

Algorithms for Heterogeneous Face Recognition

Abstract

Automatic face recognition (AFR) is a domain of biometric studies. It attained enough maturity in the last few decades. Based on AFR algorithms, several reliable systems were developed for critical tasks like entry control, face registration, surveillance etc. The accuracy of performance of these algorithms is high under the controlled environments. However, the recognition task becomes complex with challenges like pose variation, occlusion, illumination variation, and modality gaps. Among these, the challenge due to the modality gap between the images to be matched has attracted the attention of the research community. They named it the Heterogeneous Face Recognition (HFR). Such conditions refer to face matching between Visual (VIS) with Near Infra-red (NIR), VIS with Thermal, or VIS with Sketch images. Unlike the conventional face recognition problem, HFR poses a challenge to the research community because the face images undergo considerable changes in appearance due to the modality gap. In this thesis, we have addressed this problem of Heterogeneous Face Recognition (HFR). We have a five-folded contribution in this thesis. Firstly, we proposed a handcrafted feature descriptor named Local Force Binary Pattern (LFBP). The LFBP features can be used directly for the matching of faces from different modality pairs. Second, we proposed a simple stacked feature descriptor. The algorithm comprises of two stages. In the first stage, distinctive features from the faces of different modalities are captured using Deep-Stacked PCA Descriptor (DSPD). In the next stage, the extracted features from the two modalities are projected to a common subspace using a coupled embedding technique. Third, we have proposed a Heterogeneous Face Quality Algorithm (HFQA), which gives a face quality score based on the content of the face image for that domain. Fourth, we have presented a database comprising of faces of individuals in sketch and visual domains with quality challenges. The database is a replication of the real-life surveillance and law enforcement scenario. Finally, we have discussed the development of an android based application for automatic classroom attendance. The application is developed based on algorithms proposed in the thesis.

Keywords: Heterogeneous Face Recognition, Face Quality Assessment, Handcrafted feature descriptor, PCAnet, Common subspace.