Performance Analysis of Pose Invariant Face Recognition Approaches in Unconstrained Environments

M. Parisa Beham, Department of Electronics and Communication Engineering, Vickram College of Engineering, Madurai, India

S. M. Mansoor Roomi, Department of Electronics and Communication Engineering, Thiagarajar College of Engineering, Madurai, India

J. Alageshan, Department of Electronics and Communication Engineering, Vickram College of Engineering, Madurai, India

V. Kapileshwaran, Department of Electronics and Communication Engineering, Vickram College of Engineering, Madurai, India

ABSTRACT

Face recognition and authentication are two significant and dynamic research issues in computer vision applications. There are many factors that should be accounted for face recognition; among them pose variation is a major challenge which severely influence in the performance of face recognition. In order to improve the performance, several research methods have been developed to perform the face recognition process with pose invariant conditions in constrained and unconstrained environments. In this paper, the authors analyzed the performance of a popular texture descriptors viz., Local Binary Pattern, Local Derivative Pattern and Histograms of Oriented Gradients for pose invariant problem. State of the art preprocessing techniques such as Discrete Cosine Transform, Difference of Gaussian, Multi Scale Retinex and Gradient face have also been applied before feature extraction. In the recognition phase K-nearest neighbor classifier is used to accomplish the classification task. To evaluate the efficiency of pose invariant face recognition algorithm three publicly available databases viz. UMIST, ORL and LFW datasets have been used. The above said databases have very wide pose variations and it is proved that the state of the art method is efficient only in constrained situations.

Keywords: DCT, DOG, Face Recognition, HOG, LBP, MSR, Pose Invariant

DOI: 10.4018/IJCVIP.2015010104
1. INTRODUCTION

Biometrics technologies are present in our real life environment, for instance: passport, access control and even when we are walking in the street. Among all biometrics techniques, face recognition is a great challenge. Technologies in face recognition are improving, but, they are still far inferior compared to biological visual system in virtually every way. So far, the state-of-the-art recognition technology can achieve very high accuracy under restricted environment, such as frontal faces with indoor lighting conditions. However, for those uncontrolled cases (e.g. outdoor with uncooperative subjects), the face recognition task still far from the requirements, since most of current face recognition systems are pretty sensitive to the pose, lighting, and other variations. Among this pose variations can be considered as one of the most important and challenging problems in face recognition. The dissimilarity between the pixel values of face images introduced by two different poses of the same person is often so large that it becomes more considerable than the one caused by difference of identity under the same pose. Therefore, the performance of appearance based methods, such as Eigenface (Turk and Pentland, 1991) and fisherface, degrades significantly when subject to large pose variations. One of the most popular solutions in pose robust face recognition is generating virtual views from a single 2D input image. In order to implement such solutions, 3D model based methods have been investigated by many researchers. 3D Morphable (Blanz and Vetter, 1999; 2003) models are of the most thriving methods in this area. The drawback with such models is their computational complexity, hence the fact that they cannot be deployed in real-time applications. In this paper we proposed a pose invariant face recognition method where the images are captures under unconstrained environments. To compare the performance of our algorithm, three standard databases, such as UMIST, ORL and LFW. Among this, UMIST and ORL is taken under controlled setting whereas LFW is in natural setting. Preprocessing techniques like Discrete Cosine Transform (DCT), Difference Of Gaussian (DOG), Multi Scale Retinex (MSR) and Gradient face are proposed. Different feature extraction methods are proposed they are, (i) LBP is used for feature extraction in which LBP are computed for each pixel, creating a fine scale textural description of the image, (ii) LDP computes the edge response values at divergent directions, and uses these responses to encode the image’s texture, (iii) HOG descriptor is a histogram which counts gradient orientation of pixels in a given image. Each preprocessing technique is proposed with different feature extraction method said above and the recognition accuracy is find by using K-nn classifier. In the classifier each face image in test set is classified by comparing it against the face images in the training set. The rest of this paper is organized as follows. Section 2 highlights the related works on pose invariance face recognition while Section 3 describes the face recognition method. The experiments and performance evaluation are reported in Section 4. Finally, the conclusion and further discussion are presented in Section 5.

2. RELATED WORK

The non-intrusive nature of the face biometric makes it superior to other biometrics. Therefore, face is one of the most suitable biometrics for surveillance applications. However, in typical surveillance scenarios, people usually walk free, and it is not always possible to capture the frontal faces. This leads to a problem in face recognition, unconstrained face recognition. Although there have been some early successes in automatic face recognition, it is still far from being completely solved, especially in uncontrolled environments. Figure 1 addresses the difficult problem of identifying a face taken in uncontrolled situations with different view point using
A Robust Embedding Scheme and an Efficient Evaluation Protocol for 3D Meshes Watermarking
www.igi-global.com/chapter/robust-embedding-scheme-efficient-evaluation/77034?camid=4v1a

Introduction to 3D Imaging
www.igi-global.com/chapter/introduction-imaging/60257?camid=4v1a