'KKWETC' Indian Face Database

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Abstract:
To test face recognition algorithm developed by researchers, it is needed to have proper database. This paper describes an Indian face database 'KKWETC' of visual and thermal static images of human faces. Images were taken in uncontrolled indoor environment. Database contains 816 static visible images of 68 subjects and 150 thermal images of 50 subjects. A baseline Principal Component Analysis (PCA) face recognition algorithm was tested on both databases. Researchers can use these databases to test algorithm and compare results. Database is available to research community through the procedure described at http://engg.kkwagh.edu.in/media/post_image/database_info_website.pdf.

Keywords: *Face recognition, database, thermal images.*

I. INTRODUCTION

Face recognition presents a challenging problem in the field of image analysis and computer vision. It is a computer application for automatically identifying or verifying a person from an image. One of the ways to do this is by comparing selected facial features from the image and a facial database. It is typically used in security systems and can be compared to other biometrics such as fingerprint or iris recognition systems.

The appearance of a face is largely affected by a number of factors including identity, pose, illumination, facial expression, age, occlusion, and facial hair [1][2]. The development of algorithms invariant to variations requires databases of sufficient size that include carefully controlled variations of these factors. While there are many databases in use currently, the choice of an appropriate database to be used should be made based on the task given. Furthermore, common databases are necessary to comparatively evaluate the algorithms. The availability of public face databases is important for the advancement of the field. It is therefore necessary to create Indian face database with variations in identity, face pose, illumination and occlusion, which will be useful for researchers in the field of face recognition.

Recent research has demonstrated distinct advantages of using thermal infrared imaging for improving face recognition performance[3][4]. While conventional cameras
sense reflected light, thermal infrared cameras measure emitted radiation from objects such as faces. The human face emits thermal radiation, which can be sensed by imaging sensors, which are sensitive in the thermal infrared (IR) band of the electromagnetic (EM) spectrum. Heat pattern is produced by the temperature variations on the surface of the face. This heat pattern can be visualized as a 2D image. Due to the presence of highly distinctive and permanent physiological characteristics under the facial skin, thermal image contain important information, which can be used for face recognition. Thermal image is independent of ambient lighting conditions as the thermal IR sensors only capture the heat pattern emitted by the object. Different objects emit different range of Infrared energy according to their temperature and characteristics. The thermal patterns of faces are derived primarily from the pattern of superficial blood vessels under the skin. The vein and tissue structure of the face is unique for each person and, therefore, the IR images are unique. Using unique IR image of person recognition rate can be improved [5].

II. 'KKWETC'DATABASE DESCRIPTION

Database contains visual images and thermal images. Visual images are with pose variations, illumination variation and with occlusion of 68 persons with 12 images per person, whereas thermal database consists of images of 50 persons with position variations in three directions.

2.1 VISUAL IMAGE DATABASE

High quality static images are taken under uncontrolled environment using Cannon 700D camera.

2.2.1 Frontal Images

Facial mug shots are static color images, taken in uncontrolled indoor illumination conditions environment. There is one mug shot per subject and these images are labeled as person number_F.jpg (e.g. 1_F.jpg). Images are in lossless 24-bit color JPEG format with the original size of 5184 X 3456 pixels. These mug shot images are what you would expect to find in a law enforcement database or when registering to a security system. There are in total 68 frontal facial mug shot images in the database, one per subject. Sample frontal images are shown in fig. 1.

Fig.1.Sample Frontal Images

2.1.2 Different Pose Images

This set of images was taken under the same conditions as frontal facial mug shots. Subjects' poses are −90, -45, -30, +30, +45, +90 degrees (+ right profile, -left profile). There are 6 images per subject in this set, which gives 408 images in total. The images are labeled as person number_P_image number.jpg (e.g. 001_P_01.jpg to 001_P_06.jpg for first person). Images with different pose angles are shown in fig. 2.

Fig.2.Sample Pose Images

2.1.3. Illumination Variation Images

Images are taken by adjusting illumination conditions for frontal image and pose variation images. Two images are taken for two different illumination conditions for each pose. There are 7 images per subject for each illumination condition, which gives 952 images in total. The images are labeled as person number_I_image number.jpg (e.g. 001_I_01.jpg to 001_I_14.jpg for first person). Sample illumination variation images are shown in fig.3.

Fig.3.Sample Illumination Variation Images

2.1.4 Occluded Images

One frontal image of each person is taken by wearing spectacle and two frontal images are taken by wearing scarf in different ways. Total 204 occluded images are available with 3 images per person. Two images are taken for two different illumination conditions for each pose. The images are labeled as person number_O_image number.jpg (e.g. 001_O_01.jpg to 001_O_03.jpg for first person). Sample occluded images are shown in fig.4.

Fig.4.Sample Occluded Images

2.2 THERMAL IMAGES

Thermal images are captured using 'Flir C2' camera. There is one mug shot thermal image per subject and two images with +90 and -90 degree positions. Thermal images were labeled as person number_T_image number.jpg (e.g. 001_T_01.jpg). Total thermal images are 150 with 3 images per person. Images are in lossless 24-bit color JPEG format with the l size of 320 X 240 pixels. Sample thermal images are shown in fig.5.

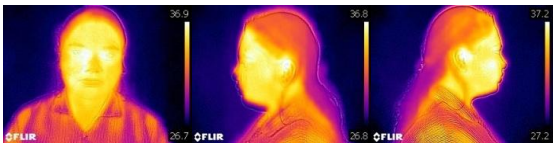

Fig.5.Sample Thermal Images

III. RESULTS

PCA [6][7] is used to find recognition rate of visual and thermal image databases. For testing visual database results front image of each person is taken for training. So total 68 images were used for training and 816 images were used for testing. We got recognition rate of 73 %. For thermal images, we used 50 frontal images for training and 150 images for testing. The recognition rate was 90 %. To improve these recognition rate more advance algorithms can be used.

CONCLUSION:

An attempt is made to construct face image database for visual and thermal images. A database is to facilitate research in human face recognition. The key features of the database are color images, which can be used for color processing or can be converted to gray scale for gray scale image processing, consist of visual as well as thermal images, database consist of images with position variation, illumination variation and images with occlusion. Hence, the database developed in the present work will certainly help researchers to develop various recognition schemes for human face recognition.

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