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A Precise Method for Gender Cataloguing using a Minimum Distance Classifier

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----------**ABSTRACT**----------
The identification of gender is a mandate for applications which has human computer interaction in its process. Now-a-days all applications have become web-enabled, starting from learning to shopping. All these applications would require an app to identify the gender of a person to improve the system performance. This paper aims in deploying a gender identification system based on basic features using a Minimum distance classifier. The system architecture is designed to have two classifiers taking different feature vectors for the classification process. The system has proved its efficiency by identifying 95.12% of female faces of Bao database (one faces dataset).

KEYWORDS *: Image processing, Minimum distance classifier, Facial images, Gender Identification, Facial Landmarks.*

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I. INTRODUCTION

Image processing is one among the research areas which never claims its saturation. Object recognition is one of the vast branches under image processing. A cosmic growth can be seen in face recognition, where the face is treated as an object. Identifying demographic attribute of human from faces is gaining increased attention. One such attribute that plays a pivotal role and exhibits enormous requisite is 'gender'. It plays an important role in human computer interaction, surveillance; content based indexing, biometrics, demographic studies and targeted advertising [1].

The problem sounds very simple because human recognition when considering this problem is nevertheless more than 95% accurate. When it comes to automated identification by a machine it happens to be a challenging task. Attribute identification research seems to have lesser contributions than face recognition research. Most of the applications look forward for a non-intrusive automated system for quality identification of gender. The current work focuses on easily observable features of face for gender identity. The scope is restricted to 2D facial images and all images are assumed to be frontal images.

II. LITERATURE REVIEW

Gender identification using human face is a challenging task in several aspects. There are various methods that have been proposed for gender identification. Identification of a person has become an absolute necessity. Personal identification is generally used for a variety of applications. A person can be generally recognized by number of features such as face, body, shape, voice, hairstyle etc. [2]. The same person can also use different styles in clothing. The way of dressing done by both male and female may be sometimes similar. The same technique goes for hairstyle also. Face gives best information for identifying the gender of a person.

Gender identification is one common application like identification of a person. Gender identification will become difficult task for the machine where as the human brain has the ability to identify between male and female. Using the voice of a person is comparatively easier than the facial images for gender identification. However a better performance is being achieved using frontal face images [3].When gender recognition deals with supervised learning, it is divided into 4 parts. i.e. object detection, pre-processing, feature extraction and classification. Support vector machine classifier is the one used by many people for gender recognition. The studies on expression analysis and face landmarks were taken from [4]. An elaborate survey on face methods used for human face recognition was found in [5]. Neural Networks has placed its prominence in identifying gender, one such net yielding a high performance is in [6]. Since work has to be done with images resolution plays a vital role, the handling of low resolution images was studied in [7]. Support vector machines as a mathematical model has proved its classification eminence for gender identification in [8]. An attempt on hybrid classifiers were also seen in the literature a baseline can be found in [9]. The basic difference in men and women from facial identity evidence was taken from [10]. Face recognition and gender identification can be performed effectively using principal component analysis. The advantage of using principal component analysis is it is easy to understand and also acquires accurate results.

III. METHODS AND MATERIALS

The objective of the work may sound simple but simple ones sometimes are difficult and challenging when it has to be automated. The problem attempted in this work has the same characteristics. The features picked are very practical ones that frame the feature vector. The flow of the system can be divided into the following phases:

1. Pre-processing
2. Feature extraction
3. Classifier construction

Pre-processing

The pre-processing is a mandatory process for any image input. The pre-processing is focused towards two goals noise filtering and image enhancement. The input is filtered and equalised for an enhanced image. Image pre-processing is directly proportional to the results achieved by the system. Quality of input plays a pivotal role in such systems.

Feature extraction

Coining the feature vector is the next vital phase. Identifying features relevant to the application is a challenging task. The features selected for this problem are,

- Forehead
- Eyebrows
- Nose width
- Lip region
- Upper lip region

Classifier construction

The upper lip region is considered to be the primary feature for classification. The moustache is a key feature that helps in quick identification of gender. This direct approach is attempted and the upper lip region is the first feature on which a classifier is constructed. The flow of the work is depicted in figure 1.

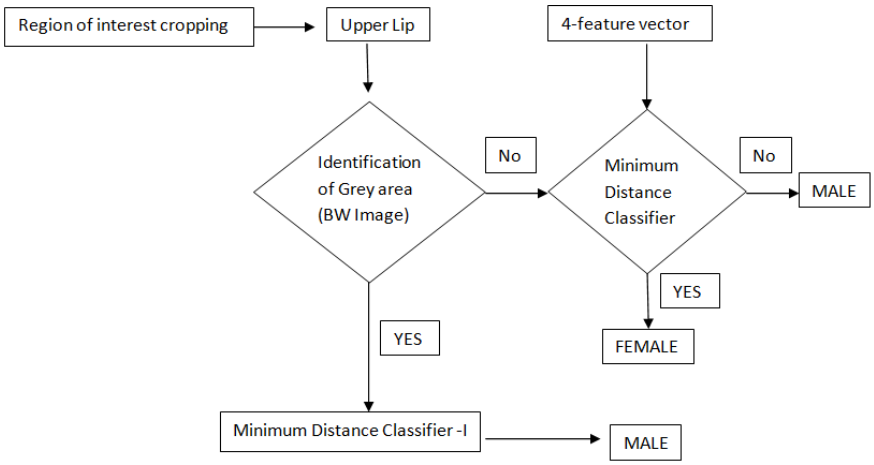

Fig. 1 Flow of the work

The classifier deployed is a Minimum Distance Classifier (MDC). The problem described requires a classifier which would classify the input images and label them with one of the class labels. A similar classification frame work has been adopted in [11] for speech processing. The classifier to be used can be a supervised classifier as the class labels are known and finite. The classifier would classify each input image or label them as class 1: female or class 2: male. The classification in other words is a decisive approach to the problem. The decision made is based on the feature vector fed to the classifier. The feature vector presented is a mixture of textual and template features. The MDC classifier falls into the linear classifier category. Assume test_f as the feature vector for an unknown input and let class1 and class2 be the templates for the 2 classes. Then computing

$$|| \; test\_f - Class_k \; ||$$

Will choose the class for which the error is minimum. It denotes the distance from test_f to $class_k$. The distance measure employed is the Euclidean distance, as the problem is linear in nature.

The architecture of this gender classifier has two classifiers MDC –I classifier, which does the classification based on a primary feature. Assuming Asian faces this feature is assumed to be inevitable in most cases on gender of male faces. This may not be the case when a global database is considered as in this work. The secondary features are fed into the MDC-II classifier when the phase I classifier classifies the image as class1: female. The figure 2 illustrates the cropping of upper lip portion and the mapping process of primary feature.

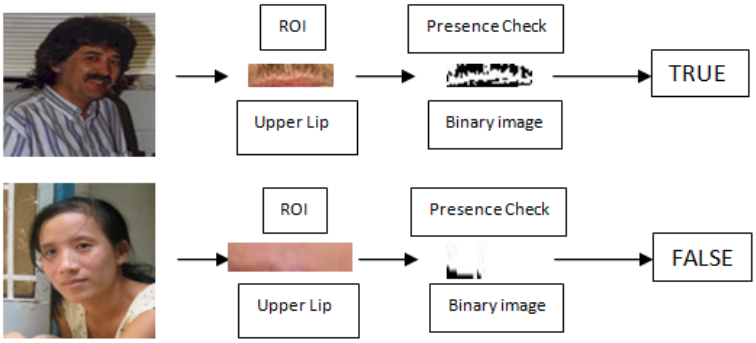

Fig. 2 Cropping the region of interest (a) Male facial image (b) female facial image

When the moustache presence is confirmed the error calculation is almost nil towards class 2: male. The MDC-I classifier labels the image and concludes the process of the test image, if the labelling happens to be class2. On its absence when the classification happens to be class 1, the classification proceeds to MDC- II.

The MDC-II picks in the 4-tuple feature vector and calculates the distance measure. The test images are classified based on the Euclidean distance computed. The threshold limits for each tuple value in the 4-tuple feature is independently initialized as each feature has a statistical independence for each test image.

IV. RESULTS AND DISCUSSION

To evaluate the performance of the proposed model the database for BAO face database which consists of colour images containing single and multiple frontal and non-frontal faces with different background and illumination differences [11]. The folder "one faces" in the database has 149 images a mix of both genders and different frontal and non-frontal images. 23 images were not frontal view of face which proved to extract features not expected to, since the model could work on 2-d facial image only. 85 were facial images of male and 41 were female face images.

The confusion matrix in table 1 shows the success rate of identifying gender. For male faces the success ratio is 70.58% and for female faces the success rate is 95.12%.

Table 1. Confusion matrix

	Male	Female
Male	60	25
Female	2	39

V. CONCLUSION AND FUTURE WORK

The model proposed for identification is very simple and a direct approach that strikes synonymous to human brain working. The model has proved to be robust enough when looking into the results as the inputs from the database has a lot of variance in terms of quality, illumination, etc. The image database constituted children faces too, which has been accounted for the result analysis, proves for the robust nature of the model proposed. The images and other occlusions like glasses and beard which has not much disturbed the model, as the region of interest do not constitute it into the primary feature. The images taken for the test data does not include only Asian images and many male images do not have the region of interest. That may be the reason for the success rate of male images a little low when compared to female success rate. A model that can accommodate the additional region of interest could be built for more robust gender identification.

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Biography:

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