

Face Recognition Using Raspberry Pi

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Abstract - Face recognition as the name suggest is the identification of Face of a particular human being present in the image. Face Recognition has numerous applications and plays a crucial role for systems based on computer vision .This paper seeks to perform a thorough explanation of modern face recognition model which is based on Raspberry Pi. This model primarily consist of three elements , specifically face detection from the image , comparison with the image already stored in the database and alerting the user or saving the date and time of the detection in the database.

For the face recognition the image is fed to a pre-trained neural network that consists of 128 measurements that are solely unique to that particular face. The sole reason behind this study was of advancement in security of the assets of Organizations and Industries. Although many face detection and recognition algorithms based on OpenCV have been developed over the years, their speed and accuracy of detection has not been up to the expectations. But recent boost in Artificial Intelligence have done some remarkable progress. Some of them face unlocking mode in mobile phones, Snapchat, Instagram, etc.

Key Words: opencv, face recognition, twilio, raspberry pi

1.INTRODUCTION:

In this Era where terms like Artificial Intelligence and Machine Learning are gaining momentum, factors such as Face Recognition have become important in tackling

malicious intent in terms of security. The rise in crime rate has drastically increased the use of modern high-tech devices for security reasons.

For the purpose of security, face recognition, face detection and biometrics are widely used. The face recognition technologies started developing in early 1960s and research is still going on at an exponential rate. The researcher Woodrow Wilson Bledsoe (the father of facial recognition) has developed a system that could classify the faces present in an image manually by recording the co-ordinate locations of various facial features. Thus from manual face recognition, the technology has now developed into a hi-tech software based research in which high precision and efficiency is achieved. The aim towards developing this model is to make it efficient and cost effective for the users.

The previous devices which were made with face recognition as its base were having multiple hardware requirements and a good amount of floor space. The main objective behind this research is to develop a affordable and efficient device which can be installed and used on a daily basis as per the user's requirement. This paper discusses the technology used for face recognition and the efficient use of hardware required for the device.

2. LITERATURE REVIEW:

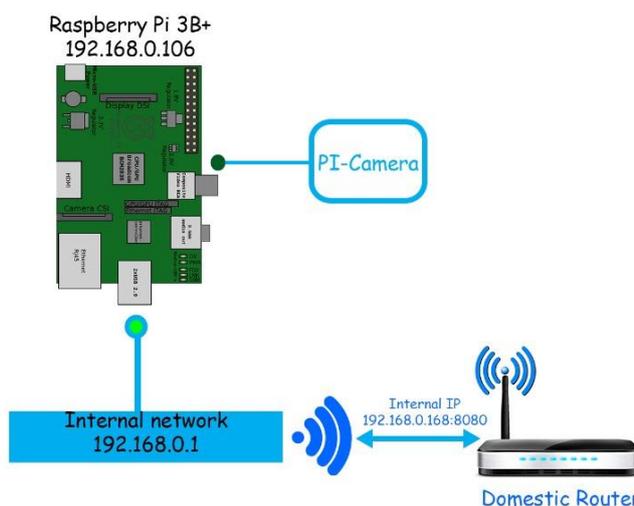
Face Detection being the most successful application of image analysis, it has recently obtained significant eyes, especially during the recent years. This is due to the emergence in face recognition conferences in recent years. There are two reasons behind this hype in Face and Gesture Detection, wide range of profitable

security based applications and the next one is the availability of feasible resources explored during the recent years. In addition, the idea of machine recognizing faces of humans continues to attract researchers from various fields such as image processing, gesture sensing, gesture recognition, neural networks, computer vision and machine learning.

The study of face recognition has been laid out as recognizing three dimensional (3D) objects from two dimensional (2D) images. Previous approaches in mid-1970 treated it as 2D pattern recognition. As a result, typical pattern classification techniques such as measuring the distance between important points present in face were used.. During the 1980s, research

On face recognition remained dormant. Since the early 1990s, interest in research of Face Recognition Techniques has grown exponentially. There might be several reasons behind this growth: an increase in interest in machine learning applications; the availability of advanced and upgraded hardware and the increasing importance towards the security.

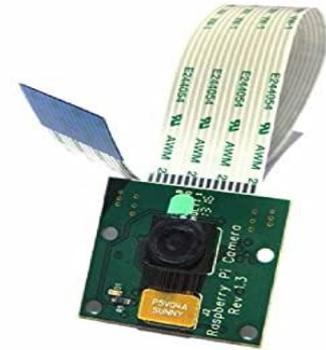
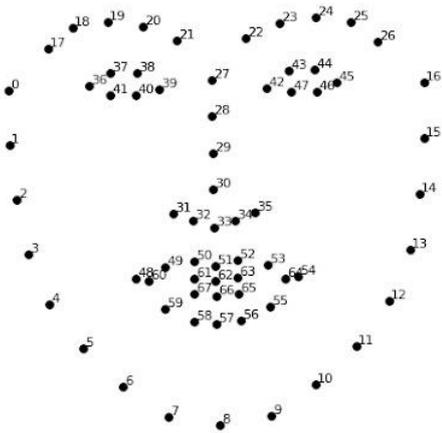
3. METHODOLOGY:



In this Project Raspberry Pi acts as a complete Surveillance and Alarming System. Our goal is to make a self-aware system that recognizes faces easily without a rigorous training system and will be able to stream the results over the internet to alarm the user of activity using Twilio SMS services.

First, we need to connect Raspberry Pi to the given hardware. Then, Boot the system and install all the required dependencies i.e.- OpenCV, NumPy, Mjpeg-streamer, Cmake, , dlib, face_recognition, Twilio and noip2 DUC. OpenCV provides a real-time optimized Computer Vision library, tools, and hardware, we will use it to capture the feed of Picam and stream it though the local network using Mjpeg-streamer. No-ip is a Free Dynamic DNS service, we will use it to access our Live Stream over the Internet as shown in the Diagram. Noip does this by pointing towards a static hostname registered on its site and checking every 15 minutes for changes to your IP address. This completes the first art of our project.

Now in our Python Project, import OpenCV, NumPy, face_recognition, datetime, os and Twilio. First, we will load the training image using face_recognition package's load_image_file function, convert it to RGB and then send it to the encoding function. Here we will create encodings for all the faces in our images. This is done using HOG (Histogram of Oriented Gradients) which is a feature descriptor used in computer vision and image processing. The technique notes the instances of gradient orientation in bounded portions of a picture. Once we get the instances, it is angled to remove unwanted rotations. Then the pre-trained neural network returns 128 measurements that are unique to the required face as shown in the fig. The measurements generated for each of the faces is then analyzed. The algorithm makes sure the measurements it generates are as accurate as possible by tweaks the neural network slightly. This generates the required Encodings of the faces. Once we have the encodings for all the faces, then we can match the measurements of the faces in the database with the faces detected in the camera feed to find similarities. To compare them, we use linear SVM classifier. The compare_faces function will be used to find if the faces match, returning true or False as the output. The accuracy of match can be determined by using the face_distance function. In situations with multiple faces, face_distance package helps in a smooth operation. Running these codes will result in a system that returns true or false based on whether a face matches its database. Now we will add presentable graphics such as target boxes and name of the person recognized displayed over the feed. Then, we will create a .csv file to record the time and name of the person recognized using the date time package. Finally, we will use Twilio SMS services to send an alert message to the registered number of the user.



4. HARDWARE AND SOFTWARE:

1. Raspberry Pi: -Raspberry pi is a small computer in itself. Raspberry pi is launched in UK in 2012. Raspberry Pi 3 model have a 1.2GHz 64-bit quad-core processor, dual-band wireless LAN, Ethernet, Bluetooth. It runs on Linux and has some input output pins. It is use to do some hardware projects, robotics, to learn coding and to explore the Internet of Things (IOT).



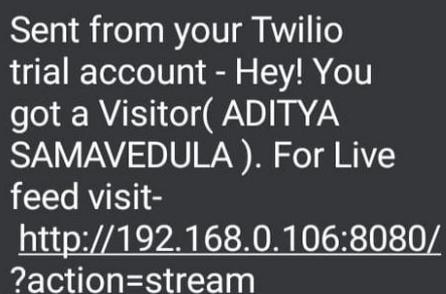
2. Pi Camera: - The Pi camera is portable camera which is compatible with Raspberry pi. It is high definition 5mp camera that has the good photo ad video capturing capacity. It can record high quality videos that supports 640*480p, 20p format. The Pi camera mostly used in drones since it is light weight and it is also used in machine learning, image and video processing projects.

3. OpenCv :- OpenCv (Open Source Computer Version Library) is open source library which is use to develop real time computer vision projects. It was developed by Intel. It has interfaces with Python java and MATLAB. It is widely used in image processing, video capturing, face and object detection.
4. NumPy :- NumPy is an open source library which contains multi-dimensional array and matrix structures. It is use to perform mathematical operation such as trigonometric, algebraic routines, Fourier transform and matrices.
5. MJPG-Streamer:- MJPG Streamer is an application which compresses individual frames of video. It is intraframe compression method. It is easy to implement with well developed libraries. MJPG is used in digital cameras, webcams. it is supported by web browsers like Google chrome, Mozillafirefox, etc.
6. CMake :- CMake is the command line interface and open source system which manages build process, build automation, testing. CMake generates a build environment that compiles source code and creates libraries. It Is use to configure projects in scripts.
2. Face Recognition:- Face Recognition is a python library it works around dlib’s facial recognition functionality. It was created by Adam Geitgey. It is used in real time face recognition ad used to find faces in images and videos.

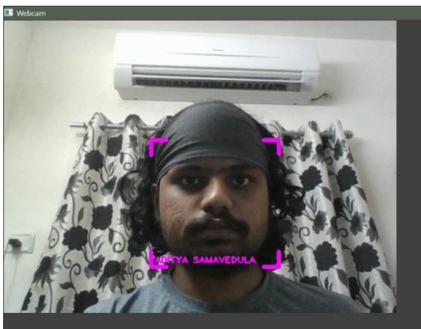
3. Twilio:- Twilio is an Application Programming Interface which is used to interconnect the internet and telecom network. It uses advanced features to send the messages to users efficiently globally.
4. Noip2 DUC: - Noip is a Free Dynamic DNS service, it is used to access our Live Stream over the Internet.

5. RESULT:

The prototype of Smart Surveillance and Alert System has been designed, in which a specified region is monitored and streamed continuously using mjpg-streamer. The algorithm continuously searches for the faces present in its database. In case of a match, the algorithm sends an alert to the system and records the name as well as time of arrival in a .csv file. This causes the Twilio SMS service to send message to the pre-coded numbers. This message contains the link of the live feed from the camera as well as the name of the Person Identified by the system. The recorded footage and message is shown in the figure below



Sent from your Twilio trial account - Hey! You got a Visitor(ADITYA SAMAVEDULA). For Live feed visit- <http://192.168.0.106:8080/?action=stream>



6. CONCLUSION:

A Smart Surveillance and Alerting System prototype is used to monitor a Working place in real-time with the end- goal of creating a self-aware system that requires minimum training and is accessible from anywhere. Our Prototype monitors the region and as soon as a person is detected on the screen a message containing the Visitors' names as well as a link to the camera feed is sent to the user. The functions of Detection, display, streaming as well as messaging through python is carried out in the Raspberry Pi. The parameters as well as the training system are easy to use and update. When required, the data (name of visitor as well as the time of arrival) is stored in a .csv/.xml file in the SD card, which can be accessed later for documentation. As a result, the system creates its own database for future reference.

7. FUTURE SCOPE:

Facial recognition based security systems have the potential to attract high number of users as it has multiple applications some of which are: to verify duplicate voters, verification of passports and visas, driving license, etc. The global powers like USA and China are investing huge revenues in developing their network for using face recognition.

In the near future face recognition technologies will be used in international airports for recognition and registration of visitors. Face recognition systems will not only be used for security purposes but also for the effective management in education and healthcare sectors.

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