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APPROACH OF THERMAL IMAGING AS A FACIAL RECOGNITION

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ABSTRACT:

In last few years, Identification Systems has received a lot of attention in various areas like Academics, Entertainment, Biomedical, Business communities etc. Biometric Identification systems have emerged as a preferred alternative to traditional forms of Identification. Several Biometric modalities research includes Fingerprint, Iris, Face and Retina recognition has got varying level of success. Our system is concerned with Thermal Imaging for Facial recognition. The convection type of heat transfer effect from the flow of hot arterial blood in vessels creates characteristic Thermal imprints [1]. Therefore when one acquires the Thermal image of Subject's face, it actually captures the vein structure of the face because the temperature of the skin is nothing but the temperature of underlying blood vessels [2]. We contribute, through this paper, to the design of thermal imaging framework able to do face recognition with unique feature extraction and Similarity measurements. The development premise is to design specialized algorithms that would extract vasculature information, create a thermal facial signature, and identify the individual.

KEYWORDS: Biometric, Image Registration, Image segmentation, thermal imagining, face recognition etc.

INTRODUCTION:

Identification systems has received and increasing attention from security point of view. These systems rely on three main elements 1) Attribute identification 2) Biographical identification and 3) Biometric identification. It may be easier for one to make fraud in first two systems; however, Biometric identification systems work on physical characteristics of an individual. Numbers of systems have been created for face recognition in various areas, but they use the camera in visible spectrum. These systems could not avoid the issues like variation in light effects and other factors like failure in detecting facial disguises. Therefore the idea behind this approach is to design a system which will overcome above issues.

LITERATURE REVIEW:

The work on Thermal imaging is recently being done on finger images [3] where authors acquired finger vein images and low resolution finger print images and combined these two evidences using a novel score-level combination strategy. The system developed two new score level combinations i.e. holistic and non-linear fusion. The utility of low-resolution finger print images acquired from webcam. The limitation of the system is that, only the low level feature extraction is done.

One more research on Thermal Imaging of Palm [2] presented the work that 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. Here region of interest of thermal images is selected; feature points of vein patterns are extracted by modifying the basic tool of watershed transformation based on properties of thermal images. The limitation is, the database employed is too small to generate reliable conclusion on the stability of such features in noisy vein patterns.

A vessel's superficial thermal imprint is at higher temperature than surrounding tissue due to convective heat produced from the flow of hot arterial blood. The Top-hat Segmentation algorithm is successful in localizing vessels [4]. post-processing algorithm is used to remove fake vasculature contours. Here, first it estimates the facial pose in the test image and then calculates the deformation of the vascular network in the database image and uses the ICP matching algorithm. This is one of the techniques to detect Facial disguises.

Few years before, in Physiology based face recognition [1], face segmentation is done over the acquired image. The major process is to make segmentation of superficial blood vessels. This after thinning Thermal Minutia Point (TMP) extraction process is performed. The limitation of this paper, so many images of each subject are required to get the fine extracted image.

The Research in this field also has been used to identify the affective state of human face [5]. Here time, frequency, time-frequency features derived from thermal infra-red data are used to discriminate between self-reported affective states of an individual in response

to visual stimuli drawn from the International Affective Picture System.

For Improved interpretation and analysis of Image processing, computational approach applied for the same [6]. In this, after capturing thermal image, the pre-processing step is done in which use of LPF, Binarization is done. Then segmentation and then averaging process is done.

The major challenge in Face recognition is related to Light variability, this is due to reflective nature of incident light. Image acquired in visible spectrum in normal light is totally different than the image acquired in low light. First approach one paper uses the Grey-level info to extract the three-dimensional shape of object. The second approach here is based on representation of image and stored model that are relatively insensitive to changes in illumination. And the third approach to handle image variations that are due to illumination differences [7].

Image Registration is a challenging task in our work. There are many registration tools present in the market. One of them is described as, Non-rigid Image registration using an Entropic similarity [8]. This tool has great importance in the field Medical imaging. This first presents the JT similarity measure that calculates how well the fixed and deformed image matches. Then the transformation model that defines the space in which best solution is found.

One more Image Registration tool i.e. Retinal image registration [9] is crucial for the diagnoses and treatments of various eye diseases. This paper provides a new retinal image registration method based on Salient Feature Region (SFR). Also the feature based methods are used to extract the features of Retinal Image.

While choosing FLIRT tool for Image registration, few parameters are necessary to be considered. One of them is Cost Function. The Selection of Cost function is based on the size and Gray scale of the image. Mutual Information cost function [10] is better alternative. It is a basic concept from Information theory, measuring the statistical dependence between two random variables or the amount of Information that one contains about the other.

PROPOSED SYSTEM:

In this Proposed work, we extend the research on the work performed by the research group in "Biometrics: Face recognition in thermal infrared," represents the first attempt at developing an algorithmic approach to face recognition using physiological information obtained from Mid-Wave Infra-Red images by presenting an approach that consists unique algorithms at extracting thermal imaging features, producing templates that rely on the most consistent features, and matching these features through newly developed similarity measures for authentication. It consists of three major modules: 1) collection of image data, 2) Image extraction, and 3) Image matching. In each of these modules, different steps for facial thermal signature extraction are taken to ensure that recognition is made through features that are consistent through several image acquisition times and are therefore part of the vein structure of the individual.

SCOPE:

1) The proposed system provides imperceptible and robust Facial Signature. Light variations can not affect the System performance.

2) Any changes on face such as Plastic surgery can not affect the performance or efficiency of the Proposed System.

ADOPTED METHODOLOGY:

The proposed system consists of the blocks as shown in below figure 01.

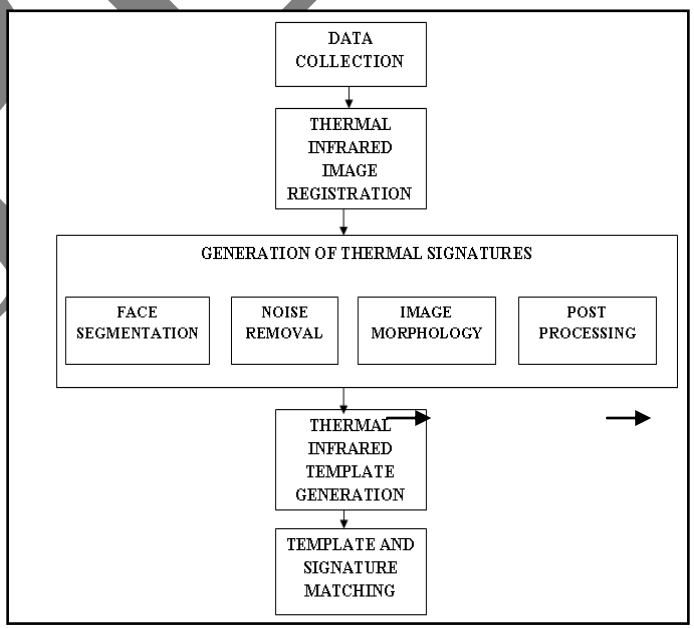

Figure 1: Block diagram

1. Data collection: Firstly system requires the raw image which is thermal image.
2. Thermal infrared image registration: Here three images are registered to one reference image of same subject.
3. Generation of thermal signatures: Here the features of thermal images are extracted to generate signature.

I. Face segmentation: Here the face of the subject is segmented from rest of the image.

II. Noise removal: Here noise is removed in order to enhance the image.
III. Image morphology: Here the images are analyzed based on shapes.
IV. Post processing: Here the skeletonization process is used to reduce the foreground regions into a skeletal remnant.
4. Template generation: Here, taking into consideration the various factors that may affect the thermal signatures, only consistent features are retained.
5. Template and signature matching: Here, a query image is compared over the templates stored in database.

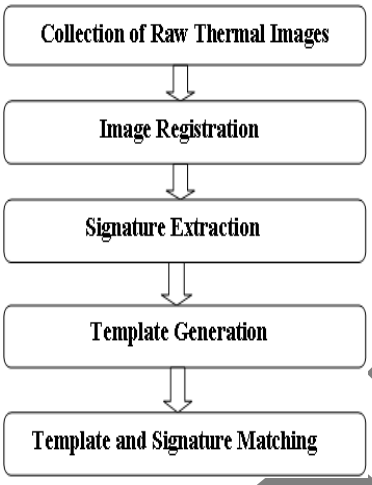

Figure 2: Flow Chart

The system Flow (Figure 02) includes following processes,

1) Collection of Raw Images
2) Image Registration
3) Extraction of Thermal Signature
4) Template generation
5) Template and Signature matching

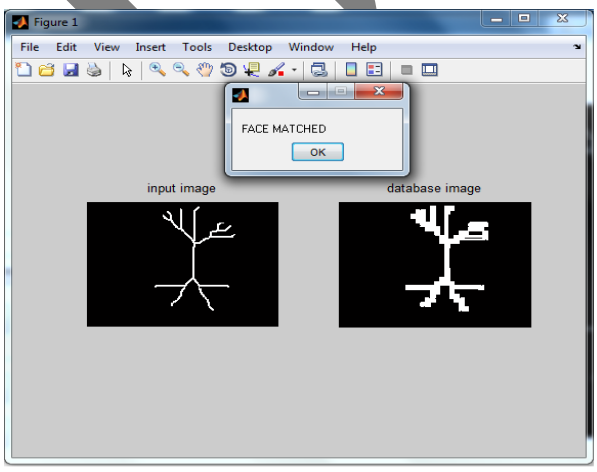

Figure 3: Results obtained in MATLAB

1) Collection of Raw Images: Data collection is the first task. It requires four thermal images of each Subject taken at different times with the gap of period of week for some subjects up to three months for others.

2) Image Registration: In this Process, four images of each Subject or an Individual are required. Among these four Images, one is Reference Image and the remaining three are registered to the reference image. The purpose behind this Registration process is to take into consideration any position changes of face.

3) Extraction of Thermal Signature: The extraction process has four main sections

- Face Segmentation: In this Process, Only the face of the Subject is segmented from rest of the Image. Only the Face is required to be considered and not the Neck region because neck area may be covered by the clothing.
- Noise Removing: In this Step, noise is removed in order to enhance the image. The use of Filters reduces the Speckle noise effects in the Image.
- Morphological operation: In this step, analyze the Images based on shapes.
- Post-processing: In this step, the skeletonization process is used to reduce the foreground regions into a skeletal remnant that largely preserves the Extent and Connectivity of the original region.

4) Template generation: Taking into account, the various factors which may affect the Thermal signature of an Individual like Ambient temperature, weight, Height of an Individual etc , take the four Extracted thermal Images of each subject and add them together. The added Image is nothing but the composite of all four. And retain only the dominant or the Consistent features.

5) Template and Signature matching: In this step, use the similarity measures as here comparison between the Templates stored in Database with the Query Image signature is required. After comparison with different templates in database, only the well matched Images will have Similarity Value near to unity.

CONCLUSION:

The presented research work has a novel approach for facial recognition and it well proven in this paper by using a MATLAB. While doing this research work the help of MATLAB simulink is taken and complete biometric face recognition model is implemented on the same. The approach presented here is an FLIRT approach for recognition of thermal images. This also uses an morphological image processing technique was implemented for extraction and processing of thermal images. In this paper, method implemented gives accurate results in the matching

process along with generalized design process. It also shows the ability of thermal infrared images used in thermal imagining.

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