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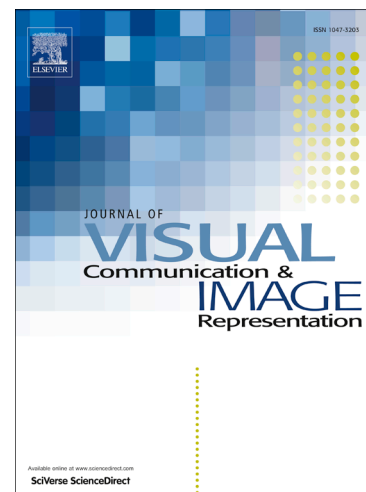
RGB-D face recognition under various conditions via 3D constrained local model

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RGB-D face recognition under various conditions via 3D constrained local model

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Abstract - This research proposes a method for 3D face recognition in various conditions using 3D constrained local model (CLM-Z). In this method, a combination of 2D images (RGBs) and depth images (Ds) captured by Kinect has been used. After detecting the face and smoothing the depth image, CLM-Z model has been used to model and detect the important points of the face. These points are described using Histogram of Oriented Gradients (HOG), Local Binary Patterns (LBP), and 3D Local Binary Patterns (3DLBP). Finally, each face is recognized by a Support Vector Machine (SVM). The challenging situations are changes of lighting, facial expression and head pose. The results on CurtinFaces and IIIT-D datasets demonstrate that the proposed method outperformed state-of-the-art methods under illumination, expression and pitch pose conditions and comparable results were obtained in other cases. Additionally, our proposed method is robust even when the training data has not been carefully collected.

1. INTRODUCTION

Human face recognition has been one of the earliest computer vision problems. Recently, it has received more attention due to its emerging applications in electronics such as cameras, cell phones, and in security applications. The main aspects affecting the performance of a face recognition system are image acquisition, feature representation and classification method. We focus on the last two factors in this research.

The major challenges in acquisition are variations in lighting conditions, facial expression, and head pose. A real-world face recognition system has to be insensitive to these variations in order to be effective. The conventional methods usually try to solve these challenges having a 2D image. An in-depth review on 2D face recognition methods is outside the scope of this paper. One can refer to [1] and [2] for good surveys on the subject.

Information about the human face in two-dimensional images may be insufficient for face recognition. Therefore, three-dimensional information has been employed for this purpose. As researchers revealed [3], combining depth and texture information leads to increasing the efficiency of face recognition. The depth information is invariant to lighting changes and image capturing conditions. Lighting conditions directly affect two-dimensional images, unlike three-dimensional ones. While the sensors for capturing depth information could be affected by lightening conditions, the 3D data is inherently invariant to illumination. In [4], for example, researchers have employed Gabor filters in order to describe the face images produced by 3D digitizers by considering pose and expression in faces. To construct a strong classifier, Linear Discriminant Analysis (LDA) and AdaBoost learning has been combined.

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