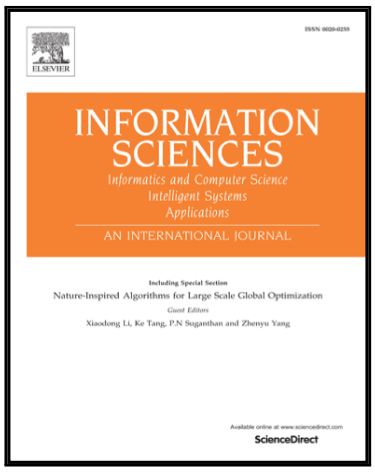

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Optimized Symmetric Partial Facegraphs for Face Recognition in Adverse Conditions

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Abstract

In this paper, we propose a memetic based framework called *Optimized Symmetric Partial Facegraphs (OSPF)* to recognize faces prone to adverse conditions such as facial occlusions, expression and illumination variations. Faces are initially segmented into facial components and optimal landmarks are automatically generated by exploiting the bilateral symmetrical property of human faces. The proposed approach combines an improved harmony search algorithm and an intelligent single particle optimizer to take advantage of their global and local search capabilities. Basically, the hybridization version aids to compute the optimal landmarks. These landmarks further serve as the building blocks to intuitively construct the partial facegraphs. The efficiency of the proposed approach has been investigated in addressing the facial occlusion problem when only one exemplar face image per subject is available using comprehensive experimental validations. The proposed approach yields improved recognition rates when compared to recent state-of-the-art techniques.

Keywords: Face recognition, Facial occlusion, Symmetric partial facegraphs, Harmony search algorithm, Intelligent single particle optimizer

1. INTRODUCTION

Face Recognition Systems (FRS) that aim to recognize faces captured in typical operational environments, need to handle *facial occlusions* apart from other challenges such as facial expressions, varying illumination conditions, scaling and so on [11, 44]. The uncertainty imposed by these real world intricacies throw another potential challenge to FRS when the registered frontal face images in the face database, used for training any proposed *Face Recognition (FR)* algorithm, could offer only *Single Sample Per Object Class (SSPOC)*. Further, automated FRS would aim to recognize faces without relying on ground truth data that represent the locations of selected facial landmarks [27]. Different techniques have been proposed to deal with these challenges of face recognition. These techniques can be classified based on their methodologies in handling occlusions problem into two types: holistic and part-based (also known component-based). In the holistic approach, the face image is treated as the whole entity, while, in the part-based approach, only the local regions are considered [3]. Moreover, approaches under this category can be further classified based on the recognition process into three classes namely: local matching approach, reconstruct approach and detect-discard approach [23]. In local matching approach [8, 24], the face image is first subdivided into small patches. Thereafter, each patch is manipulated in isolation. In the reconstruction based approaches [43], the occlusions are tackled as a reconstruction problem where the occluded probe face image is reconstructed using a linear combination of gallery images. In the case of detect-discard approaches [35], detected regions that are perceived to be occluded in a given face image are discarded in the recognition process. Another class of prominent techniques that have attained promising performance in the face recognition domain are graph-based and deep learning methods.

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