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FACE RECOGNITION USING MACHINE LEARNING

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ABSTRACT

Facial recognition, a technique that utilizes various features of the face to verify and identify individuals, is becoming more popular in various industrial applications including security, surveillance, and access control. Due to machine learning's capability to learn complicated patterns from enormous datasets, it's an effective approach for facial recognition. The utilization of machine learning for face recognition is a methodology comprising three distinct stages: face detection, feature extraction, and classification. The first phase involves an algorithm that recognizes the facial features in a given image or video source. Following this, the feature extraction process identifies key geometric and textural characteristics from the detected face. Lastly, the extracted data is run through a classification algorithm to determine its corresponding class - usually ascertaining identity information. To address the challenge of recognizing faces accurately convolutional neural networks (CNNs), support vector machines, and random forests are some examples of machine learning algorithms that have been identified. CNNs are especially promising as they can identify hierarchical representations within images thereby providing better accuracy. With that said even though these modeling techniques show promise they still struggle with problems posed by uncontrolled lighting conditions, pose variations and occlusions. Moreover like any facial recognition technology needs to meet strict ethical standards because it also brings up privacy concerns. From healthcare to security and entertainment industries, facial recognition powered by machine learning is revolutionizing how we see automation. As datasets grow larger and more sophisticated algorithms emerge, we can expect further breakthroughs in this arena.

Keywords - Convoluted Neural Networks, Facial Recognition, Machine Learning, Support Vector Machine. OpenCV.

1. INTRODUCTION

The last few decades have witnessed considerable advancement in facial recognition technology, with researchers working on methods to recognize faces under low-light conditions and various expressions. Notwithstanding these developments, establishing a dependable method for face recognition remains an uphill task within more demanding settings characterized by overdone options that are heavy on resources. However, thanks to the rapid progress made with artificial intelligence (AI), face recognition has evolved into a reliable identification option that outperforms other biological authentication alternatives. One advantage is that it operates flawlessly without preliminary acquaintance with the subject. When it comes to verifying one's identity online, facial recognition and detection are widely used. These technologies are also used in smartphones for face unlocking and in bank self-service machines to keep tabs on users. Facial detection and recognition technology are responsible for making our lives a little bit easier by speeding up processes and adding some technological fun to them. It works through a two-step process, beginning with facial detection which is critical in the face recognition process. As after detection of face, the basic

question that arises is “to whom this face belongs to”. This problem is solved via face recognition process by evaluating through four stages like detection, feature extraction, tracking & recognition.

The method with the help of python and OpenCV in deep learning is the most effective way for to detect the person's face. This method is useful in many fields like military, security, schools, colleges and universities, airlines, banks, online web applications, games, etc. as this system uses the powerful Python algorithm to make face detection and recognition easy and effective. When the system detects a face, it generates a sub-image and this sub-image is scaled so that the face appears in the center and is presented at a uniform size. OpenCV already provides an algorithm to locate faces.

2. BACKGROUND LITERATURE

➢ *Face Tracking*

The purpose of this algorithm is to sense the face in real time and tracing the same objects. Here, we use training sample images of another object of our choice to detect and track with the training classifier. Face tracking is part of the face recognition system. Here we can use several system algorithms to extract specific feature of human face.

➢ *Face Detection*

In Face tracking, this face detection process actually checks whether image is an image of a face. The search process actually works on the Haar Cascade Classifier. Object detection using the Haar feature based classifier is an efficient object detection method proposes by Paul Viola and Michael Jones. **This** is **a** machine learning approach where the cascade Function is trained on images. It is used to detect objects in different images.

➢ *Haar Cascade Classifier Features*

In Face Detection, we had calculated that the first selected feature appears to be the focus on the property that the eye region is often darker than the nose and cheek regions. The second selected feature is based on the eye feature that is darker than the bridge of the nose. However, you don’t need the same window applied elsewhere as the ball. A facial recognition system captures facial features images detects, retrieve, stores and matches. However, it is difficult to lay wires in places where the terrain is not good. This system is proposed based on the real time face recognition that is reliable, safe, fast and needs improvement under different lighting conditions.

3. METHODOLOGY

The system comprises of two phases first is the training phase in which training of machine learning models happens and next is the testing phase in which testing of trained models and evaluation of their performances happens. Firstly, the environment for the system is created and all the necessary libraries are installed. The libraries that are necessary for the system are NumPy for numerical calculation, pandas for the dataset creation and data operations, seaborn for data visualization, skLearn for machine learning algorithms instances, OpenCV for computer vision tasks and CNN(Convolutional neutral Network) for image classification tasks.

After the environment creation, data collection is done; hence open-source data is used. The data is in image format hence it is taken and fed to the next part of the system. The image is then passed to the media channel for facial feature estimation; which then detects the 33 key points in a given frames and provides the visibility value to the 3-D coordinate value of these key points. These 33 key points form the basis of a new dataset, and each key point coordinate and visibility become a feature of the new data set. It then applies data pre-processing techniques to clean the data and make everything suitable for a machine learning model. Normalization is applied to the data set for data pre-processing**.** Normalization is the process of ensuring that all values in a data set are between 0 and 1**.** The main reason for this is that some machine learning models need normalized data to work efficiently and get good results. Then, feature engineering is used to derive new features from the existing features in the dataset. For this, we converted the key points to vectors**.** This vector represents a 3-D face features, and these vectors are used to calculate the feature

measurements. Finally, all processed data is passed to a classification-based machine learning algorithms for training. Test data must be acquired/ generated first**.** This data must be new and should not consist of redundant data in the training phase. We tried to compare various classifiers for the classification of facial features. These classifiers include Ridge Classifier, Logistic Regression Classifier, Gradient Boosting Classifier, Random Forest Classifier, and KNN Classifier. These methods of classification have aided in providing the best outcomes with increased accuracy. Web scraping has been used to collect the dataset. The aim was to collect the photographs in a way that would yield the best results.

4. MODELING AND ANALYSIS

Model training: Once data analysis is complete, it is the time to train the data using classification- based machine learning algorithms. Therefore, the system uses five machine learning algorithms: Logistic regression, Random Forest Classifier, Gradient Boosting Classifier, K - Nearest Neighbor Classifier and Ridge Classifier. Accuracy is used as an evaluation criterion to evaluate machine learning models.

A classification model was created to accurately recognize the person. It is proposed to evaluate the efficiency of classification algorithms. For all approaches we used, this was done with the confusion matrix. This project includes many aspects subdivided into different modules and components. This project was created as a result of integrating these elements at several levels.

***Collecting Dataset*:** We have obtained the dataset with the help of web scraping. We manually cleaned the data set to improve it. If the images were not good, they were discarded. If the requirements are met, the image is loaded into the dataset. Data set cleaning can also be done using a variety of methods.

***Creating Landmarks*:** Algorithm execution was characterized by the creation of landmarks. The designated landmarks were occupied with the help of the media pipe. If found, the CSV file will contain the landmarks. Exception handling can handle missing landmarks.

Applying Algorithms: Logistic Regression, ANN Classifier, Gradient Enhancement, Random Forest Classifier and Ridge Classifier are the top five techniques used. For best results, we used all of these classification techniques when building the model. Each of these algorithms was applied separately to the model. Additionally, the algorithm that showed the best result was used.

Best Model Selection: A combination of many algorithmic parameters were used to select the best model. This yielded many results and Gradient Boosting is the most appropriate classification strategy based on the best results so far.

5. RESULT

This method allows the computer to understand the images by recognizing the visual elements and noticing the patterns that occur by relying on a large database. It can also return “no match” if the similarity is below threshold. The use of neutral networks for face recognition is demonstrated, where we can see a proposal for semi supervised learning method using support vector machines for face recognition. The recognition system works simple and effectively. Thus, it can be said than an image of the original face can be reconstructed form the native interface if unique features of the face are added in the correct proportions. Each face exhibits only certain facial features that may not be present in the original image.

6. CONCLUSION

As we enter to the Fourth Industrial Revolution, we can be sure that everything revolves around technology and automation. We are observing changes in the industry that requires technological advances. These developments not only changed the way companies operates, but also changed our daily lives into daily lives. Powerful data protection methods to ensure that no criminals have access to sensitive information to aid forensic investigation. We’ve experimented with different methods in this project and all those face recognition methods have worked well. The Face recognition system is based on face recognition. This system can be used to identify the unknown persons. This is simple, efficient and saves time and money. With the machine learning algorithm. The system is simpler and more reliable and anyone can make it according to their requirements.

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