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A feature level multimodal approach for palmprint identification using directional subband energies

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ABSTRACT

Palmprint based personal identification has gained preference over other biometric modalities due to its ease of acquisition, high user acceptance and reliability. This paper presents a palmprint based identification approach which uses the textural information available on the palmprint by employing a feature level fusion of contourlet transform (CT) and non-subsampled contourlet transform (NSCT). The proposed algorithm captures both local and global details in a palmprint as a compact fixed length palm code. After establishing the region of interest (ROI), the two-dimensional (2-D) spectrum is divided into fine slices using iterated directional filterbanks. Next, directional energy component for each block from the decomposed subband outputs is computed separately for the two transforms. The features from both domains are then fused at feature levels. Palmprint matching is then performed using normalized Euclidean distance classifier. The algorithm is tested on complete database of 7752 palm images of Polytechnic University of Hong Kong, and 500 palm images of GPDS Hand database from University of Las Palmas de Gran Canaria. The experimental results were compiled for features based upon individual transforms and fused one. CT based approach demonstrated the decidability index of 2.7734 and equal error rate (EER) of 0.2333% while NSCT based approach depicted decidability index of 2.8125 and EER of 0.1604% on palm database of Polytechnic University of Hong Kong. Similarly, CT based approach demonstrated the decidability index of 2.6212 and equal error rate (EER) of 0.7082% while NSCT based approach depicted decidability index of 2.7278 and EER of 0.5082% on GPDS hand database. The multimodal approach based upon feature fusion achieved decidability index of 2.8914 and EER of 0.1563% on database of Polytechnic University of Hong Kong and decidability index of 2.7956 and EER of 0.3112% on GPDS hand database. The quantitative measures confirm progressive improved results in three approaches for both the databases.

1. Introduction

Biometrics is identification of an individual on the basis of unique physiological and behavioural patterns. Biometrics is fast replacing other means of authentication like passwords and keys due to the inherent drawbacks in them and increased effectiveness and reliability of the biometric modalities. The passwords can be forgotten or hacked, while keys can be lost. The individual's unique physiological or behavioural characteristics, on the other hand, are hard to forged or lost. Fingerprint and face are the common biometrics used nowadays, but they have inherent problems. The illumination variations affect the performance of face recognition algorithms, while fingerprint, along with technological challenges, has less user acceptability due to the historical use in crime investigations. Palmprint is a biometric modality which has recently drawn great attention owing to its strengths like ease of acquisition, robustness, user acceptance in addition to its uniqueness and rich distinguishable contents and features. Palmprint biometric is potentially a very effective biometric since it offers widely discernible and discriminating features like palm lines, wrinkles, minutae and delta points. The palmprint analysis is divided into four main specialized categories which are described briefly as follows (Shu and Zhang, 1998):

1. Ridgeology analyzes friction ridges found on palmprint, and also weighs up point features and minutiae which is quite similar to fingerprint minutiae.
2. Edgeoscopy examines characteristics of ridge edges and take stock of ridges, ridge endings, bifurcation and dots.

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