THERMAL IMAGING AS A BIOMETRICS APPROACH TO FACIAL SIGNATURE AUTHENTICATION

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Abstract

A new thermal imaging framework with unique feature extraction and similarity measurements for face recognition is presented. The research premise is to design specialized algorithms that would extract vasculature information, create a thermal facial signature, and identify the individual. The proposed algorithm is fully integrated and consolidates the critical steps of feature extraction through the use of morphological operators, registration using the Linear Image Registration Tool, and matching through unique similarity measures designed for this task. The novel approach at developing a thermal signature template using four images taken at various instants of time ensured that unforeseen changes in the vasculature over time did not affect the biometric matching process as the authentication process relied only on consistent thermal features.

Keywords: thermal imaging, face recognition, vasculature information, facial signature, biometric matching.

1. Introduction

The use of thermal mid-wave infrared (MWIR) portion of the electromagnetic (EM) spectrum solves the problem of light variability. Also, any foreign object on a human face such as a fake nose could be detected, as foreign objects have a different temperature range than that of human skin. Due to these benefits, a lot of effort has been aimed at developing human face recognition systems in the MWIR spectrum. However, since cameras in the MWIR portion of EM spectrum are available at a much higher cost than their visible band counterparts, much of the research done in human face recognition in the MWIR spectrum is still in its infancy.

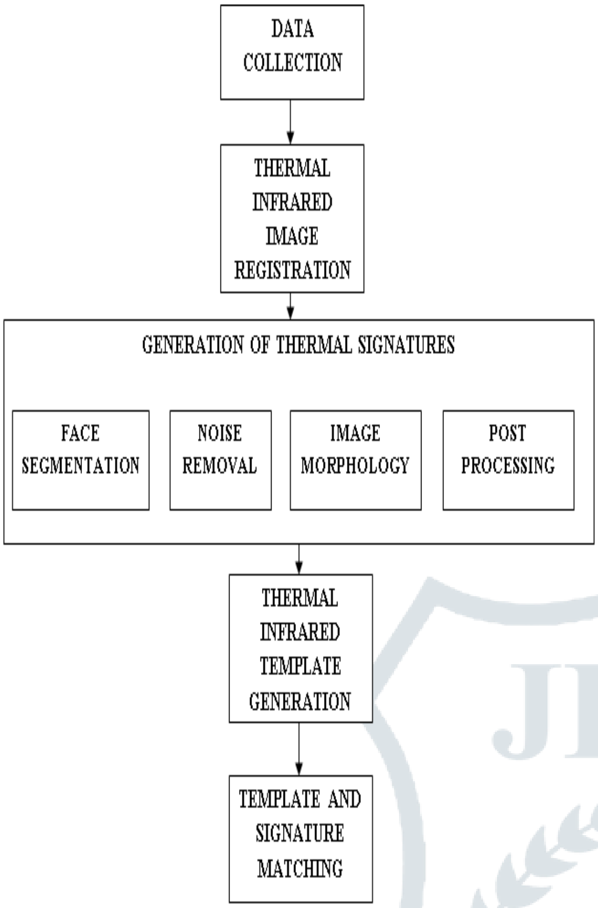
The binarization method segmentation is not suitable to the region wise. Some unwanted sub regions are present here. So overcome of this problem we use the region wise segmentation of active contour segmentation algorithm. The main drawback of dealing with the information fusion problem at image/intensity level is that, it is difficult to extract and distinguish between complementary and redundant information, since for a specific tissue type, a higher intensity value does not necessarily indicate a stronger tissue characterization ability which reflects how a modality can discriminate one tissue type from another.

In the existing systems the database employed is too small to generate a reliable conclusion on the stability of such features in the noisy vein patterns also there is difficulty in detecting facial disguises. The light variability leads to problems in matching.

11) Proposed Method

This paper realizes the potential of thermal MWIR imagery for human identification using the vein structure of hands in “Biometric verification using thermal images of palm-dorsa vein patterns,” and by using finger vein patterns in “Artificial immune system for personal identification with finger vein pattern”. Thermal images have been used to identify the affective state of humans in the previous work on “Classifying affective states using thermal infrared imaging of the human face".

The accuracy result obtained using skeletonized templates and signatures for the subjects in the existing database are lower than the accuracy results obtained using our own database. We have demonstrated consistency in determining similarity between signatures and their corresponding thermal templates that were a priori generated and which consolidated thermal features that were obtained at various time intervals. This is an important aspect of any biometric matching technique to be able to handle minute or subtle changes in thermal imaging that could complicate the similarity measurements and therefore the identification process. The facial feature template as designed ensures that small changes in the vasculature over time could not impede the matching process, with the premise that those features that belonged to the vasculature should be consistent over time. It is based on this premise that the current authentication process is made to rely only on consistent thermal features as reflected in the thermal facial template.



Block Diagram

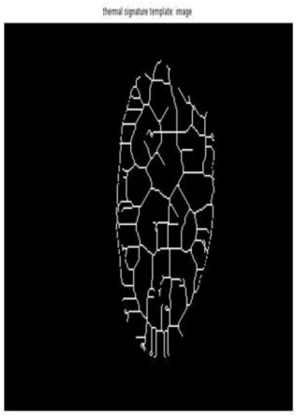
111) RESULTS

The results of this paper is shown in the form of screen shots at different stages

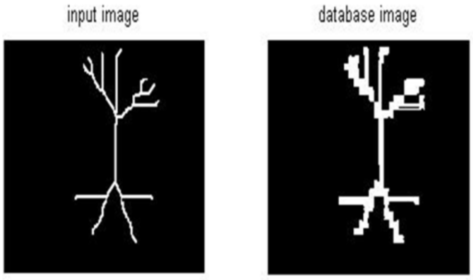
Input Image

Registered Image

Segmented Image



Thermal Image Signature



Authentication

1V) Conclusion

This paper has presented a novel approach for biometric facial recognition based on extracting consistent features from multiple thermal infrared images. The approach used FLIRT for thermal image registration and localized-contouring algorithms to segment the subject's face. A morphological image processing technique was developed to extract features from the thermal images, thus creating thermal signatures; these signatures were used to create templates which were then matched using similarity measures.

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