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A Survey Paper on Gender Classification using Deep Learning

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ABSTRACT

With technological advancements many small to large, simple to complex activities are automated. Growth of Artificial Intelligent techniques has eased the way we would look to solve the real-world problems. One such area which has recently gained lot of attention is the biometric analytics like Face Recognition, Fingerprint, voice etc. It involves extracting features such as face expressions, gender, age etc. Gender information plays a vital role in areas such as human computer interaction, crime detection, gender preferences, facial biometrics for digital payments etc. This paper proposes gender recognition using facial images and fingerprints with different algorithm like Visual Geometry Group-VGGNet16‖, Segmentation based Fractal Texture Analysis (SFTA) etc.

Keyword: - Gender Identification, Biometrics, Face Image, Fingerprint, SFTA, SVM, CNN.

I. INTRODUCTION

Identifying human's gender based upon their biometric traits, such as fingerprint, palm print, face, gait, iris and voice plays a vital role in forensics application and has now become an important area of research in biometrics. Now-a-days e-security is in acute need of finding accurate, secure and cost-effective alternative to password and personal identification. As the saying goes —Face is the index of mind‖, human face can depict many characteristics such as ethnicity, gender, age, emotions etc. Facial analysis has recently gained lot of attention from research fraternity. Undoubtedly fingerprint biometrics is one of the most reliable and viable solution for all these problems. A person's fingerprint data is distinctive and cannot be relocated. A successful gender classification approach can boost the performance of many other applications including face recognition and smart human-computer interface. Face recognition, expression identification, age determination, racial binding and gender classification are common examples of image processing computerization. Gender classification is very straightforward for us like we can tell by the person's hair, nose, eyes, mouth and skin whether that person is a male or female with a relatively high degree of confidence and accuracy; however, can we program a computer to perform just as well at gender classification? The conventional sequence for recent real-time facial image processing consists of five steps: face detection, noise removal, face alignment, feature representation and classification. With the aim of human gender classification, face alignment and feature vector extraction stages have been re-examined keeping in view the application of the system on smartphones.

II. LITERATURE REVIEW

2.1 Features and Synthesis Classifiers for Gender Classification using Fingerprints.

The objective of this work is to study the impact of feature level fusion and synthesis of classifiers for gender classification using fingerprints. Initially, feature level fusion of Multi-Block Projection Profiles features and Segmentation based Fractal Texture Analysis (SFTA) features are extracted for a single instance of fingerprints. Further, along with the feature level fusion and synthesis of classifiers on fingerprint have been piloted and the experiments are conducted accordingly on four different Homologous fingerprint databases. The results reveal that feature level fusion with synthesis of classifiers greatly improves the efficiency of gender classification over the non-fused and single classifier and outperforms the earlier reported techniques. [1]

2.2 A Real Time Gender Recognition System Using Facial Images and CNN.

With technological advancements many small to large, simple to complex activities are automated. Growth of Artificial Intelligent techniques has eased the way we would look to solve the real world problems. One such area which has recently gained lot of attention is the facial analytics. It involves extracting features such as face expressions, gender, age etc. Gender information plays a vital role in areas such as human computer interaction, crime detection, gender preferences, facial biometrics for digital payments etc. This paper proposes an improved Convolutional Neural Network (CNN) framework for real time gender classification from facial images. A pretrained model Visual Geometry Group ―VGGNet16‖ is used. It loads image datasets consisting of male and female images and trains consistently for 16 hours. Haar Cascade classifier is used to classify images based on facial traits. The proposed architecture exhibits a much reduced design complexity as compared to other CNN solutions applied in pattern recognition. A recognition accuracy of 90% was achieved with this method. [2]

2.3 Estimation of age groups using facial recognition features.

Facial recognition has been used to detect emotions, gender, expressions and identity. These topics have been extensively studied. But, automatic Age Estimation is a topic that has not been researched much. The basis of our topic is that there are features on the human face that change as our age increases and in our project we utilize these features for age group classification. We classify the images into 6 age groups- (0-6, 8-12, 15-20, 25-32, 38-53, 60-100). The process involves 3 stages:-Pre-processing, Feature Extraction, Classification. Preprocessing includes commotion decreasing, standardization and change of the crude information into structure that is suitable for the pattern recognition. A small set of good features is selected from the available features, in order to provide best matching information. This process discovers important features to obtain an effective and improved answer for a given problem which is the next step. At last the classification or clustering stage is performed. Classification comprises of allotting a class mark to a given pattern while clustering discoveries homogeneous small groups in information. We also deal with comparison study of various feature extraction techniques (Haar feature extraction, HOG feature extraction) and classification techniques (Naïve Bayes, SVM, KNN, Neural Network-Back propagation algorithm) and finally try to determine the best possible combination for age group classification. Convolutional Neural Networks is also applied to estimate the age groups. [3]

III. DIFFERENT METHODOLOGY

3.1 CONVOLUTIONAL NEURAL NETWORKS

Convolutional Neural Networks (CNNs) is the most popular neural network model being used for image classification problem. The big idea behind CNNs is

that a local understanding of an image is good enough. The practical benefit is that having fewer parameters greatly improves the time it takes to learn as well as reduces the amount of data required to train the model. Instead of a fully connected network of weights from each pixel, a CNN has just enough weights to look at a small patch of the image. It's like reading a book by using a magnifying glass; eventually, you read the whole page, but you look at only a small patch of the page at any given time.

Consider a 256 x 256 image. CNN can efficiently scan it chunk by chunk — say, a 5 × 5 window. The 5 × 5 window slides along the image (usually left to right, and top to bottom), as shown below. How "quickly" it slides is called its **stride length**. For example, a stride length of 2 means the 5 × 5 sliding window moves by 2 pixels at a time until it spans the entire image.

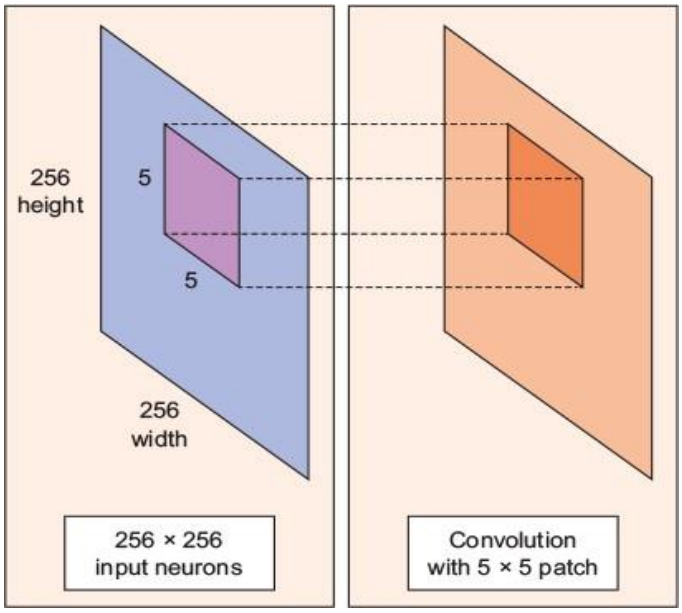

Figure-1 : CNN 256 X 256 Image

A **convolution** is a weighted sum of the pixel values of the image, as the window slides across the whole image. Turns out, this convolution process throughout an image with a weight matrix produces another image (of the same size, depending on the convention). Convolving is the process of applying a convolution.

The sliding-window shenanigans happen in the **convolution layer** of the neural network. A typical CNN has multiple convolution layers. Each convolutional layer typically generates many alternate convolutions, so the weight matrix is a tensor of 5 × 5 × n, where n is the number of convolutions.

As an example, let's say an image goes through a convolution layer on a weight matrix of 5 × 5 × 64. It generates 64 convolutions by sliding a 5 × 5 window. Therefore, this model has 5 × 5 × 64 (= 1,600) parameters, which is remarkably fewer parameters than a fully connected network, 256 × 256 (= 65,536). The beauty of the CNN is that the number of parameters is independent of the size of the original image. You can run the same CNN on a 300 × 300 image, and the number of parameters won't change in the convolution layer.

3.2 NAÏVE BAYES

Naive Bayes is a simple technique for constructing classifiers: models that assign class labels to problem instances, represented as vectors of feature values, where the class labels are drawn from some finite set. It is not a single algorithm for training such classifiers, but a family of algorithms based on a common principle: all naive Bayes classifiers assume that the value of a particular feature is independent of the value of any other feature, given the class variable. For example, a fruit may be considered to be an apple if it is red, round, and about 10 cm in diameter. A naive Bayes classifier considers each of these features to contribute independently to the probability that this fruit is an apple, regardless of any possible correlations between the color, roundness, and diameter features.

For some types of probability models, naive Bayes classifiers can be trained very efficiently in a supervised learning setting. In many practical applications, parameter estimation for naive Bayes models uses the method of maximum likelihood in

other words, one can work with the naive Bayes model without accepting Bayesian probability or using any Bayesian methods

A Naïve Bayes classifier is based on Bayes rule and simple form of Bayesian network. It is a simple probabilistic model relies on the assumption of feature independent in order to classify data. The algorithm assumes that each feature is independent of presence or absence of other feature in input data as this assumption is known as „naïve".

Bayes classifier use Bayes theorem, which is

$$P(c/F) = \frac{P(F/c)\,P(c)}{P(F/c)}$$

P(c/F) = probability of feature F being in class c

P(F/c) = probability of generating feature F given by class c

P(c) = probability of occurrence of class c

P(F) = probability of feature F occurring In above context,

In above context, we are looking for class c, so we find probable class given for given feature, F. Denominator does not depend on class so we treat it as a constant. Numerator depends on class so we focus to determine the value of P(F/c).

3.3 Simple Vector Machine (SVM)

The one vs one strategy involves training a single classifier per class, with the samples of that class as positive samples and all other samples as negatives. This strategy requires the base classifiers to produce a real-valued confidence score for its decision, rather than just a class label; discrete class labels alone can lead to ambiguities, where multiple classes are predicted for a single sample. In pseudocode, the training algorithm for an OvO learner constructed from a binary classification learner L is as follows:

Inputs:

- ✓ L, a learner (training algorithm for binary classifiers)
- ✓ samples X
- ✓ labels y where yi ∈ {1, … K} is the label for the sample Xi Output:
- ✓ a list of classifiers fk for k ∈ {1, …, K} Procedure:
- ✓ For each k in {1, …, K}
- ✓ Construct a new label vector z where zi = 1 if yi = k and zi = 0 otherwise
- ✓ Apply L to X, z to obtain fk Making decisions means applying all classifiers to an unseen sample x and predicting the label k for which the corresponding classifier reports the highest confidence score: This trains K (K – 1) / 2 binary classifiers for a K way multiclass problem

IV. CONCLUSION

Gender Classification using Face recognition and finger print recognition system is a complex image-processing problem in real world applications with complex effects of illumination, occlusion, and imaging condition on the live images. It is a combination of face detection and recognition techniques in image analyzes. Detection application is used to find position of the faces in a given image. Recognition algorithm is used to classify given images with known structured properties, which are used commonly in most of the computer vision applications. The goal of this paper is to review the facial expression and finger print recognition system. On a basis of the extensive study of different approaches to the problem of face action representation, appropriate algorithm can be selected for each stage of a system.

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