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Drone Detection and Classification Using Music (Multiple Signal Classification) Algorithm

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Abstract: ***The rapid augmentation of drones in different sectors has raised concerns regarding privacy, security, and safety. This project proposes a novel drone detection and classification approach by integrating the YOLOv5 framework with a MUSIC-based algorithm to address the above issues.***
The aim is to postulate an efficient and accurate model capable of identifying and classifying different types of drones in real time. The project leverages the YOLOv5 architecture incorporated with the MUSIC algorithm for superior speed and accuracy. By training YOLOv5 on a large dataset of drone images, the model can learn to identify visual features and specific characteristics unique to drones, permitting effective detection and classification.
Keywords: YOLOv5, Multiple Signal Classification, Image-based, Speed, Accuracy.

I. INTRODUCTION

Unmanned Aerial Vehicles (UAVs), also known as drones, have substantially increased usage across a wide range of industries, including photography, agriculture, surveillance, and delivery services. However, the widespread availability and accessibility of drones have raised issues about their potential misuse. To address these concerns, efficient and effective drone detection and classification systems are essential. By leveraging the ability of YOLOv5 with the Multiple Signal Classification algorithm, we aim to create an image-based approach that can effectively detect and classify drones in various environments. This project aims to contribute to developing drone surveillance technologies, enabling a safer and more secure environment in the phase of increasing drone usage.

II. LITERATURE SURVEY

A. Acoustic-Based Drone Detection Using Machine Learning (2022)

Authors: Chaudhry Awais Ahmed, Faryal Batool, Wajeeha Haider

It aims to propose a system that can detect drones using signals and machine learning techniques. The method makes use of microphones to record drone sounds. It entails recording the drone's audio transmissions. Acoustic-based drone detection mainly relies on sound signals. Environmental factors such as rain and background noise can impact the accuracy of detected systems.

B. Drone Object Detection Using Deep Learning Algorithms (2021)

Authors: Aswini N, Uma S V

The system's goal is to efficiently identify objects in real time when they are photographed by the drone's camera. To train the model, a convolutional neural network (CNN) is utilised. The drone will subsequently be equipped with the trained model to perform detecting tasks. Deep learning algorithms can have demanding computational needs, which could make it difficult to handle data in real-time on a drone with low computer power.

III. PROPOSED SYSTEM

A. Data Exploration

The image data set is trained using MakeSense.AI annotations. It includes parameters such as class ID, normalized x-coordinate, normalized z- coordinate, normalized width and normalized height of the bounding box.

B. Splitting data into train & test

The dataset is split in to training and test data to evaluate the model's performance.

C. Model Generation

YOLOv5 model integrated with MuSic Algorithm is trained using the arguments img, batch, epochs, weights. The model is converted in to list and labellings are encoded. Class Function is created for trained and tested data. The outcome is checked with sample image.

D. User signup & login

Flask Framework with Sqlite is used for signup and login.

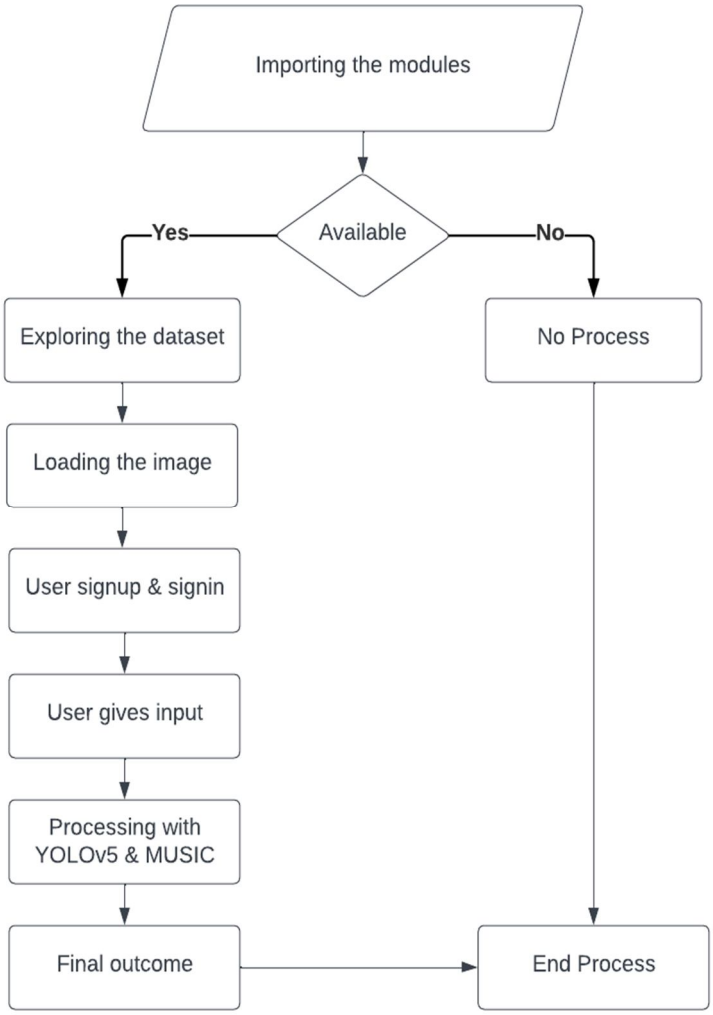
E. User Input

User gives input as an image. The image is pre-processed with the trained model.

F. Prediction

The processed image produces the type of drone and the probability that the drone is detected correctly in the given place.
YOLOv5 integrated with MUSIC Algorithm considers different parameters like class, probability of the class, and Bounding box.The proposed system provides good detection and classification performances.

IV. ARCHITECTURE



V. ALGORITHM

A. *Music Algorithm integrated with YOLOv5*

Integrating a MUSIC algorithm with YOLOv5, an image-based object detection and classification framework, can provide a unique drone detection and classification solution.

Multiple Signal Classification(MuSiC) is developed to know the directions, angles that arrive at an array of sensors. YOLOv5 incorporated with MuSiC helps in identifying the image localizations.

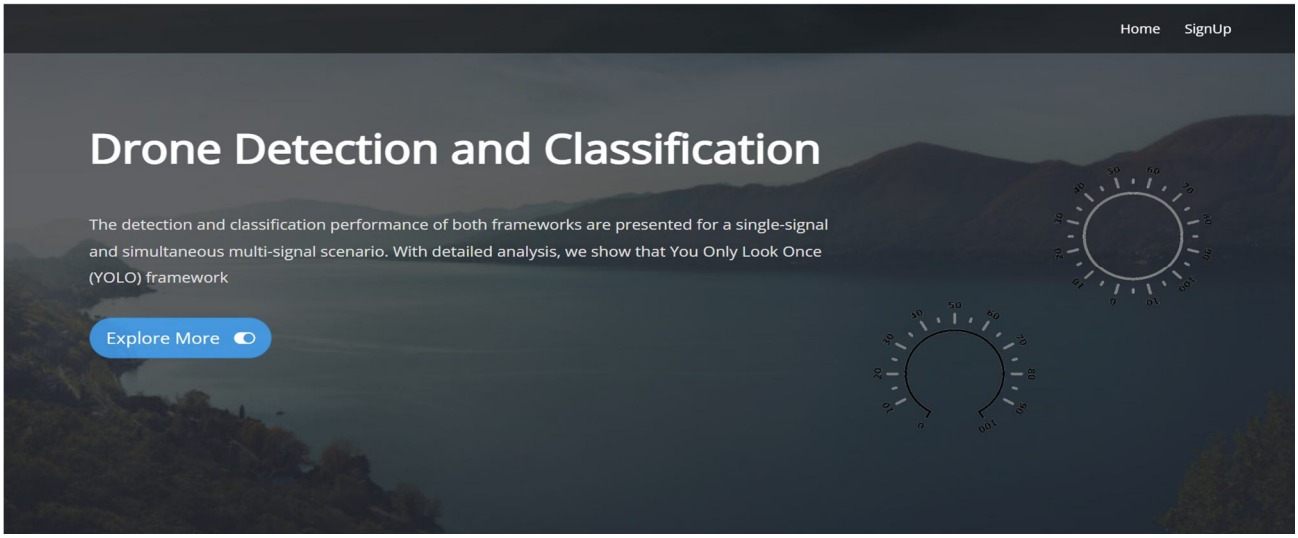
YOLOv5 is an object detection algorithm that stands for "You Only Look Once version 5". It is an extension of the original YOLO algorithm that aims to improve object detection accuracy and speed. YOLOv5 was developed by ultralytics and is widely used in computer vision tasks. It analyses the visual information captured by cameras or other sensors. Detecting drones with acoustic signatures can be made easy with the MUSIC algorithm. The Architecture of YOLOv5 contains Backbone Network, Feature Pyramid, and Detection head. The detection head predicts the class probabilities for each bounding box.

The YOLOv5 model is trained for the given dataset using MakeSense.AI annotations, including arguments such as img, batch, epochs, and weights. The images and annotations are loaded, and the class function for training and validation data sets is generated. The trained model with the above arguments is used for classification.

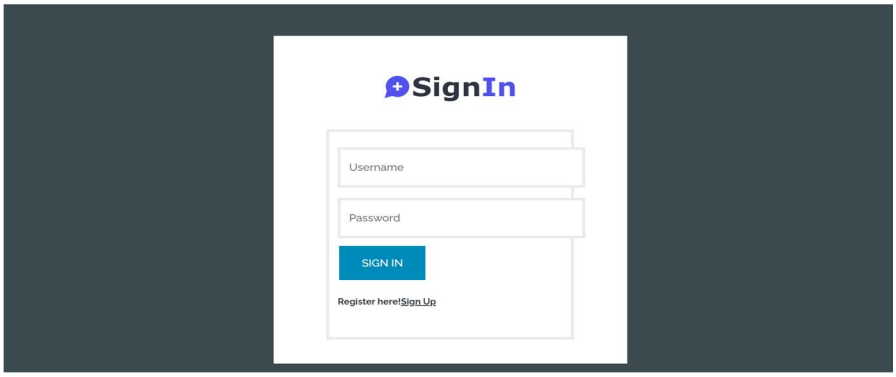
VI. RESULTS

The interface is provided for user where user has to enter the details and upload an image**.**

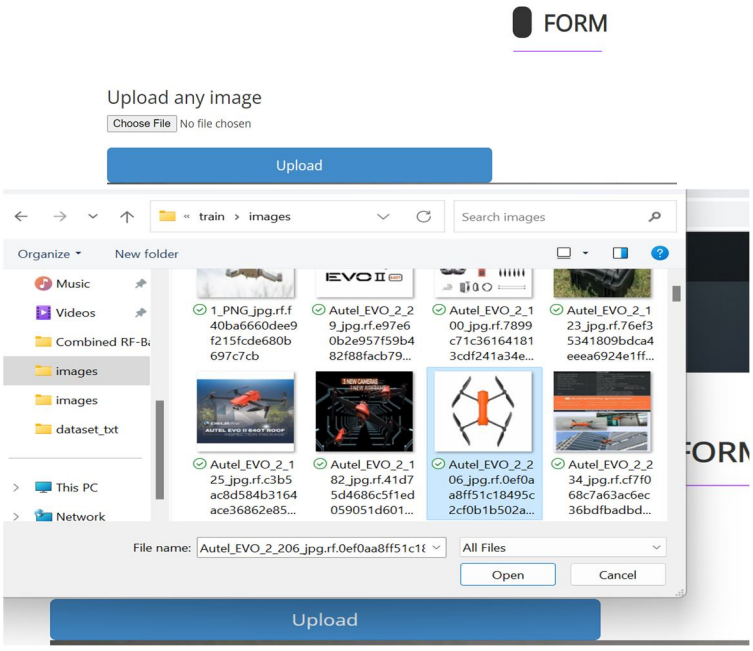
A. *Drone Detection and classification Homepage*



B. *Sign-in Page*



C. Upload an image



D. Output1

E. Output2

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VII. CONCLUSION

The YOLOv5 framework was incorporated with MuSic Algorithm to effectively perform drone detection and classification. The model is trained on multiple images using annotations. The model can predict the type of drone and the probability that the drone is detected correctly at the current place. Integrating the YOLOv5 with MUSIC Algorithm improves the detection and classification performance. A robust model can be created in future work that can detect and classify the drone images in unsupervised learning situations.

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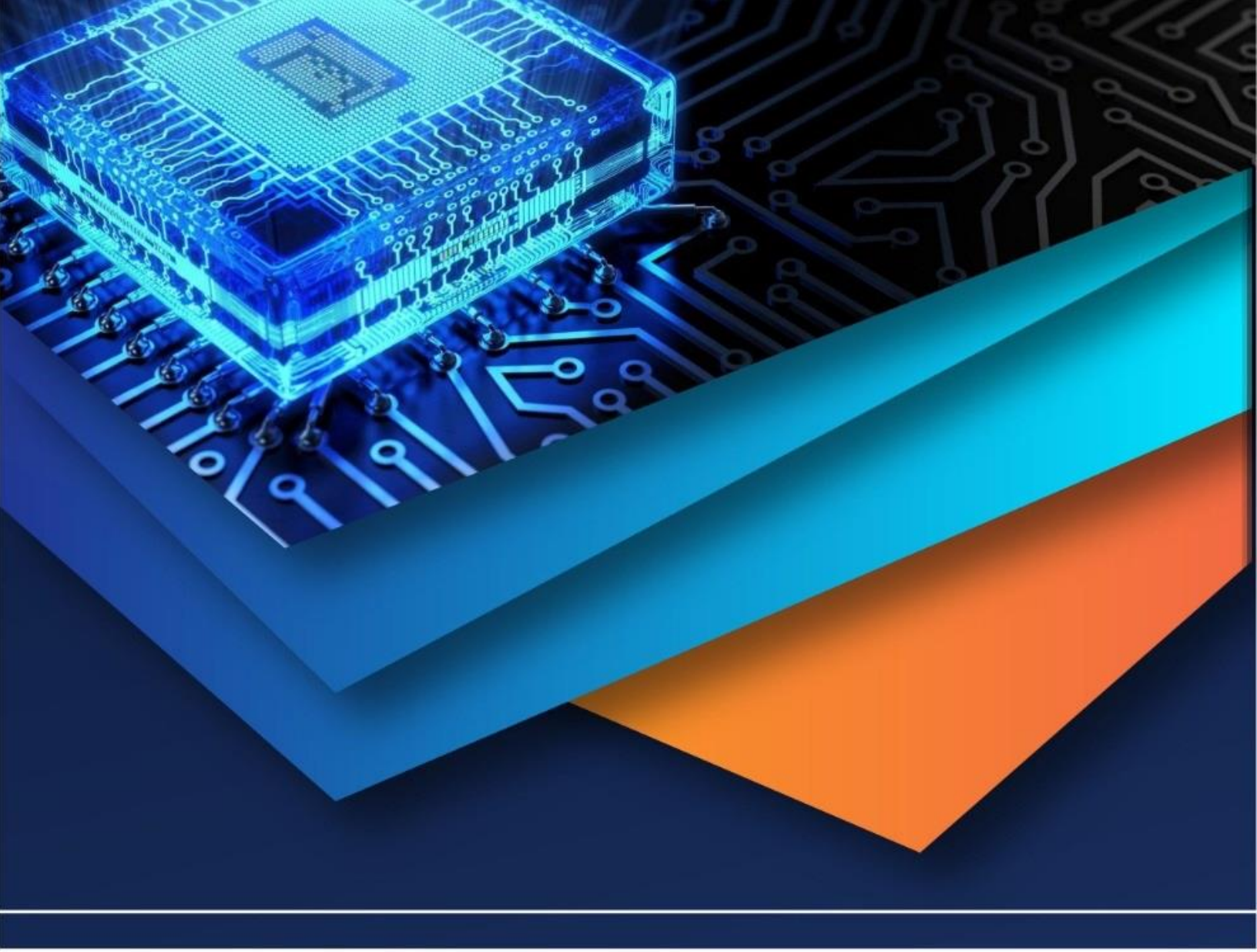

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