International Journal of Research in Engineering, Science and Management
Volume-3, Issue-6, June-2020
www.ijresm.com | ISSN (Online): 2581-5792

Face Recognition Using Machine Learning

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***Abstract*: Face recognition is basically a technique that eyes to recognize human faces and acquire its use in different fields for example in security, diagnose diseases, smarter advertising, etc. Throughout the years this field evolved and there are many approaches and many different algorithms which aim to make the face recognition as effective as possible. The use of different approaches such as neural networks and machine learning can lead to fast and efficient solutions. This study is aimed to create a prototype system, that detects and identifies the faces from the digital images. The technology used in this study is Machine Learning through the python, which is the base of the whole developing prototype with the composition of the OpenCV and the NumPy.**

***Keywords*: Machine Learning.**

1. Introduction

Each face in this world has uniqueness. Therefore, it is an identity of humans. Human beings have the capability of recognizing a person or a face but the machine is not able to perform the task. Face recognition is an individual's understanding and interpretation of the face, particularly the human face, especially concerning the associated information processing in the brain.

The proportions and expressions of the human face are important to identify the origin, emotional tendencies, health qualities, and some social information. From birth, faces are important in the individual's social interaction. Face recognition is very complex as the recognition of facial expressions involves extensive and diverse areas in the brain. Sometimes, damaged parts of the brain can cause specific impairments in understanding faces.

The successful implementation of the Intended module is lying over the correct and proper way of the detection of the faces in the digital images. For the purpose of the detection of the face there is the use LBPH (Local Binary Patterns Histograms), as it detects the face by trying to cover its local structure by comparing each pixel.

2. Literature Survey

Wael Abd Almageed et al. uses the newly learning model which was pose-aware deep learning model for the face recognition. In this attempt, for generating the multiple pose specific features, a face image is processed by several pose-specific deep convolutional neural network (CNN) models.

Since the author takes the advantages of the post specific CNN features, there was a reduction in the sensitivity of the recognition system to the pose variations. On the basis of performance of the recognition pipeline, CNN layer selection and pose model selection were performed. This novel representation achieves better results than the state-of-the-art on IARPA's CS2 and NIST's IJB-A in both verification and identification task.

Whereas, R.C. Gonzales and R. E. Woods were presented a different approach for the facial expression recognition which was also based on the neural network ensemble. In this approach there was extraction facial expression features to a great degree through multi-expression eigenspace analysis. And, after all that there was a training of several neural networks having eigenspace of different expressions.

Wright J. and Yi Ma and Mairal, J. and Sapiro, G. and Huang, T.S. and Shuicheng Yan had more emphasis on local features analysis for robust face recognition by using LFA. Only those features are pointed in the face which shows highest deviation from statistically expected face are extracted from the image. A triangle inequality based punning algorithm was developed to increase the performance and speed up the matching between the query features and the database of the model features.

Deep learning provides a natural way to obtain feature representations from data without relying on hand-crafted descriptors. Chen, Xue-wen, Melih Aslan, Kunlei Zhang, and Thomas Huang produces generically descriptive yet class-specific features, by deep feature analysis using unsupervised and supervised learning in a cascaded fashion. The method provides the full benefits of the availability of large-scale unlabeled data and learn discriminative and generic features which are supervised and unsupervised respectively. Then for obtaining multi-channel deep facial representations for face recognition, it is applied on the multiple essential facial regions. The efficiency is applicable on both the type of face benchmark databases whether it is controlled or uncontrolled.

By using the technique of pattern recognition, image processing and computer vision, a real time face recognition technique can be developed through the neural networks. This

was carried by the Fazl-Ersi and E. Tsosos.

By compositing real face images in a given dataset, Guosheng Hu and Xiaojiang Peng, proposed a function which result into the generation of training datasets of synthetic images in a great degree. They proved that, this function made us learn from 10,000 training images, which performs with models trained from 500,000 images. By using this approach, they also obtain result state-of-the-art on the CASIA NIR-VIS2.0 heterogeneous face recognition dataset.

3. Proposed Work

Our objective is to make a system that will use computer vision techniques to automatically detect and identify faces from digital images. The identification and recognition is based on prominent facial features such as region of the eyes, face shape etc. We are trying to build a fast and efficient face recognition system that detects faces very quickly in cluttered backgrounds. We want to minimize the effects of unwanted objects in the real time environment. Once the face detection part is done, our next motive is to train our system with sufficient images. For each image, a feature vector is to be computed.

Phase 1: Dataset and Data Gathering:

This step involves gathering face data of the persons you want to identify. The first hurdle is to detect faces from given images. A proper dataset is required to train the algorithm properly before we use it for recognition purposes. The perfect dataset for this particular problem would be a large repository of images with variation in terms of age, ethnicity, image background, and accessories such as eyeglasses, sunglasses, hats, etc. We used both a manually created set of images and Labeled Faces in the Wild (LFW) dataset designed for studying the problem of unconstrained face recognition. The size of the dataset is 173MB and it consists of over 13,000 images of faces collected from the web.

Phase 2: Training and Recognizer:

This step involves feeding the face data and respective names of each face from the dataset to the recognizer so that it can learn. We use three different recognizers: Eigen Faces, Fisher Faces and Local Binary Patterns Histograms one by one. These uses different processes to read training images for each person/subject along with their labels, detect faces from each image and assign each detected face an integer label of the person it belongs to.

Phase 3: Recognition:

In this step, new images of the faces of people used to train earlier are used. Test dataset is the sample of data used to provide an unbiased evaluation of the recognition model. Then we verify if the recognizer can accurately recognize the faces and assign them the correct person's label.

4. Implementation

A. *Code Dependencies*

a) OpenCV 3.2.0
b) Python v3.5
c) NumPy

B. *Required Modules*

a) cv2: This is the OpenCV module for Python used for face detection and face recognition.
b) os: We will use this Python module to read our training directories and file names.
c) numpy: This module converts Python lists to numpy arrays as OpenCV face recognizer needs them for the face recognition process.

The system has basically three sections that is, prepare training data, train face recognizer and the last one is prediction.

During the session of preparing of training data, it is beneficial to have as much as data for the training purpose. We use labeled data of each person, so that training of the model is get quite easier. We form a subfolder for every person images which are properly labeled. Considering that the OpenCV face recognizer only accepts labels as integers, we need to define a mapping between integer tags and the person's actual name.

Now, during the train face recognizer, we are using the LBPH recognizer. After that the last part will be the prediction. This is where we get to see if our algorithm is recognizing our individual faces or not.

We're going to take one test image of each person, use face detection and then pass those faces to our trained face recognizer.

5. Conclusion

Face recognition technology is one of huge importance and is being widely used around us, from mobile phones to biometric systems. Efforts are ongoing to improve the ease of use, accuracy and reliability of the technology. While several models for face recognition exist, such as geometric, template-based and statistical approach based models, it has been found out that machine learning neural network implementations such as the one used in this project turn out to be the best. We can broadly say that in this approach we let the computer learn how to distinguish between faces on its own by seeing a variety of pictures. Research work on the various problems and proposed solutions of Facial Recognition was done in this project and a survey paper was proposed. We implemented an accurate and real-time executable face recognition system. New facial recognition technology represents huge perspectives and promises for future evolution.

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