# Chapter 57
# Hybrid BFO and PSO Swarm Intelligence Approach for Biometric Feature Optimization

**Santosh Kumar**
*Indian Institute of Technology (BHU), India*

**Sanjay Kumar Singh**
*Indian Institute of Technology (BHU), India*

## ABSTRACT

*Nature-inspired novel swarm intelligence algorithms have gained more proliferation due to a variety of applications and uses in optimization of complex problems and selection of discriminatory sets of features to classify huge datasets during the past few decades. Feature selection is an efficient and useful pre-processing technique for solving classification problems in computer vision, data mining and pattern recognition. The major challenges of solving the feature selection problems lay in swarm intelligence algorithms which are capable of handling the vast number of feature sets from involved databases. In biometric based recognition systems, face recognition is a non-intrusive approach to identify individuals based on their discriminatory sets of facial feature vectors. In this paper, the authors tend to propose a unique novel hybrid based on Bacterial Foraging Optimization (BFO) and Particle swarm optimization (PSO) approach for the selection of best facial feature vectors that enhance the identification accuracy of the individual recognition because concerned facial info will contain useless and redundant face expression. The proposed hybrid approach mitigates irrelevant facial features in the feature space and selects the relevant set of features from the facial feature space. The proposed feature selection approach presents promising experimental results with respect to the number of facial feature subsets. The identification accuracies are superior to other approaches from the literature.*

DOI: 10.4018/978-1-5225-0788-8.ch057

## 1. INTRODUCTION

Biometrics based recognition systems are getting more proliferation due to a variety of applications and uses for the individual identification due to increasing the security requirements of organizations in private, public sectors and societies (Zhao et al., 2003). A basic biometrics based recognition systems essentially depends on several biometric characteristics which in turn have to possess certain primary characteristics of individuals. These primary properties consist of universality, distinctiveness, permanence and collectability (Jain et al., 2007). The principal biometric characteristics which adhere to these properties are face, iris, retina, fingerprint, ear, voice, gait and palm print, etc. The primary biometric characteristics can be classified into two groups- (1) physical biometric characteristics and (2) behavioral biometric characteristics. The physical characteristics are face, iris and fingerprints and behavioral characteristics are namely, voice, signatures and gait of individual (Jain et al., 2007).

Face as physical biometric characteristic has advantages over other biometric modalities (e.g., Ear, Iris, Palm print, Fingerprints) for recognition purpose. Face recognition is gaining significant attention in security applications. Face recognition is a non-intrusive because it can be performed without the subject knowing and identifies the individual based on their discriminatory facial feature vectors (Jain et al., 2007). To verify (e.g., one to one matching process) or identify (e.g., one to many matching process) an individual based on face images (Zhao et al., 2003), the discriminatory sets of features are extracted from these face image databases and compared with stored templates of facial images in the facial database. Therefore, it has become a predominantly important in modern times due to the demand for the enhancement of individual security (Jain et al. 2007).

The face recognition based biometric systems have various applications on legacy systems such as individual identification, access control and authentication, passports, voter registration, crowd management by surveillances, the interaction of human-computer and deployment of smart cards. Moreover, face recognition is a long studied problem for various covariates such as illumination, pose variation, disguise and occlusion, which are still challenging the recognition of individual's facial expressions. The facial features are extracted from the different face images of individuals (subjects). The extracted huge data of facial features may contain many features that are either redundant or irrelevant sets of features. The irrelevant feature sets may provide miss classification of data and not provides the enhanced performance measurements (e.g., verification, identification accuracy, classification accuracy).

The feature selection is that the method of choosing a set of important features from the extracted features. It is a vital pre-processing step for the foremost machine learning algorithms, particularly pattern classification and object recognition (Guyon & Elisseeff, 2003). The objective of feature selection is to determine the most relevant and useful subset of features from the data sets for the representation of any application domain without comprising the predictive accuracy, represented by set of features. In face recognition systems, facial features are extracted from the face database, however, these features may have a problem, known as the curse of dimensionality due to a huge number of features have been occupied in feature space (Zhao et al., 2003). The search space has been explored by feature selection algorithms to find the optimal sets of discriminatory feature subset from the feature space. Moreover, feature selection algorithms can be broadly classified into wrappers and filters based approaches which are distinguished based on the choice of evaluation metric and find out the better performance measures.

The nature galvanized primarily based swarm intelligence algorithms play a significant role in the selection of unique sets of features from the extracted features sets of feature space. The main objective is to mitigate the miss classification problem of individuals based on their inter and intra class vitiations