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Face Recognition Using Transfer Learning

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ABSTRACT: Transfer learning is a machine learning method where a model developed for a task is reused as the starting point for a model on a second task. It is a popular approach in deep learning where pre-trained models are used as the starting point on computer vision and natural language processing tasks given the vast compute and time resources required to develop neural network models on these problems and from the huge jumps in skill that they provide on related problems. It is a research problem in machine learning that focuses on storing knowledge gained while solving one problem and applying it to a different but related problem. The main motto of transfer learning is to take a model trained on a large dataset and transfer its knowledge to a smaller dataset. We will see in depth in this paper.

KEYWORDS: Face Recognition, Transfer Learning, neural networks, machine learning.

I. INTRODUCTION

Recently, face recognition is attracting more attention in the society of network multimedia access. Areas such as network security, context indexing and retrieval, and video compression benefit from face recognition technology. Network access control via face recognition not only makes hackers virtually impossible to steal one's password but also increases the user-friendliness in human-computer interaction. Face recognition is an image processing technique which aims to identify human faces and has found its use in various different fields for example SECURITY. Throughout the years this field evolved and there are many approaches and many different algorithms which aim to make face recognition possible. The whole process of facial recognition is a difficult task and requires a lot of computations. The face recognition is divided into two basic steps. In the first step, the face recognition algorithm must identify the face and in the second step, the algorithm extracts important features used to identify the face. In this chapter, we present a brief overview of face recognition in the background section, relevant works to our project with their advantages and disadvantages, how we relate to these studies and how this project can provide some beneficial features for any normal user to keep their data safe and secure.

The paper is organized as follows. Section II describes automatic text detection using morphological operations, connected component analysis and set of selection or rejection criteria. The flow diagram represents the steps of the algorithm. After detection of text, the text region is filled using an inpainting technique that is given in Section III. Section IV presents experimental results showing results of images tested. Finally, Section V presents the conclusion.

II. RELATED WORK

There are many different algorithms used for face recognition. These algorithms for face recognition can be divided into different categories as:- 1. Geometric feature based methods 2. Template based methods 3. Correlation based methods 4. Matching pursuit based methods 5. Singular value decomposition based methods 6. The dynamic link matching methods 7. Karhunen-Loeve expansion based methods. However, among all of this, the efficient and perfect result is calculated by using transfer learning. As mentioned, the face recognition methods are often computationally complex operations and performing them takes a lot of computational power and energy^[2]. Moreover, recently the face recognition is more often applied on devices which require lower power consumption such as mobile phones, where machine learning, deep learning are quite lengthy and high power consuming approaches. To reduce this to a certain level Transfer Learning is useful for face recognition.

The work in this project is divided into 4 parts (1) Face Detection: Haar Cascade Algorithm:- It is an Object Detection Algorithm used to identify faces in an image or a real time video. The algorithm uses edge or line detection features. It is a machine learning based approach where a cascade function is trained from a lot of positive and negative images. It is then used to detect features in other images. all possible sizes and locations of each kernel are used to calculate lots of features. (Just imagine how much computation it needs? Even a 24x24 window results over 160000 features). For each feature calculation, we need to find the sum of the pixels under white and black rectangles. To solve this, they introduced the integral image. However large your image, it reduces the calculations for a given pixel to an operation involving just four pixels.^[6]

(2) Analyse Facial Features: Feature Based Face detection Method:- The feature-based method is to locate faces by extracting structural features of the face. It is first trained as a classifier and then used to differentiate between facial and non-facial regions. The idea is to overcome the limits of our instinctive knowledge of faces. This approach divided into several steps and even photos with many faces. It report a success rate of 94% accuracy.

(3) Train the model: After successfully extracting the features, the training process comes into the picture. For the recognition of authorized person, the model is trained such that it do not recognize the false images and predict the result. This training is carried out using Keras module which open to use and free of cost. In keras, there are some pre-trained models, out of which VGG16 is used in this project. All the upper 14 layers, out of 16, are kept as it is and the last 2 layers are modified to get the desire output.

(4) Face Recognition:Comparing faces with the Trained Model:- Now, we have trained model for the faces from image stored in dataset. We just have to predict, comparing it with the pre-trained model, whether the person is authorized or not. We can do that with basic machine learning classification algorithms. We will use a Haarcascade Classifier. Other classification algorithms also can work, with TRANSFER LEARNING, haarcascade works more efficiently. We have to train classifier that can take measurement from new image and predict whether the person is authorized or not. Running this classifier takes milliseconds.

Each input feature is connected to each neuron in the hidden layer, the total number of connections is the product of the input feature size (m) and the hidden layer size (n). Since each connection is associated with a weight parameter, the number of weight parameters is $m \times n$. Each output neuron is associated with one bias parameter, hence the number of bias parameters is n. The total number of trainable parameters = $m \times n + n$.

Convolutional neural networks have two special types of layers. this shrinks the size of the image. If the filter were to pass over an border pixel say (0, 1), then there would be no output, since this pixel would not have neighbours for the convolution to go through. This would appear as a blacked out border around the image of width $k/2$. When a convolution filter of size $k \times k$ is passed over an image of size $n \times n$, then the output size becomes $n-k+1$.

VGG16 is a convolutional neural network model proposed by K. Simonyan and A. Zisserman from the University of Oxford in the paper "Very Deep Convolutional Networks for Large-Scale Image Recognition". The model achieves 92.7% top-5 test accuracy in ImageNet, which is a dataset of over 14 million images belonging to 1000 classes. It was one of the famous model submitted to ILSVRC-2014. It makes the improvement over AlexNet by replacing large kernel-sized filters (11 and 5 in the first and second convolutional layer, respectively) with multiple 3×3 kernel-sized filters one after another.^[7]

Advantages of transfer over traditional learning:-

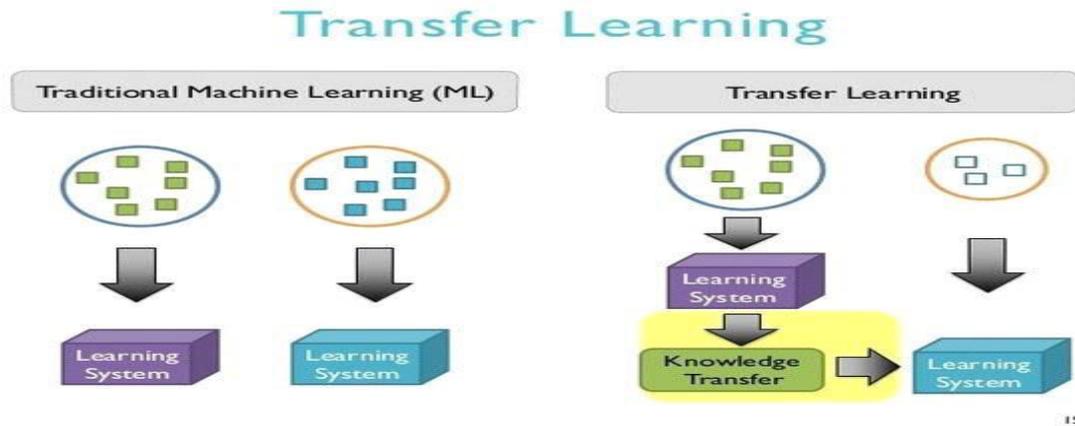


Figure 1: Advantages of transfer learning over traditional learning

The Structure of VGG16:-

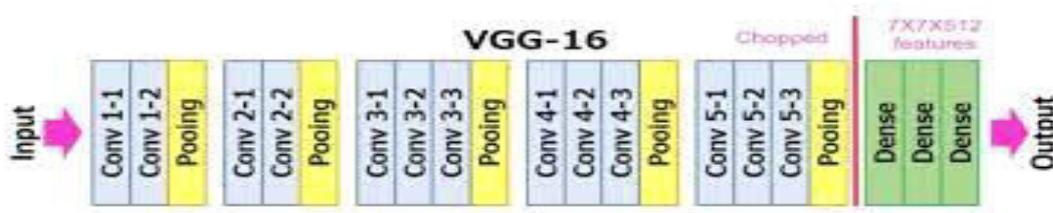


Figure 2: Structure of VGG16

III. METHODOLOGY

Algorithm for generating of attendance after registering students and uploading a image as:

1. Get the real-time images of user and store it in separate folder.
2. Train the model using stored data.
3. Encode the detected faces.
4. Generate result for face with trained model.
5. Compare the face with the trained model.
6. Predict whether the person is valid user or not.

IV. CONCLUSION

. In this approach, a face recognition using transfer learning is thoroughly described. Thus this system has proved that it is important and secured. The system can be easily accessed and used on any computer. For face recognition haar cascade method is used. The proposed approach provides a method to identify the individuals by comparing their input image obtained from real-time images captured through camera with respect to train model. The access to the system is determined as, the percentage of the person trying to access the system, is high. Every time the user has to verify the id password along with the facial recognition.



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