Gender Recognition From Face Images Based on Textural Analysis and Machine Learning Approach

S.MuthuPandian,P.RadhaKrishnan,S.Prakash

Abstract— The system gender classification from face images based on textural analysis and an artificial neural network. Face granulation process is applied for input faces for slices representation using Difference of gaussian approach. Here Weber's Local Descriptor is used for gender recognition. Here this local descriptor extends it by introducing local spatial information through divide an image into a number of blocks, calculate WLD descriptor for each block and concatenate them. This spatial WLD descriptor has better discriminatory power and followed by statistical features are evaluated which is useful to distinguish the maximum number of samples accurately and probabilistic neural network with RBF kernel classifier will be used as classifier. The simulated results will be shown that spatial WLD descriptor with used classifier gives much better accuracy with lesser algorithmic complexity than state of the art gender recognition approaches

Index Terms— Gender recognition, PNN, WLD, Cooccurrence features, granular computing.

1 Introduction

The gender classification is an important task which in turn can enhance the performance of a wide range of applications including identity authentication, human-computer interaction, access control, and surveillance, involving frontal facial images. A large majority of gender Classification approaches are based on extracting features from face images and then giving these features to a binary classifier. Human faces provide crucial information regarding gender, age, and ethnicity, in addition to identity. Several important fields for applications of gender classification have been identified, such as biometric authentication, surveillance and security systems, demographic information collection, marketing research, real time electronic marketing, criminology, augmented reality, and lately, new applications in social networks using face recognition. Gender classification based on facial images is currently one of the most challenging problems in image analysis research. The face is a characteristic feature of human beings which contains identity and emotion. It is possible to identify a person and her/his characteristics such as emotion (or expression) and gender from her/his face. Recognizing human gender is important since lots of social interactions and services depend on the gender. People respond differently according to gender. Human computer interaction system can be more user-friendly and more human-like when it considers the user's gender.

- *R.MuthuPandian is currently pursuing masters degree program inApplied Electronics in Tagore Engineering College, India,. E-mail: muthupandian12@gmail.com*
- *P.Radhakrishnan ,AssistantProfessor,Electronics andCommunication Engineering , Tagore Engineering College,India, E-mail: Krish75radha@gmail.com*
- S.Prakash,Professor, *Electronics andCommunication Engineering , Tagore Engineering College,India,*

2 Face Detection

It is process to extract face regions from input image which has normalized intensity and uniform in size. The appearance features are extracted from detected face part which describes changes of face such as furrows and wrinkles (skin texture). In this system model, an executable (.dll- dynamic link library) file is utilized to extract face region. It is used for face detection process is based on haar like features and adaptive boosting method.

3 Face Granulation

This approach is used to represent the facial information in several parts to extract the features and discriminate presence of variations such as pose, expression and illumination. To detect face granules, 2D Gaussian low pass filter is used to generate difference of Gaussian between two successive filtering at each reduced version of image. At each iteration level, the image will be down sampled to desire size to make difference of Gaussian pyramid. These granules are used to provide facial features such as smoothness, edge details and blurriness.

4 Weber Local Descriptors

Weber's Local Descriptor is used for gender recognition. Here this local descriptor extends it by introducing local spatial information through divide an image into a number of blocks, calculate WLD descriptor for each block and concatenate them. This spatial WLD descriptor has better discriminatory

power and followed by statistical features are evaluated which is useful to distinguish the maximum number of samples accurately

4.2 Differential Excitation

For calculating differential excitation $\mathcal{E}(xc)$ of a pixel xc first intensity differences of xc with its neighbors xi, i = 1, 2, …, p are calculated as follows:

$$\Delta I_i = I_i - I_c \quad (1)$$

Then the ratio of total intensity is difference of xc with its neighbors xi to the intensity of xc.

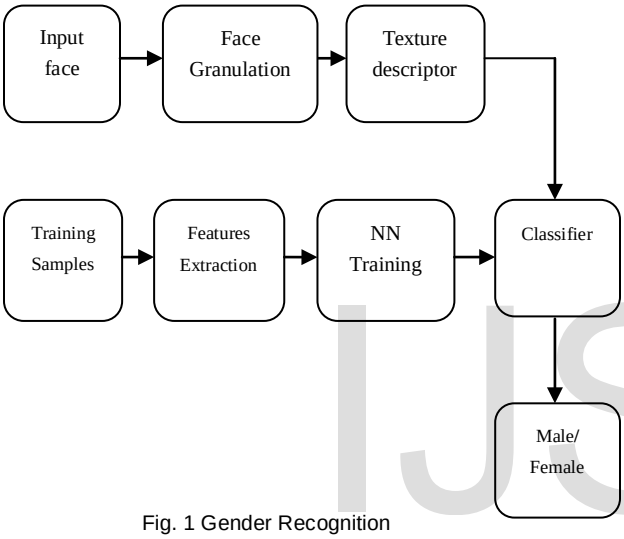

Fig. 1 Gender Recognition

Arctangent function is used as a filter to enhance the robustness of WLD against noise. The differential excitation may be positive or negative. The positive value indicates that the current pixel is darker than its surroundings and negative value means that the current pixel is lighter than the surroundings.

4.3 Gradient Orientation

Next main component of WLD is gradient orientation. For a pixel the gradient orientation is calculated as follows:

$$\theta(x_c) = \arctan(\frac{I_{73}}{I_{51}}) \quad (2)$$

Where is the intensity difference of two pixels on the left and right of the current pixel xc, and is the intensity difference of two pixels directly below and above the current pixel.

5 Statistical Features Extraction

5.1 Energy

Where is the intensity difference of two pixels on the left and right of the current pixel xc, and is the intensity difference of two pixels directly below and above the current pixel.

5.2 Contrast

Contrast is the main diagonal near the moment of inertia, which measure the value of the matrix is distributed and images of local changes in number, reflecting the image clarity and texture of shadow depth.

5.3 Entropy

It measures image texture randomness, when the space co-occurrence matrixes for all values are equal, it achieved the minimum value.

5.4 Homogeneity

It Measures the closeness of the distribution of elements in the GLCM to the GLCM diagonal.

6 Supervised Classifer

Supervised learning with non knowledge based classifier will be used for gender classification. The neural network model PNN is used here to act as a classifier with radial basis function for network activation function. The training samples features with assigned target vectors are fed into created PNN model for supervised training to get network parameters such as node biases and weighting factors. Finally, test image features are simulating with trained network to make decision of gender Male or Female. Probabilistic networks perform classification where the target variable is categorical and this architecture has three types of layers such as an input layer, a pattern layer, and an output layer. The input neurons (or processing before the input layer) standardizes the range of the values by subtracting the median and dividing by the inter quartile range. The input neurons then feed the values to each of the neurons in the hidden layer.

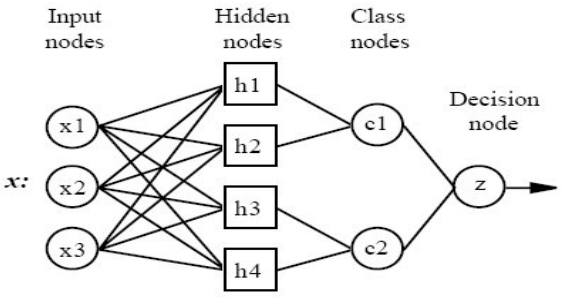

Fig. 2 Architecture of Neural Network

There is one pattern neuron for each category of the target variable. The actual target category of each training case is stored with each hidden neuron; the weighted value coming out of a hidden neuron is fed only to the pattern neuron that corresponds to the hidden neuron's category. The pattern neurons add the values for the class they represent (hence, it is

a weighted vote for that category). The decision layer is different for PNN and GRNN networks. For PNN networks, the decision layer compares the weighted votes for each target category accumulated in the pattern layer and uses the largest vote to predict the target category.

7 Experimental Analysis

An experiment uses sample images collected from FERET face database for performance evaluation. It includes male and female face with front pose and better illumination images. An above extracted webers face with statistical features will be compatible for classifying a pattern of faces in real world

Fig. 3 Sample Test Image With Face Detection

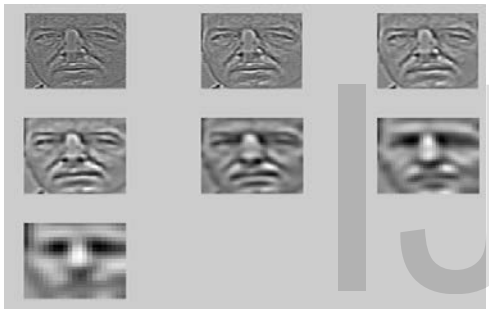

FIG. 4 FACE GRANULES AT DIFFERENT SCALE SPACE

The proposed texture descriptor could provide a better discriminate power in various facial images which is helpful to recognize male and female face images with better sensitivity rather prior methods such as LBP and wavelet with PCA.

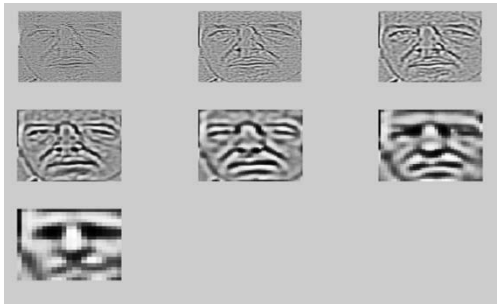

Fig. 5 Weber Face for Each Granule

8 Conclusion

It is presented an automated gender classification system from processing of human faces for computer vision application. This processing system could provide the gender results either male or female with better classification accuracy. It worked effectively with an influence of methodologies such as face granulation, webers local texture analysis and supervised probabilistic neural network which acts as a classifier. This system provides better recognition rate of 97.5% and from this analysis, the classification accuracy will be depends on number of training samples and features extracted from samples was recognized. Further this processing system will be enhanced with features of identifying the human emotions from face images.

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