

Abstract

Driving by the need of security, biometrics as a research field has reached quite a progressive stage where it is a commonplace. Taking into consideration the time that biometrics took to reach this level. It is safe to say that it was able to find its place in human beings daily routine pretty fast. Nowadays, we witness a big leap in technology where the acquisition hardware used in biometrics is of high quality, which results in an immense amount of captured data. Now, having a tremendous quantity of data can be beneficial however, it is mostly time consuming to process all of them. Therefore, the intervention of a discipline that can control the flow by helping selecting the most relevant data "features" is much needed, for instance, optimization can fulfil the role.

Face is one of the most widely used and accepted biometric traits. Face recognition systems are now being utilized in many applications ranging from individual (e.g., smartphone user authentication) to large scale (e.g., border crossing screening) scenarios. Most face recognition systems employ feature selection after feature extraction to enhance the accuracy of the frameworks. In other words, feature selection is one of the important phases that any recognition system must go through as the final results depend on it. This thesis mainly address the feature selection aspect in face recognition, where we introduce an optimized feature selection method based on Particle Swarm Optimization (PSO) to select a block of features instead of single feature. In particular, first the captured face image is divided into a regular number of blocks (sub-images), then Binarized Statistical local features (BSIF) local descriptor is applied on each block for feature extraction. Next, a PSO scheme is utilized to select the blocks/features. The nearest neighbor classifier is employed to get the

value of the fitness function (here, equal error rate (EER)) for block/feature selection. The blocks with the smallest EERs are chosen to represent the face image representation and recognition. Experimental results on public olivetti research laboratory face database (ORL) show promising results. In addition to feature selection in this thesis we also address the issue of feature extraction and dimensionality reduction by proposing a novel descriptor based on monogenic signal representation and Binarized Statistical Image Feature (BSIF) to extract distinctive and relevant features from face image, named (M-BSIF). Our proposed feature description scheme, first applies band pass mechanism via log-Gabor filter on the image, then a monogenic filter is applied to decompose face image into three complementary. Next, BSIF is utilized to encode these complementary components in order to extract M-BSIF features. Experimental analyses on three publicly available databases (i.e., ORL, AR, JAFFE) demonstrate the efficacy of M-BSIF descriptor.

Keywords: Biometrics; Face recognition; Feature selection; Dimensionality reduction; Feature extraction, Optimization