FUSION OF MULTI-CLASSIFIERS FOR ONLINE SIGNATURE VERIFICATION USING FUZZY LOGIC INFERENCE

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ABSTRACT. *Compared to physiologically based biometric systems such as fingerprint, face, palm-vein and retina, behavioral based biometric systems such as signature, voice, gait, etc. are less popular and many of the research in these areas are still in their infancy. One of the reasons is due to the inconsistencies in human behavior which requires more robust algorithms in their developments. In this paper, an online signature verification system is proposed based on fuzzy logic inference. To ensure higher accuracy, the signature verification system is designed to include the fusion of multi classifiers, namely, the back propagation neural network algorithm and the Pearson correlation technique. A fuzzy logic inference engine is also designed to fuse two global features which are the time taken to sign and the length of the signature. The use of the fuzzy logic inference engine is to overcome the boundary limitations of fixed thresholds and overcome the uncertainties of thresholds for various users and to have a more human-like output. The system has been developed with a robust validation module based on Pearson's correlation algorithm in which more consistent sets of signatures are enrolled. In this way, more consistent sets of training patterns are used for training. The results show that the incorporation of multi classifier fusion technique has improved the false rejection rate and false acceptance rate of the system as compared to the individual classifiers and the use of fuzzy logic inference module for the final decision helps to further improved the system performance.*
Keywords: Fuzzy logic, Multi classifiers, Online signature verification, Back propagation neural network, Pearson correlation

1. **Introduction.** Biometrics technology has gained importance in recent years to provide a more secure method of identification based on the physiological and behavioral characteristics of a person [1]. Physiological characteristics such as face, retina, finger prints, palm veins, etc. have been widely researched and many of these biometric based products have been commercialized and used in a wide variety of applications. However, behavioral type biometric systems are still lacking in terms of commercialized products, the main reason being the behavioral type biometric systems such as signature, voice, gait, etc. usually have higher error rates when compared to physiological based biometric products.

The assessment of a biometric trait is strongly dependent on the specific application since it involves not only technical issues but also social and cultural aspects [2,3]. It is also important to realize that no trait is able to completely satisfy all the desirable characteristics of biometrics systems. In this sense, handwritten signatures bear importance in certain applications of biometric systems [4,5], due to the fact that handwritten signatures have long been established as the most widespread means of personal verification. Signatures are generally recognized as a legal means of verifying an individual's identity by administrative and financial institutions. These factors provide the advantage