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A Short Review of Multimodal Biometric Recognition Systems

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Multimodal Biometric Recognition Systems

Multimodal biometric systems, which combine two unimodal recognition systems into one single method, can be used to overcome the limitations of individual biometrics. This paper will do a short but critical review on recently developed for enhancing multimodal biometric systems. As can be seen from Celik et al. [1] the biometric information can be combined using different types of fusion of biometric data at different levels, i.e., at the feature level, matching-score level or decision level. The biometric data classification and throughput of the biometric recognition systems can be carried out by analysing these fusion levels.

Haghighat et al. [2] reported that feature level fusion can be more effective in terms of biometric data classification by owing to that a feature set which contains richer information in regard the input biometric data than that of matching score or decision level fusion. They proposed a discriminant correlation analysis (DCA), a new technique of feature level fusion that integrates the class associations into the correlation analysis of the feature sets. Hence, the pairwise correlation is maximized, and between-cross correlation is eliminated by an effective use of this new technique (DCA) at feature fusion level. This low computational attribute can be modelled for real-time applications such as performing various complex biometric databases. Joshi and Kumar [3] developed wavelet based feature fusion method for enhancing the performances of face and signature recognition systems. The proposed method by Joshi and Kumar has achieved higher classification accuracy than offline signature and face based identification system. Furthermore, false acceptance rate (FAR) has been reduced to even 3% for this multimodal biometric system (face and signature) using Caltech and Ucoer real signature databases. Another feature level fusion method is proposed by Naderi et al. [4] for a multimodal biometric system based on iris, palmprint and fingerprint. Wavelet transform and Gabor filter are used to extract features from iris and palmprint, while minutiae extraction and alignment is combined for fingerprint systems. A new rank-based fusion algorithm called Maximum Inverse Rank (MIR) is studied to develop a robust trimodal biometric system that simultaneously checks the variations in scores and also bad ranking from the module. The experimental results demonstrated that the proposed work efficiently increased the accuracy in terms of correct classification rate (CCR). Kumari and Suma [5] also studied on feature level fusion for person recognition system based on multiple sources like fingerprint, palm print and iris. The proposed study focused on a dimensionality reduction technique Principal Component Analysis (PCA) that reduces the rich set of information after feature level fusion in triple biometric system. While bifurcations and ridge endings are fused for fingerprint based recognition, 2D-Gabor and Log-Gabor features are integrated for palm print and iris recognition systems. The experimental results revealed that false acceptance rate (FAR) and false rejection rate (FRR) are improved in the proposed multimodal system.

Apart from complex multimodal biometric recognition systems, wearable devices become popular to be equipped with simple sensors and interacting with biomedical smart devices. That enables the integration multimodal biometric systems with wearable devices to capture a physiological signal of a subject. From this perspective, biometric authentication systems can be developed by wearable biometric devices. Rathgeb and Uhl [6] developed a wearable biometric system that is worn on the arm by the person and the authentication is made when the user is successfully recognized by the wearable device that required a fully match from a database installed itself.

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