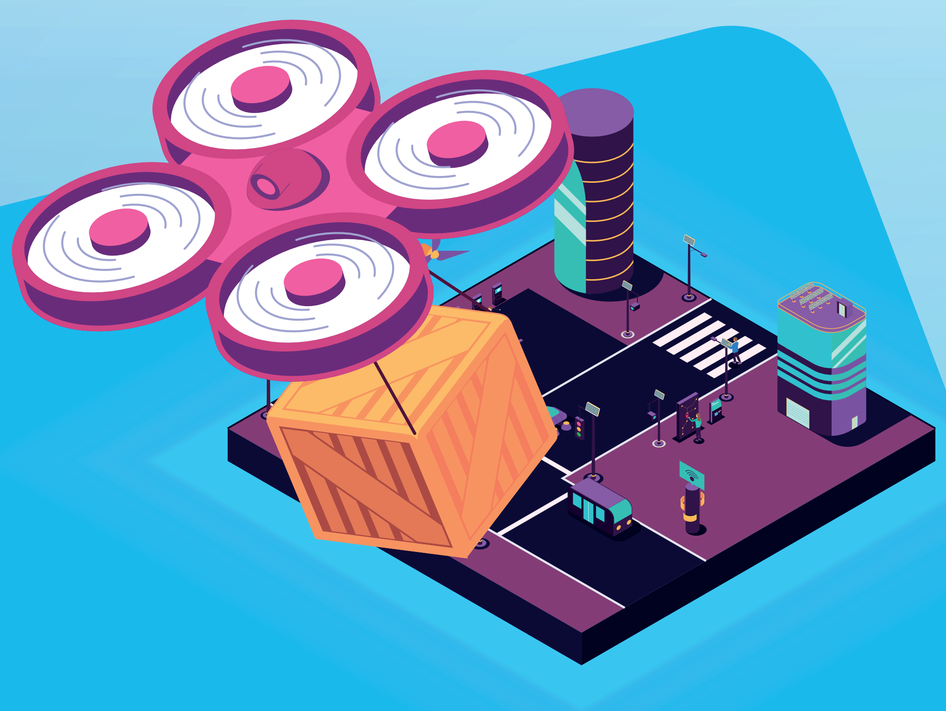
Detection of unmanned aerial vehicles has recently become an important security issue. In this project, a system will be designed using machine learning methods that detect the aircraft based on the sound waves they produce. The final result of the project consists of a real-time detector that listens to the environment and alarms if there is a drone. The final result consists of both the hardware of the system and the algorithms that run on it.

SOLUTIONS METHODOLOGY

1. **SOUND RECORDS** — 132 MINUTES DRONE SOUND RECORD
2. **DECIMATION** — FILTERING AND DOWNSAMPLING
3. **SEGMENTATION AND FRAMING**
4. **WINDOWING AND FFT**
5. **MEL-SPECTROGRAM AND MEL-FILTER BANK**



6. **DATA SEPERATION**
   - %80: TRAINING
   - %10: VALIDATION
   - %10: TEST
7. **MODEL PARAMETER TUNING**
8. **MODEL TRAINING** — CNN ARCHITECTURE THAT HAVE 24 LAYERS IS USED
9. **TRACKING ALGORITHM**
10. **REAL TIME DETECTION**



RESULTS AND DISCUSSIONS

We successfully completed our model with the signal processing and machine learning techniques that we applied in our project. The features of the system we created are as follows:

1. Optimal operation range is between 0-50 meters.
2. Maximum range is 100 meters.
3. Stable against to air conditions.

WORKS UP TO 100 METER

UP TO 50 METER | 96% ACCURACY

This project was completed within the context of ELE401-402 Graduation Project courses in Hacettepe University, Faculty of Engineering, Department of Electrical and Electronics Engineering.