

Automated Home Surveillance System using OpenCv

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Abstract The idea is to automate the home surveillance system by making the cameras smarter. The system aims at building a notification system that alerts the residents of the house about any intruder that gets detected in the cameras . The primary goal of the system is to train the system with the faces of the residents of the house , so that it can easily detect intruders after that . On detection of intruders , an SMS message will be sent to the residents of the house , enabling them to take measures well in time. This system will result in better home surveillance than existing one. It uses OpenCV library and KNN algorithm for the implementation of the same. The notification system is implements through way2sms in real time. It is used to send real time sms to the residents of the house informing them about the intruders.

Index Terms- facial recognition; intruder detection, knn algorithm, open CV.

I. INTRODUCTION

The crime rates are increasing day by day. Ignorance of people towards home security may lead to theft or burglary causing financial and emotional losses.

Many researches have proved that alarm systems that alarm systems help deter burglars. Another research conducted by the University of North Carolina proved that intruders would be hesitant to enter a home fitted with a security system.

. These figures reflect the effectiveness of home security systems.

Now the question is how to maintain an effective security system as Keeping a watch at your home in your absence is really tough. Installing of camera is not enough o avoid the criminal activities. The constant monitoring is not possible in day to day life. To overcome this problem a smart way of keeping surveillance at homes needs to be developed.

The Objective of home surveillance system is to develop a smarter and efficient system that notifies the house owner upon intruder detection, where the system is trained to recognize family members and hence detect intruders.

Once the intruder is detected the system will send a notification to the house owner via sms/Email This system provides Real time monitoring.

1.1. Preparation of data set

First step in development of efficient home surveillance system involves preparing a dataset that contains pictures of family members so that facial recognition model can recognize family members and hence detect intruders.

The bigger the data set higher will be the accuracy of facial recognition model.

1.2. Intruder detection

Once the data set is prepared and the model is trained to recognize family members it can easily detect a face which is not present in it's data set and term it as an intruder

1.3. Notification system

Once the intruder is detected an instant sms is sent to the house owner . As constant monitoring of web cam recording is not possible in day to day life ,this system optimizes the web cam monitoring by catching attention of the house owner only when an intruder is detected. Features of this system can be further extended by introducing additional hardware and making the system capable of sending the video of activities of intruder to the house owner in real time.

The development of this project will lead in building a smarter system for monitoring the criminal activities, thefts etc. This system developed will play an important role over the existing system which requires a lot of human effort and constant monitoring, such systems often turn out to be inefficient as they are more helpful in the investigation purposes after the crime takes place and hence does not help in prevention of crimes. The system will be designed in such a manner that if the intruder is detected the information will be send to the owner of the house. This will keep the house owner updated ; lower down the occurrence of any type of attacks and also helps in preventing criminal activities such as theft, kidnapping etc.

II. OPEN CV FACE DETECTION USING HAARCASCADE

Object detection based on har cascade classifier is very effective. Machine learning is the basic foundation of Cascade function which is trained from a set of varied images

our basic requirement involves facial detection. first step involves the algorithm requiring set of images with faces and then det of images without faces so that further features can be extracted in the second step we deduct the total of pixels within white rectangle from the total of pixels within black rectangle which together constructs a feature weighted total of weak classifiers construct the strong classifier It is known as weak classifier because it is incapable of classifying an image when kept alone but along with others form a strong classifier

It is a very tedious method and requires a lot of time as we take 24*24 window and apply thousand of feature just to check of it is noise or face region. we propose a better solution as most of the region in an image is noise so we thought that it would be more efficient to know if a window is face or noise so that it can be discarded without being processed so that more time could be spent on processing face region. The window is processed and sent to second stage only if it consists of a face. the window which passes all the region is face training hence forth we can train our system to detect various objects like trees , human etc. using open cv.

The detailed process is explained below:

Here we will deal with detection. OpenCV already contains many pre-trained classifiers for face, eyes, smile etc. Those XML files are stored in opencv/data/haarcascades/ folder.

III. K NEAREST NEIGHBOR CLASSIFIER (KNN)

The K nearest neighbor (kNN) classifier is an extension of the simple nearest neighbor (NN) classifier system. non parametric decisions form the foundation of Database consisting of training images as compared with the query image on the basis of distance of it's features. Image contain the minimum distance from query image is considered as the resultant image. distance functions such as city block distance d1, Euclidean distance d2 or cosine distance dcos play significant role.

$$d_1(x, y) = \sum_{i=1}^N |x_i - y_i| \quad (1)$$

$$d_2(x, y) = \sqrt{\sum_{i=1}^N |x_i - y_i|^2} \quad (2)$$

$$d_{\cos}(x, y) = 1 - \frac{\vec{x} \cdot \vec{y}}{|\vec{x}| \cdot |\vec{y}|} \quad (3)$$

K sample images which are the nearest to the query image are used by knn algorithm. class ci consists of such samples. class cm consists of the query image conataining majority of occurrences among the k samples Value of k along with total no of sample and their topological distribution palys a major role in the performance of knn classifier. knn is wiely used classification problems.The most significant aspects to evaluate any technique are efficient interpretation of output, time required for calculation and the power to predict. K nearest neighbor process customs K adjoining models to the interrogation image. Each of these models fits to a branded class Ci. The interrogation image Iq is characterized to the class CM which has the popular of occurrences among the K models. The concert of the kNN classifiers vastly associated to value of the k, the number of the models and their topological distribution.

IV. CONVOLUTIONAL NEURAL NETWORKS

Well-organized organization images can also be attained by Convolutional neural networks built on deep artificial neural networks which are also proficient to perform object recognition within scenes. Various characteristics of graphic information such as expressions, individuals, thoroughfare signs, tumors, platypuses can be branded through this system. optical character recognition (OCR) are achieved by cnn in direction to digitize text and make natural-language processing probable on analog and hand-written brochures, where the images are cryptograms to be recorded.

CNNs can also be functional to sound when it is characterized visually as a spectrogram. More recently, convolutional networks have been functional unswervingly to text analytics as well as grid data with graph convolutional networks. The efficiency of convolutional nets (ConvNets or CNNs) in image acknowledgement is one of the key motives why the world has roused up to the worth of deep learning. They are running key fees in computer vision (CV), which has noticeable submissions for self-driving cars, robotics, drones, security, medical analyzes, and dealings for the visually impaired.

The task of aspect acknowledgment comprises Credentials of a person amid a digitalized image or a video setting. Processor claims proficient of accomplishment this task, branded as facial recognition systems, have been about for periods. The all-purpose impression of face recognition is detecting facial features by mining facial milestones and then associate to supplementary images by identical those features.

However, face recognition is still one of the most germane and challenging exploration areas in computer vision and pattern recognition due to distinctions in facial expressions, poses, and illumination.

For face recognition concluding CNN , stages to be taken are as follows:

1. Detect/identify faces in an image (using a face detection model).
2. Predict t face poses/benchmarks
3. Consuming data from step 2 and the authentic image, estimate face encodings(numbers that describe the face)
4. Equate the aspect encodings of branded faces with those from assessment images to state who is in the picture

V. INTRUDER DETECTION PROCEDURE

Intruder Detection is carried out using a face recognition system that is trained with the photos of the family members (residents of the house). It involves following steps :

1. Gathering of data: Collect the images contain face of the person to be identified.
2. Training the system: Train the system by feeding the data consisting information about the face and name of the person to identified.
3. Final Recognition: Test the recognizer by feeding new information which is not present in it is database to see if it is able to recognize them.

MANDATORY MODULES

Ingress the ensuing modules:

- cv2: This is the OpenCV module for Python implied for face discovery and face recognition.
- os: training directories could be easily read using this module
- numpy: open cv requires numpys arrays for facial recognition and they can be obtained using this module which converts python list into numpy arrays for the face recognition process.

1.4. Data Gathering

Preliminary stage involves detection of face in each image . Once, we contract the area of interest containing the face in the image, we will use it for working out the recognizer. For the resolution of face detection, we will routine the Haar Cascade given by OpenCV. The haar cascades that arise with OpenCV are placed in the /data/haarcascades> directory of your OpenCV installation.

We will practice haarcascade_frontalface_default.xml for detecting the face. So, we freight the cascade consuming the cv2.CascadeClassifier job which takes the path to the cascade xml file.

1.5. Preparing the data

Facial recognition in the image is done with the aid of CascadeClassifie.detectMultiScalefunction..TheCascadeCla

ssifier.detectMultiScale function yields a slope of faces. For respective face it yields a rectangle in the arrangement (Top-Left x pixel value, Top-Left y pixel value, Thickness of rectangle, Altitude of rectangle.). The constraints are:

1. image : Milieu of the sort CV_8U holding an image where stuffs are detected.
2. scaleFactor : Limitation requiring how much the image size is condensed at each image measure.

This scale aspect is used to produce scale pyramid as revealed in the picture. Presume, the scale aspect is 1.03, it means we're using a trivial phase for resizing, i.e. diminish size by 3 %, we grow the fortuitous of a corresponding size with the model for detection is found, while it's posh.

3. minNeighbors : Restriction stipulating how many neighbors each candidate rectangle should have to recollect it. This limitation will mark the class of the detected faces: complex value outcomes in less detections but with higher quality. We're using 5 in the code.
4. flags : Limitation with the equal gist for an old force as in the function cvHaarDetectObjects. It is not used for a new cascade.
5. minSize : Minutest probable object size. Objects minor than that are unheeded.
6. maxSize : Maximum possible object size. Objects larger than that are unheeded.

If faces are found, it yields the situations of detected faces as Rect(x,y,w,h).

1.6. Adding Labels to the data

Numeric labels are attached with the data of different persons and similarly the dictionary is prepared to assign names to those lables.In this example , we have used the images of 3 residents only .The data is reshaped to make the training easier and smooth.

numpy.reshape(array, shape, order = 'C') : shapes an array without changing data of array. It is used to flatten the data

Parameter :

a : array_like Array to be restructured.

newshape : int or tuple of ints

The original shape should be well-suited with the new shape. If an integer, then the outcome will be a 1-D array of that span. One shape measurement can be -1. In this instance, the value is anecdotal from the length of the array and lingering magnitudes.

order : {'C', 'F', 'A'}, voluntary

Recite the elements of a using this index order, and place the elements into the reshaped array using this index order. 'C' means to read / write the elements using C-like index

order, with the preceding axis index changing fastest, back to the first axis index changing slowest. 'F' means to read / write the essentials using Fortran-like index order, with the first index varying loosest, and the last index shifting gentlest.

Returns :

reshaped_array : ndarray

This will be a innovative sight object if probable; otherwise, it will be a duplicate. Note there is no assurance of the remembrance design (C- or Fortran- contiguous) of the reimbursed array.

VI. NOTIFICATION SYSTEM

The residents of the house are notified about the intruders through an SMS which is sent to their mobile phones . The way2sms library is used to send text messages . It takes the mobile no of the recipient and the message to be sent as input from the user Firstly the code logs in to <http://www.way2sms.com/> through the url provided by us in the code . Then the SMS is scheduled and a session is requested. The session headers are mentioned telling about the browsers compatible for the process , like here , the browsers compatible are : Mozilla/5.0 (Windows NT 10.0; Win64; x64) , AppleWebKit/537.36 (KHTML, like Gecko), Chrome/67.0.3396.99 Safari/537.36

The session is started and in the rest of the code , message length , login details and other parameters are checked before sending the SMS. Finally the session is logged out after succesfull msg delivery.

VII. CONCLUSION

Intruder detection has been performed through facial recognition using open cv. The model has been trained to recognize family members and hence detect intruders. KNN classification alorithm has been tested with different values of K to obtain accuracy in facial recognition. Moreover , the larger the size of dataset , the better is the training and better recognition . It can also be concluded that KNN has less accuracy in real time intruder detection on a small dataset. OpenCv haarcascade classifier works well for face detection. Notification system has been implemented using way2sms so that house owner receives a notification as soon as the intruder is detected. SMS messages are sent in real time without any delay .

VIII. REFERENCES

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