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AUTONOMOUS FACE DETECTION AND IMAGE RECOGNITION DRONE SYSTEM

[1] Dhanesh Debnath, [2] Shah Shivam, [3] Dr. Gaurav Kumar Ameta, [4] Utpalkumar Bhupendrabhai Patel

[1] Student, [2] Student, [3] Assitant Professor, [4] Assitant Professor
[1] Btech Computer Science & Engineering (Artificial Intelligence)
[1] Parul University, Vadodara, Gujarat

Abstract : The integration of autonomous drones with advanced computer vision technologies has led to significant advancements in various fields, including surveillance, search and rescue, and security. This paper presents the design and implementation of an Autonomous Face Detection and Image Recognition Drone System. The system utilizes state-of-the-art deep learning algorithms for real-time face detection and recognition, allowing the drone to identify individuals of interest efficiently. Additionally, the dr one is equipped with intelligent navigation capabilities, enabling it to autonomously navigate through complex environments while performing its tasks. The proposed system offers a versatile solution for applications such as law enforcement, crowd monitoring, and event security, enhancing situational awareness and response capabilities.

Keywords—Drone, Facial recognition, Convolutional Neural Network, YOLOv7 and LBPH Algorithm

1. INTRODUCTION

The objective of the project on "Autonomous Face Detection and Image Recognition Drone System" is to design and develop a system that can detect and recognize faces and images autonomously. The system should be able to capture and analyse images in real-time, process them, and provide accurate results. The drone should be able to navigate and perform its task with/without any human intervention, making it suitable for use in various fields like security, agriculture, and environmental monitoring. The system should also be robust and able to perform well in different lighting conditions and weather environments.

The project aims to develop an innovative and advanced system that can detect and recognize faces and images in real-time. The system will be designed to use machine learning algorithms that can learn from past data and improve its accuracy over time. The face detection feature will be able to identify faces even if they are partially obscured, and the image recognition feature will be able to identify objects and landmarks.

2. LITERATURE SURVEY

The literature review of the "Autonomous Face Detection and Image Recognition Drone System" aims to provide an overview of the state-of-the-art in face detection, image recognition, drones and autonomous systems, and machine learning algorithms. This review summarizes the existing research related to the project and highlights any gaps that the project aims to address.

A. Drones and Autonomous Systems

Drones and autonomous systems have been widely used in various applications, including search and rescue, agriculture, and environmental monitoring. The development of drones and autonomous systems has been driven by advancements in sensor technology, including GPS, cameras, and LiDAR. Recent research has focused on developing autonomous systems that can navigate through different environments, including indoor and outdoor environments, and avoid obstacles. These systems use machine learning algorithms to learn from sensory data and make decisions based on environmental cues.

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B. Face Detection

Face detection is a critical aspect of the autonomous system, enabling it to locate and recognize human faces in real-time. The Viola-Jones algorithm is one of the most commonly used algorithmsfor face detection, which uses Haar-like features to identify faces in an image. However, this algorithm has limitations in terms of speed and accuracy. But Yolov7 algorithm is one of the fastest algorithms used for face detection. Recent research has focused on deep learning algorithms for face detection, including convolutional neural networks (CNNs) and recurrent neural networks (RNNs). These algorithms have shown promising results in terms of speed and accuracy, and they can also handle occlusions and variations in lighting.

C. YOLO — You Only Look Once

All the previous object detection algorithms have used regions to localize the object within the image. The network does not look at the complete image. Instead, parts of the image which has high probabilities of containing the object. YOLO or You Only Look Once is an object detection algorithm much is different from the region-based algorithms which seen above. In YOLO a single convolutional network predicts the bounding boxes and the class probabilities for these boxes.

YOLO works by taking an image and split it into an SxS grid, within each of the grid we take m bounding boxes. For each of the bounding box, the network gives an output a class probability and offset values for the bounding box. The bounding boxes have the class probability above a threshold value is selected and used to locate the object within the image. YOLO is orders of magnitude faster(45 frames per second) than any other object detection algorithms. The limitation of YOLO algorithm is that it struggles with the small objects within the image, for example, it might have difficulties in identifying a flock of birds. This is due to the spatial constraints of the algorithm.

D. LBPH algorithm

Local Binary Pattern (LBP) is a simple yet very efficient texture operator which labels the pixels of an image by thresholding the neighbourhood of each pixel and considers the result as a binary number. It was first described in 1994 (LBP) and has since been found to be a powerful feature for texture classification. It has further been determined that when LBP is combined with histograms of oriented gradients (HOG) descriptor, it improves the detection performance considerably on some datasets.

3. METHODOLOGY

Using computer vision and deep learning methods, the Autonomous Face Detection and Picture Recognition Drone System is a cutting-edge project that enables a drone to identify and recognise human faces in real-time. The device can fly and go to particular areas to take pictures and identify people since it is meant to run autonomously with little human input. The idea is based on cutting-edge algorithms and deep learning models that give the drone the ability to examine pictures taken with its onboard camera and recognise the presence of human faces in the scene.

Convolutional neural networks (CNNs) are used by the system to learn and categorise information in photos, allowing it to discriminate between human faces and other things. High-resolution photos are taken by the drone's camera and sent to a central processing unit (CPU), where they are evaluated using pre-trained deep learning models. The system is built to maximise face identification and recognition speed and accuracy, allowing it to process photos in real-time.

The technology compares the identified face with a database of known people using sophisticated image recognition algorithms to identify individuals. Facial recognition technology is used to extract and save distinctive face traits from the photos of people in the database. When a match is made, the system can reveal details about the person it has located, including their name, whether authorised or unauthorised.

Project Platforms used in Project:

Project Platforms used in Project The Autonomous Face Detection and Image Recognition Drone System is a project that utilizes a combination of hardware and software platforms to achieve its goals. The project platforms can be broadly categorized into two categories: drone hardware platforms and computer vision software platforms.

Drone hardware platforms:
Drone: This is a professional-grade quadcopter drone platform designed for commercial and industrial applications. It features advanced sensors and an onboard camera system that can capture high-quality images and video. The Matrice 200 series can also carry additional payloads, such as the CPU and other sensors required for face detection and recognition.

NVIDIA GTX 1650: GeForce GTX 1650 gaming laptops are built with the breakthrough graphics performance of the award-winning NVIDIA Turing™ architecture. With performance that's up to 2X the GeForce GTX 950M and up to 70% faster than GTX 1050, it's the supercharger for today's most popular games, and even faster with modern titles.

Computer vision software platforms:

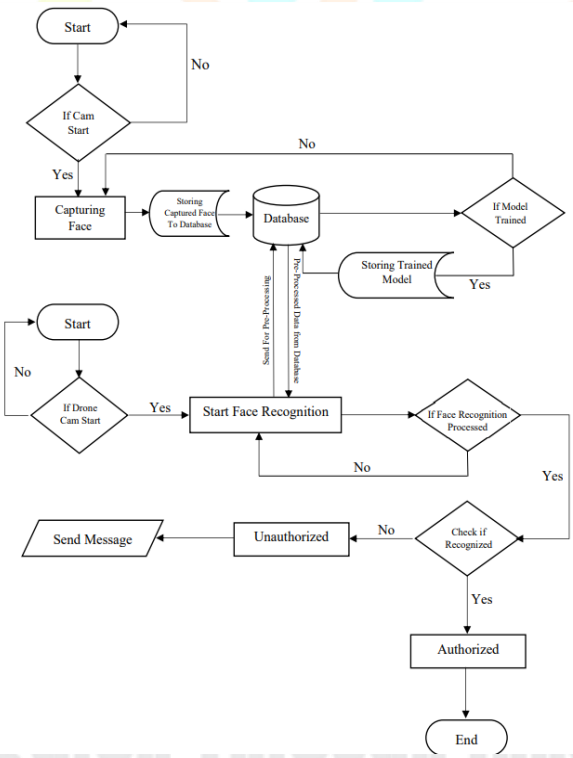
OpenCV: OpenCV is an open-source computer vision library that provides a wide range of functions for image and video processing, including object detection, face recognition, and machine learning.

TensorFlow: TensorFlow is an open-source machine learning library developed by Google. It provides a range of tools and functions for training and deploying deep learning models, including convolutional neural networks (CNNs) used for face detection and recognition.

Steps to perform project:-
Step1. First the cam will start and capture the face.
Step2. Then the captured face will be stored in the database.
Step3. Then the model will train the image and send the trained image to the database to store data.
Step4. After completing the image processing, The drone cam will start.
Step5. Drone cam will start face recognition from the database if the recognition process is accepted.
Step6. Then it will check whether the face is authorized or unauthorized.
Step7. If the face is authorized then the program will end and start over.
Step8. If the face is unauthorized then a message will be sent to admin. In this project, we are using Yolov7 Algorithm and LBPH algorithm to build the model.

YOLO (You Only Look Once)
You Only Look Once (YOLO) proposes using an end-to-end neural network that makes predictions of bounding boxes and class probabilities all at once. It differs from the approach taken by previous object detection algorithms, which repurposed classifiers to perform detection.
Following a fundamentally different approach to object detection, YOLO achieved state-ofthe-art results, beating other real-time object detection algorithms by a large margin. While algorithms like Faster RCNN work by detecting possible regions of interest using the Region Proposal Network and then performing recognition on those regions separately, YOLO performs all of its predictions with the help of a single fully connected layer.
Methods that use Region Proposal Networks perform multiple iterations for the same image, while YOLO gets away with a single iteration.

4. DIAGRAMS (FLOW DIAGRAM)



5. CONCLUSION

The Autonomous Face Detection and Image Recognition Drone System is a revolutionary tool that has the potential to revolutionize the way businesses and organizations use drones. With the system's advanced capabilities, businesses can now leverage the use of drones to capture valuable data and provide insights into their operations. The system has the potential to revolutionize the way businesses and organizations operate, providing them with the necessary data and insights to improve their operations and increase their productivity.
The autonomous face detection and image recognition drone system is a complex project that involves the integration of various software and hardware components, including object detection and recognition software, image processing software, machine learning algorithms, autonomous control software, user interface software, data storage and retrieval software, networking and communication software, security and privacy software, and testing and validation software.

The system is designed to operate in real-time, autonomously detect and track faces, and generate accurate and reliable data that can be used to inform decision-making and optimize performance. In conclusion, the autonomous face detection and image recognition drone system is an innovative and powerful technology that has the potential to transform a wide range of industries. The development of such a system requires a significant amount of expertise and resources, but the benefits are enormous.

Acknowledgment

In this semester, we have completed our project on "AUTONOMOUS FACE DETECTION AND IMAGE RECOGNITION DRONE SYSTEM". During this time, all the group members collaboratively worked on the project and learnt about the industry standards that how projects are being developed in IT Companies. We also understood the importance of teamwork while creating a project and got to learn the new technologies on which we are going to work in near future.

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