GENDER IDENTIFICATION USING FACE IMAGES

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Abstract— *Gender classification is arguably one of the more important visual tasks for an extremely social animal like us humans—many social interactions critically depend on the correct gender perception of the parties involved. Many research studies have been conducted on face recognition to improve its accuracy since the first research. But face recognition still far from achieving accuracy that on par with human facial features and gender classification. However, all of them have still disadvantage such as not complete reflection about face structure or face texture. In general, gender classification in supervised learning setting requires extraction of features from face images, training classifiers using those features (eyes, nose and mouth) and finally performing classification of new faces. This work uses appearance-based approach with dimensionality reduction techniques for feature extraction. The features extracted from the training set are used for training KNN/SVM classifier. And finally images in the test set are classified using the classifier. Also we try to achieve much more accuracy than previous approaches. In this paper described two phases such as feature extraction phase and classification phase*

Keywords—Image Processing and computer vision,Feature Selection, Classification, Geometric Corrections, Edge Detection, Feature Measurement

INTRODUCTION

In previous years, we have seen lots of various feature extraction and pattern classification developed for gender identification. The upcoming applications and software designs of computer vision and pattern recognition in portable devices and networked computing require the optimal development of resource limited algorithms. The most crucial and valuable biometric feature of a human is his face. It gives us many useful information which includes gender, age, ethnicity, expression etc. many crucial and important applications such as human identification computer vision approaches for observing people etc. needs a correct, successful and reliable classification or identification methods. It is a very difficult job to differentiate between male and female. Thus it has become very important and necessary to have dependable and trustworthy classifier to enhance the identification performance.

METHODOLOGY

[1]This paper introduced the best gender classification algorithm in terms of identification rate. They used an appearance-based approach using support vector machine along with radial basis function (SVM+RDF). They claimed to have achieved 46.6% identification rate after classifying close to 2000 images from FERET database.

[3]In this paper an investigation of principal component analysis(PCA)for face identification with respect to sex, ethnicity, expression, age etc. is made. They found that these components can be introduced into very few instances of PCA components. So with respect to gender, they found width of eyes, size of lips, thickness of eyebrows and the human expressions much more useful.

[4]This paper showed that a system by studying on gender classification with automated detection and aligns faces. They tried to experiment with 120 combinations of automatic detection of face, alignment of face and identification of gender. They did this by using support vector machine and found that the success rate of their approach was 86%.

[7]This paper represented full body images in a fixed view (frontal or back) as a group of features to represent various parts of the body so as to give out information for the identification of gender. They built a learning algorithm to combine the acquired information and try to identify the gender. The best accuracy that they were able to achieve was approximately 75% for both fixed view and the mixed view.

ALGORITHM

In the proposed system we have tried to design and develop a software that will improve the efficiency and accuracy of identification of gender. In the previous system we have seen the use of MATLAB libraries, but in our proposed system we will be using EmguCV Library and Microsoft computer vision libraries along with various filtering techniques. Our approach is comprised of the following steps:

Step 1: Upload the image into the system and verify it according to the given rules. The size of the image must be at least 200 KB. The content must be a human face and the image must not be blurry.

Step2: Apply various pre-processing techniques in order to correct some inaccuracies in the image.

Step3: In this step we apply various filters to the image. Using this filter we create a ghost image of the image. These filters are used to detect various shaped and sizes of the human face at various places on the face. We used combination of different filtering techniques which includes Laplacian 3x3 and 5x5, Gaussian 3x3 and Gaussian 5x5, Sobe 13x3, Prewitt 3x3, Kirsch 3x3.

Step4: Apply edge detection techniques. Using this we detect the component on the face which are eyes, nose and the lips. Then with the combination of library functions and filters the weight of these detected components are calculated. Based on these values the gender is identified.

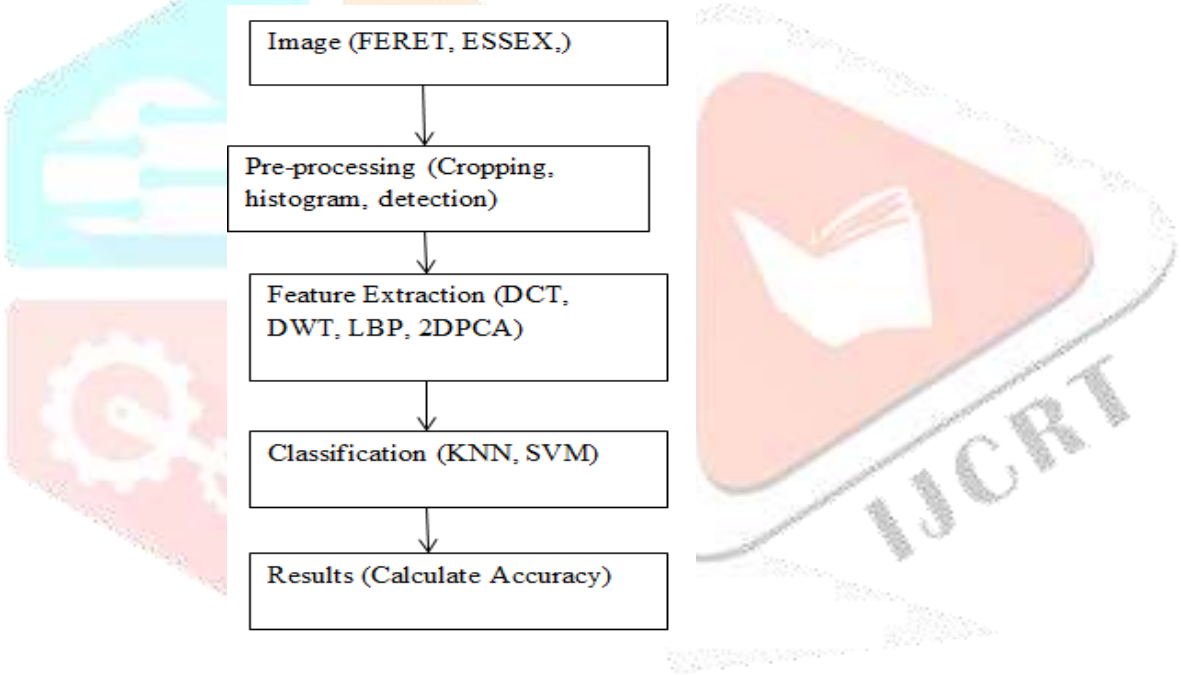

Fig. 1: Steps for Gender Identification using Face Images

KNN Algorithm[10]:

K-Nearest Neighbour algorithm is a very easy to use yet effective supervised learning approach. It classifies the object into a group of similar objects. It is the most widely used classification technique among the data scientist.

In short, this classifier is called as KNN Classifier. KNN solves the problem of classification and also helps in pattern recognition. Here KNN is being used to identify the features of the face while working with the filters. It classifies the face features as eyes, nose and mouth. And using this classification we can easily identify the face of the person.

In simple words KNN predicts the label given by the user to detect the nearest neighbouring class. The clas which is very much identical is identified using certain distance measuring algorithms like Euclidean distance.

KNN Pseudo code:

1. Calculate "$d(x, x_i)$" i =1, 2… n; where d denotes the Euclidean distance between the points.
2. Arrange the calculated n Euclidean distances in non-decreasing order.
3. Let k be a +ve integer, take the first k distances from this sorted list.
4. Find those k-points corresponding to these k-distances.

5. Let k_i denotes the number of points belonging to the i^{th} class among k points i.e. $k \geq 0$
6. If $k_i > k_j \; \forall \; i \neq j$ then put x in class i.

Sobel Filter[11]:

The Sobel operator, also called as the Sobel–Feldman operator is widely used in image processing and computer vision, especially with edge detection algorithms where it creates an image focusing on edges.

More specifically, it is a discrete differentiation operator, computing the gradient of the image intensity. At each step in the image, the result of the Sobel filter is either the corresponding gradient vector of this vector. The Sobel–Feldman operator is based on convolving the image with a small, separable, and integer-valued filter in the horizontal and vertical directions and is therefore relatively inexpensive in terms of computations. On the other hand, the gradient approximation that it produces is relatively crude, in particular for high-frequency variations in the image.

Laplacian Filter[12]:

Laplacian Operator is also a derivative operator(Similar to Sobel-Filter) which is used to find edges in an image. The major difference between Laplacian and other operators like Prewitt, Sobel, Robinson and Kirsch is that these all are first order derivative filters while Laplacian is a second order derivative mask. In this mask there are two major types- Positive Laplacian and Negative Laplacian filter.

Another difference between Laplacian and other operators is that unlike other operators Laplacian didn't take out edges in any particular direction but it take out edges in following classification.

- Inward Edges
- Outward Edges

Laplacian is a derivative operator; its uses different gray level discontinuities in an image and try to de-emphasize regions with gradual varying gray levels. This operation in result produces such images which have grayish edge lines and other discontinuities on a dark background. This produces inward and outward edges in an image. This image is called as ghost image.

The important thing is how to apply these filters onto image. We can't apply both the positive and negative Laplacian operator on the same image. we have to apply just one but the thing to remember is that if we apply positive Laplacian operator on the image then we subtract the resultant image from the original image to get the sharpened image. Similarly if we apply negative Laplacian operator then we have to add the resultant image onto original image to get the sharpened image.

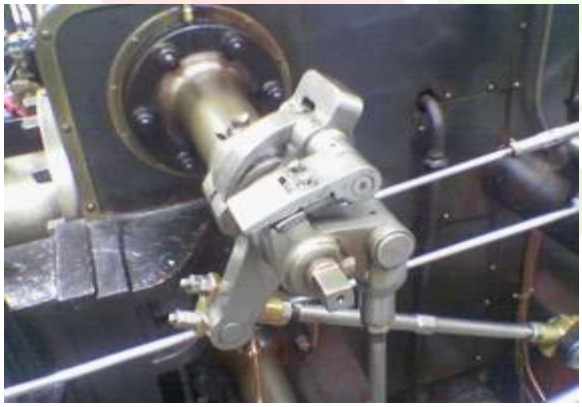

Fig. 2: Applying Filters to obtain Ghost Images of a Steam Engine

Description:

An image is given to the system which is stored in the file system of the computer. Then the image goes through a number of validations using KNN algorithm. KNN checks whether the given image consists of a face or not. If there is no face in image (like image of a tree) then the procedure is terminated and the user is asked to provide a proper image. Now if face is found then several filters are applied like Sobel Filter, Laplacian Filter and the image is converted into black-and-white kind of image that consists of features that are needed to be extracted. Then with the help of computer vision libraries(like OpenCV, EmguCV) we perform several calculations and the gender of the person is found and displayed on the screen.

Experimental Conditions:

In order to evaluate the performance of the algorithms, about 56 photos of different people with different races (Indian and Americans).The quality of image is changed because of change of lighting conditions of the place where the system was installed. The success ratios of gender classification with 56 persons were 98.3 %. Algorithms have shown good reasonable accuracy for the photos from our test set, as shown in Table I. The proposed system has a low complexity and is suitable for real time implementations, such as real time facial animation.

Fig. 3: Initial Screen of the system

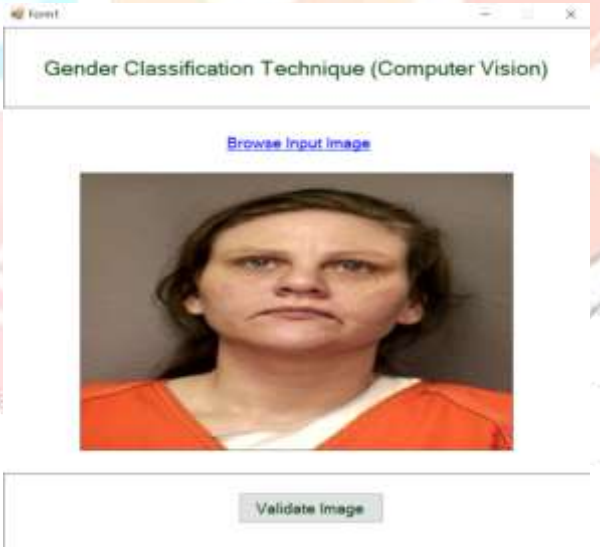

Fig. 4: Taking input from users

Fig: Applying filter to get ghost images

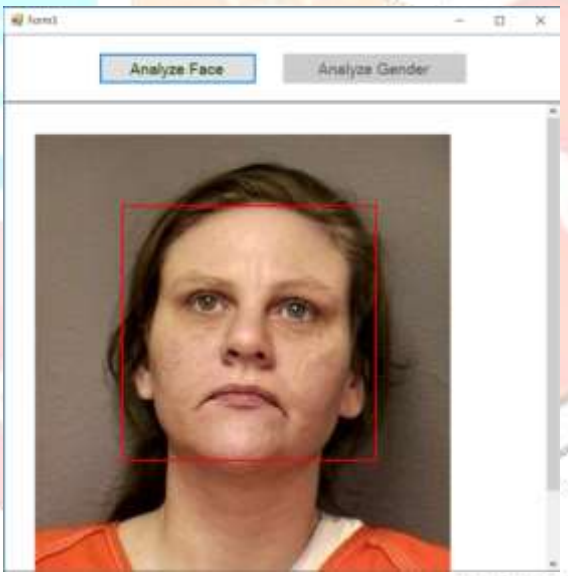

Fig: Getting Face Components

Age		Male	Female
	10 Years	11	5
	20 Years	7	8
	30 Years	6	8
	40 Years	3	5
	50 Years	2	1

Table I: Statistics of the Experiments

Fig: Final Results with confidence score

Future Works

This field one of the important fields in computer science, since most application now depends on identification the gender of human, so
the future work is applying it with deep learning methods and also identifying the gender from the component of the face to be more accurate

CONCLUSION

In this paper, we have discussed the general system in gender identification method uses pre-processing, face detection, Feature Extraction and then classification. Working on pixels to classify gender is more expensive so for gender classification prefers to extract face features rather than direct work on pixels. Also presents a survey on various gender identification techniques and algorithms that was proposed earlier by researchers for the better development in the field of classification. It also provides an overview of some of the on-going researches in gender identification in entirely unrestrained settings remains a very challenging task in all it steps.

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