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Artificial Intelligence
In
Unmanned Aerial Vehicles

Name - Sandeep Kumar

Reg – 11902180

Roll – 70

Subject Code – INT417

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Abstract

Applications of unmanned aerial vehicles technology have shown a very big rise in the recent times. One of the main reasons is less cost, advancement in remote sensing technology. Artificial intelligence will become an integral part of unmanned aerial vehicles and can be used for various applications. Incorporation of such intelligence in a practical system is the need of hour. The aim of this paper is to show how artificial intelligence in drones using image processing. Intelligent drones are now the requirement of many fields right from courier delivery to defense, surveillance and rescue. Face-recognition system is proposed which is based on dataset creation, training and recognizer. Implementation of face-recognition system shows acceptable results.

Keywords

Artificial intelligence (AI)

Image processing (IP)

Face recognition Unmanned aerial vehicles (UAV)

Personal Computer (PC)

Introduction

Unmanned aerial vehicles (UAVs) also popularly known as drones can be defined as a flying object without any human pilot on board. The first drone came in this world in the year 1849, and since then the technology for drones has developed to a great extent. Initially, drones were used in military applications. But, seeing the cost at which these drones function, attempts were made to make them more humane. Since the early 1990s, UAV were being used for various applications. Also, they were now serving as a platform for robotic studies. With applications in fields such as aerial cinematography, journalism, surveillance and delivery systems, drone technology is one of the highest worth technology.

Artificial intelligence (AI) and robotics are becoming one of the next industry buzzwords and are now being used in almost every field. In 1956, John McCarthy held the first academic conference on AI. AI is nothing but an intelligent behavior of machines rather than the normal behavior. In subsequent years, it has experienced several waves of optimism. In today's world, AI is considered as a fast growing and an advanced field of science. AI can be achieved in many ways. Various scientists have framed various pathways for achieving AI. But as such, there is no general procedure or method for AI research. Devices or machines with AI prove to be more efficient and user-friendly than traditional machines. Thus, enormous researchers are working on imparting AI in industrial as well as domestic applications.

The main objective of our paper is to understand how face recognition system works in drones for surveillance cameras and other UAV applications.

Literature Review

In this section, we produce the literature survey regarding AI, image processing (IP) and drone technology. Various researchers have worked in these fields. For better understanding, this section is divided into two subsections: (i) UAV and its applications and (ii) UAV with AI.

UAV and Its Applications

When introduced for the first time, UAVs were used as a weapon for war. This raised many questions about how they can be used fruitfully. Its capability to be used as a tool of vision was neglected. This started the research work in using this ability of drones. Construction companies started using these drones to monitor surrounding areas for safety and inspection. It was this time that UAVs found its place in journalism. UAVs equipped with camera have recorded major events such as natural calamities and terrorist activities, thus providing an inexpensive but efficient way to collect data from parts where it is not feasible for people to reach. Not only journalism, but also these UAVs found its application in cloud computing as carriers of wireless base stations. Attempts are also going on to use UAVs as a tool for conserving environment. They are used to collect data about forest areas or areas near rivers to analyze and conserve them.

UAV with AI

While few researchers were studying about UAV, advancements were made simultaneously in existing UAV by other researchers, which involved using various other concepts like AI or IP along with UAV. AI in UAV can enhance its functioning many folds. Even they can be made to fly autonomously using different techniques like localization and mapping. Various sensors can be used to localize and automate an UAV. After localization, it is important to make the UAV follow desired path. Various controllers such as PID and IMC controllers can be used for this purpose. And in order to fly it continuously, it is necessary to develop a system to replace batteries automatically.

Such intelligent UAVs can be used for various applications such as: using radar drone for accident control, detecting different types of sinkholes (natural or man-made) using thermal cameras, detecting source for gas leaks using particle-filter-based algorithm, following a person by position estimation, person detection and trajectory planning, path planning using image processing, improve somatic sensation, botmaster to steal data using Wi-Fi network, automation using built-in sensors, detecting empty parking slots using car detection via image processing, trajectory planning using fuzzy logic controllers, object tracking using neural networks and image processing.

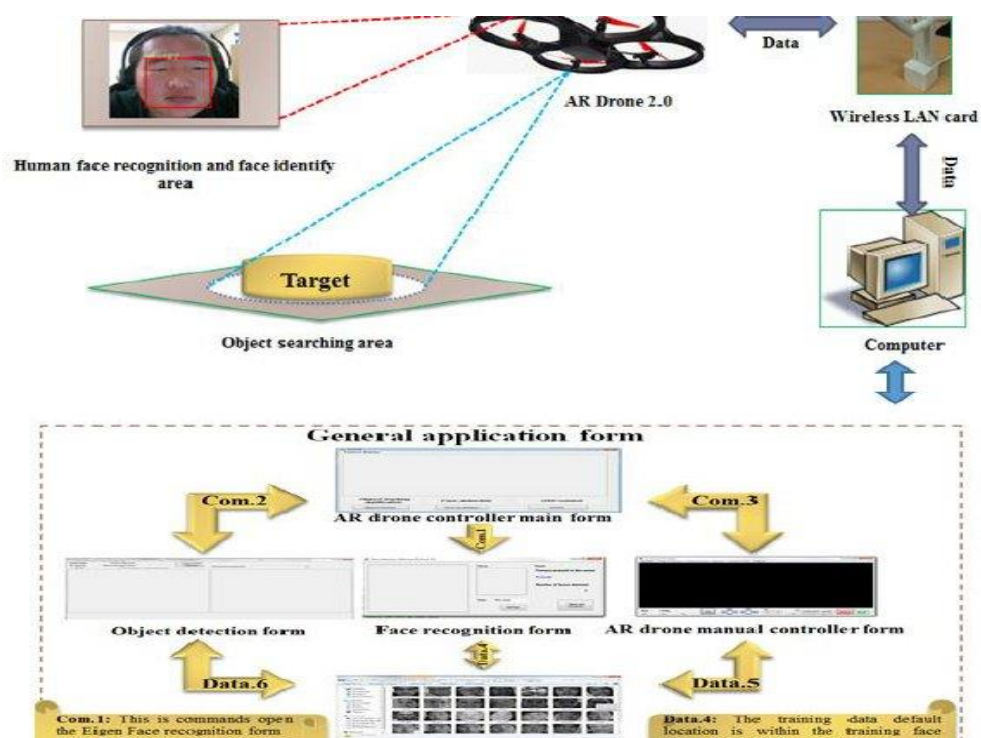
From above literature review, it is clear that the research work in UAVs and their enhancement is at a different level than it was few years back. But there can be more advancement in current working of drones. These drones can be used as a tool for searching and surveillance using the camera attached to it. This can be done by modifying the main microcontroller of the drone, or by simply controlling the motion using the feed obtained by the UAV camera. Such UAVs are known as UAV with FPV (first-person view). In this

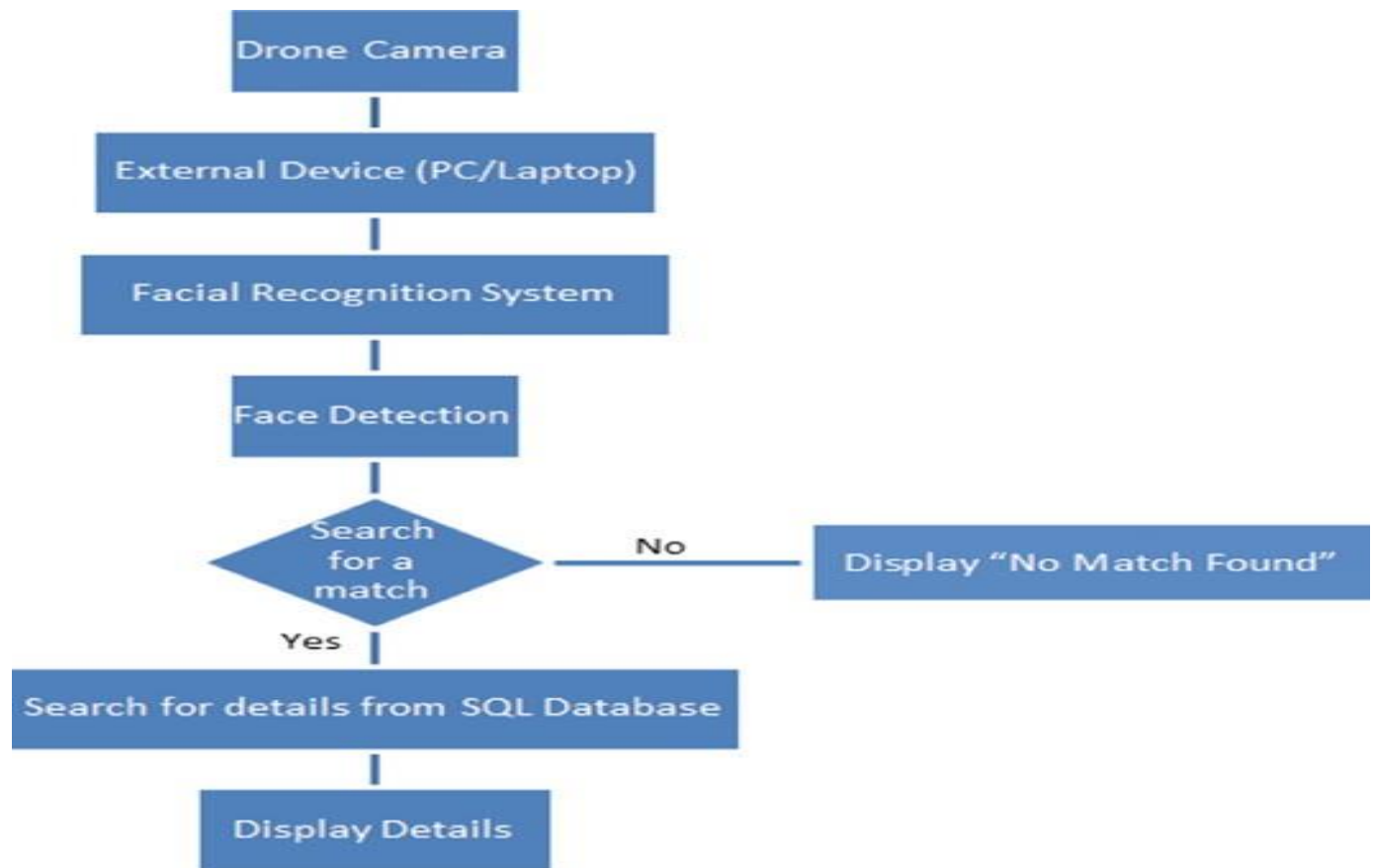
Methodology

The main step of this paper is to get the idea behind the AI in drone cameras. In this research we have shown AI which can do face recognition. For facial recognition, it is necessary to send the live video feed from the camera drone to a device where actual IP is done. This can be achieved by using the signals from the drone camera using a Wi-Fi module. The device in which actual IP is done is connected with the drone using Wi-Fi. The camera feed from the drone is sent to the external device like PC or laptop. This feed is used for IP and facial recognition to obtain the final output.

Face Recognition

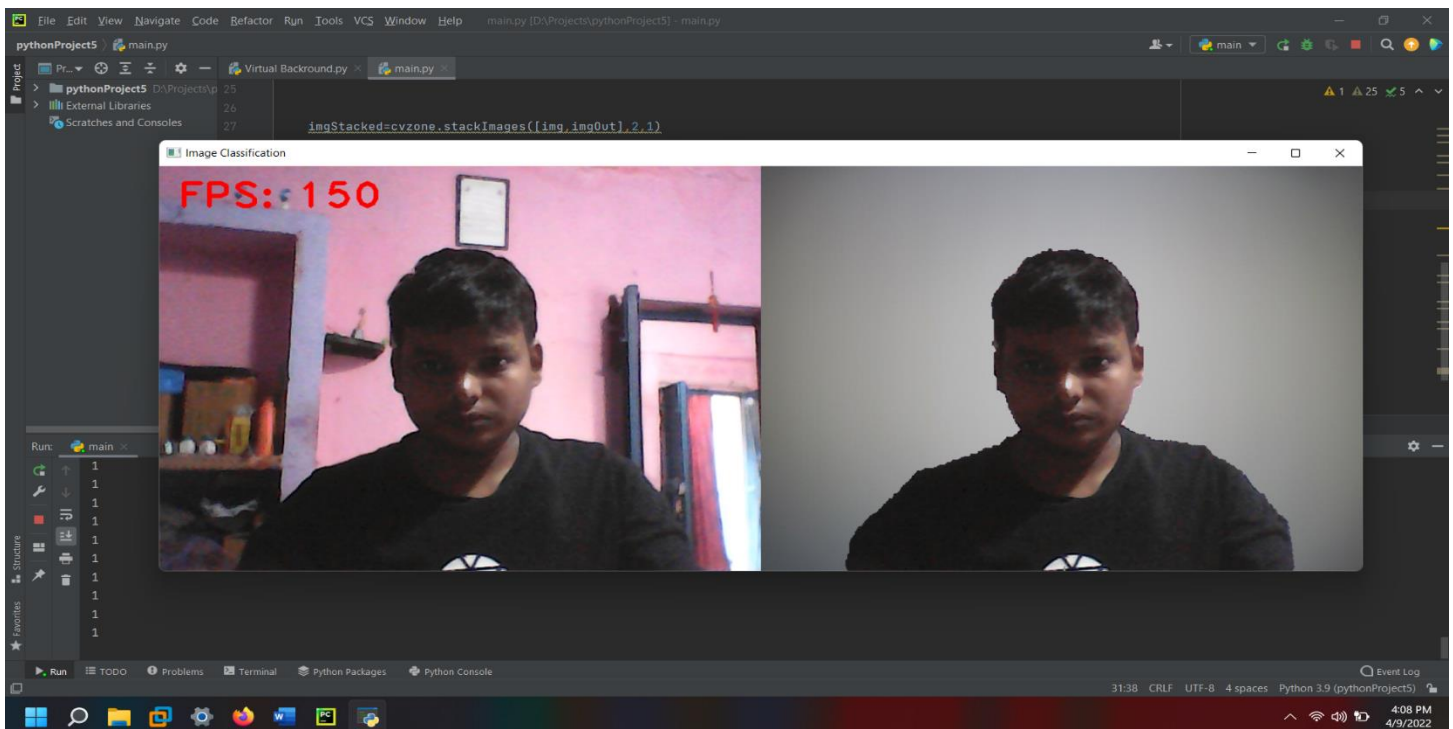
A facial recognition system identifies a person from a digital image or a video frame from a video source. It can be done by comparing selected facial features from the image and a face database. Security systems with this capability are preferred. Over biometrics such as fingerprint or eye iris recognition systems. Recently, it has also become popular as a commercial identification and marketing tool. A face-recognition system can be made using Python, SQL and OpenCV library.





Face Detection

Face detection can be done using Python and OpenCV library. We are using a cascade classifier in this programme, which can be loaded with a pre-trained xml file. OpenCV already have these pre-trained classifiers ready for face detection. Algorithm of face detection is as follows:



- Step (1) Define the device used to capture the images.
- Step (2) Convert the images captured into greyscale images.
- Step (3) Use the face detection classifier to detect the faces.
- Step (4) Display the output on the laptop/computer screen.

DataSet Creation

The dataset generator captures few sample faces of one person from a real-time live video frame and assigns a unique ID to it, and it will save those samples images in a folder for future references. All the images that are saved in the dataset are converted into greyscale images. Algorithm of dataset creation is as follows:

- Step (1) Using face detection, detect the faces from the input device.
- Step (2) Creating a dataset folder.
- Step (3) Take id and name from the user.
- Step (4) Take 100 pictures and saving them inside the dataset folder

Trainer

To perform face recognition, a face recognizer must be trained first using a pre- labelled dataset. In my previous step, we created a labelled-dataset for our face- recognition system; now, it's time to use that dataset to train a face recognizer using OpenCV and Python. We are using a local binary pattern histogram to train the face images. Algorithm of trainer is as follows:

- Step (1) Access the images from the dataset folder.
- Step (2) Extract the features of the images using local binary pattern histogram.

Recognizer

The recognizer is used to recognize faces in real time. If a particular face matches with the database that is created, it would display all the information related to that particular individual. Algorithm of recognizer is as follows:

- Step (1) Define the device used to capture the images.
- Step (2) Use face detection, to detect the face from the input feed.
- Step (3) Access the trained dataset.
- Step (4) Check if information related to the detected image in the database.
- Step (5) If yes, then display the information related to that person on the screen.
- Step (6) If no, then display no match found.

Conclusion and Future Scope

AI is considered to be the most advanced and important field in current world. A lot of researchers are currently working on AI. This proves the presence of AI in almost all the devices developed in this decade, such as mobile phones and surveillance cameras. Also, AI-based UAV are now a days seeing an uptrend in domestic applications such as photography. But a further advancement in the technology would result in high-end applications too.

Developing UAV with IP would result in a great impact in defense-related applications. Not only that, but also such UAV would prove helpful in rescue operations. Implementing advanced AI in such systems could result in complete automation of UAV.

Implementing systems like the one discussed above can prove effective in applications like surveillance. It can also be used to track down criminals using facial recognition techniques. Law enforcements can use such systems to track underage citizens going off-track. In a domestic basis, schools and colleges can use this method for the sake of attendance. UAVs are still a growing field of technology with many applications still untouched. A number of applications particularly in big data analytics have not even been thought of as yet.

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