Automated Warehouse Security System Using Facial Detection based on Machine Learning

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Abstract: **-We now live in a world where everything is automated and linked to the internet. The Internet of Things, Machine–Learning and image processing, for example, are evolving daily. The security system in a Warehouse is a typical example of this transition, where an employee's presence can be recorded without traditional method of roll call. This in turn helps avoid consumption of time. Another cause for concern is that warehouse thefts have been rising rapidly over the years. In such circumstances, every owner of the warehouse should be concerned about taking security measures to safeguard its valuable inventory. In order to tighten up the security at the entrance and exit gates, a powerful access control system must be deployed.**

The first step before being able to do image analysis would be to take relevant frames from the video streams. This is crucial to a smart interactive device and requires extensive compression of the data to run the models on the features identified as most relevant. One also needs the device to identify and react to certain events (owner coming in, break-in etc.) through a frame by frame comparative analysis.

During the training stage of the machine learning model, a large training dataset of images is used, where different variations of a single image is considered with respect to exposure, angle, expression etc., A portion of the dataset is used for cross-validation of the training model. This cross-validation dataset provides a performance metric for the accuracy of the training model.

At the user end, a camera captures and acquires the person's image entering the door. This image is further processed and sent to a backend database for verification. The trained model compares the features of the captured image with the existing image in the database and checks if the features match. If they do, the system will allow the person in and if the features don't match, the system will alert the security management.

Keywords:**-Recognition, Detection, Security, Machine Learning, Warehouse**

I. INTRODUCTION

One of the most important things that have to be considered by smart home owners, offices, public buildings, laboratories, government buildings and security. Standard mechanical security system which is most commonly used utilizes a key card to open and close a door. Conventional systems are on the lower security side and are considered less effective as the user is required to open the door by first inserting the key's mother, then turning the key so that the door can be opened.

Several factors, like the ease of duplication of keys, prospect of losing a key, etc. attribute it to a lower level of security.

Protection of homes and institutions is guaranteed to some extent with the help of the available systems. However, this is not sufficient in the case of critical places like military offices and scientific laboratories. These places have valuable data and money hence. They require highly secure systems at every point in time to ensure protection.

Off late, there is a staggering need to make better security systems. Capturing the video stream, automatically detecting and tracking a human face and then recognizing the person's identity through the use of a camera to facilitate facial recognition is the proposal of this project. Human faces in the video frame are not always front facing, hence the method should be able to detect the face with an angle.

Facial datasets and training a classifier model after normalization, pre-processing and dimensionality reduction have to be dealt with before real-time recognition.

Series of problems that has to be countered under facial recognition in a sequential manner are:

1. Identification of all the faces by looking at a picture.
2. Recognizing that each face irrespective of the angle and bad lighting, is still a face.
3. Identify unique features of the face that can be used to tell it apart from the other faces by comparing the size of the eyes are, the length of the face, etc.
4. Finally, determining the person by comparing the unique features of the examined face to the database of the existing faces that are already known.

II. METHODOLOGY

A pipeline needs to be built which solves every step of the facial recognition individually and send the output of the present step to the next one.

Put differently, several machine learning algorithms will be combined.

It turns out that the estimations that appear self-evident to people like the shape of their hairline, doesn't truly make

sense to a machine looking at some pixels in a picture. Analysts have found that the foremost approach is to let the computer figure out the estimations to gather.

The deep learning algorithm is better at finding out the locations of a face that are required and necessary to measure. A Deep Convolutional Neural Network is the solution. The principal component analysis algorithm can also be used to classify the images and for the detection with the help of histogram of oriented gradients to process the images.

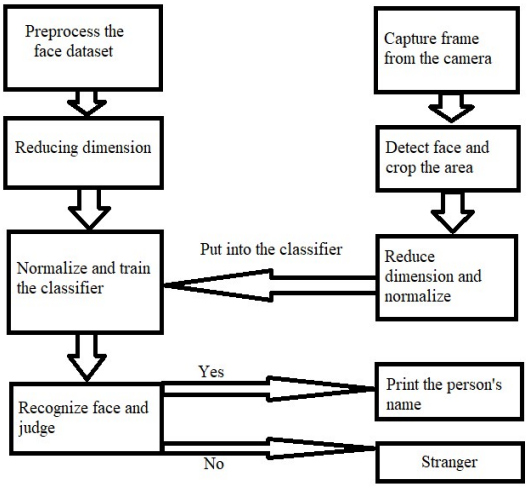

Fig. 1 Flowchart of making a predictive model

1. Pre-processing of the dataset.

The face dataset has to be preprocessed. The data has to be analyzed and screened in order for it to be contemplated by the model. The dataset needs to contain relevant information regarding the person required for the detection and recognition and hence it is labeled with the required information. The pre-processing stages the dataset in a clean format for the machine learning model to be trained on.

2. Reduction of Dimensions

The dimensions of images have to reduced or increased. The dataset has to be refactored in order for it to be in a normalized format. The images are either increased in dimensions or cropped to lower resolution. The images are normalized to meet a common set of rules to be fed into the model.

3. Normalize and Train the classifier

The images are reduced in dimensions in the previous step of the pipeline. This image data set in the form of arrays and matrices are normalized. This normalization converts the values in the array of dataset to fit into maximum and minimum limit. Normalization fits the data into a known range of values.

4. Detect face and Normalize

The images frames are captured from the camera. A detection algorithm is run on these frames.

This data now contains only the exact face dimensions of the captured images. These images are ready for recognition and can be fed into the classifier.

5. Recognition

The frames fed into the classifier are in the format of number arrays normalized into the required format. This data is compared with the previously trained dataset. The comparison uses a best match mechanism. It picks up the distance between the captured image and the dataset. Picking up the best match, the images are recognized. If the person is not recognized, the model raises an alarm.

III. CONCLUSION

Solving each step of facial recognition separately and passing the result of the current step to the next step can be accomplished by building a pipeline for which we need to chain together several Machine Learning (ML) algorithms.

Measurements like nose shape that seem obvious to humans does not make sense to a computer looking at individual pixels in an image. Letting the computer figure out the measurements to collect itself has been discovered to be the most accurate approach. When compared to humans, deep learning is more competent in figuring out which parts of a face are important to measure.

Training a Deep Convolutional Neural Network is the key solution. This process works by looking at 3 face images at a time:

1. First, a known person's facial image is loaded for training.
2. Second, another picture of the same known person is loaded.
3. Third, a picture of a completely different person is loaded.

Measurements generated for each of those three images is reviewed by the algorithm. Then the neural network is slightly tweaked so that it makes sure the measurements generated for 1 and 2 are slightly closer while measurements for 2 and 3 are further apart.

Once trained, the model can even be used to generate measurements for a face that it has never seen before.

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