Gender Recognition Using Nonsubsampled Contourlet Transform and WLD Descriptor

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Abstract. Gender recognition using facial images plays an important role in biometric technology. Multiscale texture descriptors perform better in gender recognition because they encode the multiscale facial microstructures in a better way. We present a gender recognition system that uses SVM, two-stage feature selection and multiscale texture feature based on Nonsubsampled Contourlet Transform and Weber law descriptor (NSCT-WLD). The proposed system has better recognition rate (99.50%) than the state-of-the-art methods on FERET database. This research also reveals that in NSCT decomposition what is essential for face recognition and what is important for other tasks like age detection.

Keywords: Gender recognition, Face recognition, WLD Descriptor, Nonsubsampled Contourlet Transform, Support Vector Machines.

1 Introduction

In category specific face recognition, facial images are first categorized based on visual cues like gender and race etc. and then face recognition is performed using category specific feature descriptors. This approach improves [17] the performance but the bottleneck is categorization. In this paper, we address the problem of face categorization based on gender i.e. gender recognition problem. Gender recognition is important from other aspects as well; it can enhance the performance of a wide range of applications such as search engine retrieval, demographic data collection, human-computer interaction, access control, and surveillance that are based on facial images.

This problem attracted the attention of a number of researchers. One of the important steps of a gender recognition system is to represent facial images with the most discriminative features; different types of features have been used such as gray scale, shape, multiscale, texture etc. [1]. Another important step of the system is classification; different techniques like support vector machines (SVM) [2], artificial neural networks (ANN) [3], and nearest neighbor (NN) [4] have been used for classification. One of the earlier gender recognition systems was proposed by Gutta et. al. [3]. Moghaddam and Yang [2] used SVM gender classification and obtained a 96.62% accuracy on FERET database. Baluja and Rowley [5] used an AdaBoost based method for

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gender recognition; for validation, they used FERET database and reported the best accuracy of 94.4%. Lu and Shi [6] fused the features from left eye, upper face region and nose in their gender recognition approach; their results showed that the fusion of features from different regions outperformed the whole face approach. Inspired by this idea, Alexandre [7] used a fusion approach based on three different types of features from multiple scales. He worked on normalized images of resolutions (20 x 20, 36 x 36 and 128 x 128) to extract shape and texture features (LBP). He achieved an accuracy of 99.07% on FERET database. Zheng and Lu [1] gave a comparison of 6 types of features using three classifiers and showed that for FERET database the best accuracy (99.1%) was obtained with features based on local Gabor binary pattern and LAD (LGBP-LDA) and SVM with automatic confidence (SVMAC). Ihsan et al. [4] used multiscale texture features based on dyadic wavelet transform and LBP (DyWT-LBP) and NN classifier and reported an accuracy of 99.25% on FERET.

Motivated by the success of multiscale texture features and SVM, in this paper we propose a new technique that employs SVM and multiscale texture features based on NSCT and Weber law descriptor (NSCT-WLD); this method has better recognition rate (99.50%) than the stat-of-the-art methods. In addition, this research reveals that it is only low subband in NSCT decomposition that is important for gender recognition; high frequency information contained in high subbands is not important, it might be interesting for detection tasks like age detection.

The rest of the paper is organized as follows. Section 2 gives the detail of the prosed system. In Section 3 the detail of experimental setup is given. Section 4 presents experimental results and their discussion. In Section 5, paper is concluded.

2 Methodology

In this section we describe the detail of the proposed Gender recognition system, which is a standard pattern recognition system and is shown in Figure 1.

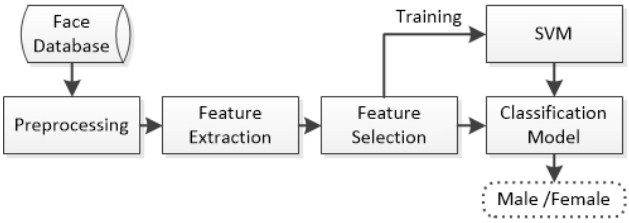

Fig. 1. System diagram for gender recognition

2.1 Preprocessing

Colored facial images are converted to YCbCr color system, where Y is luminance component; human eyes are sensitive to this component, as such it plays key role in the recognition process. We used Y component for gender recognition.