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STATEMENT OF THE PROBLEM

OBJECTIVES

HYPOTHESES

RESEARCH METHODOLOGY

RESULTS & DISCUSSION

FINDINGS

RECOMMENDATIONS/SUGGESTIONS

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SCOPE FOR FURTHER RESEARCH

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PERMANENT IDENTIFICATION OF SKIN MARKS (PISM): A HYBRID APPROACH FOR ROBUST FACE RECOGNITION

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ABSTRACT

Face or facial recognition is the identification of human by the unique characteristics of their faces. It is a biometric identification by scanning a person's face and matching it against library of known facts. Robust face recognition is a challenging goal because similarity of all human faces compared to large differences between face images of the person due to variations in lighting conditions, view point, pose, age, health and facial expression. The image may not always be verified or identified in facial recognition alone. This paper presents a method to use skin detail analysis and surface texture analysis for robust face recognition. Surface texture analysis uses skin biometrics, the uniqueness of skin texture to yield more accurate results. In this paper we propose a hybrid technique for robust face recognition the technique includes skin detail analysis and surface texture analysis. The method is being introduced as PISM (Permanent Identification of Skin Marks) approach.

KEYWORDS

PISM, face recognition, biometrics, skin detail analysis, surface texture analysis.

1. INTRODUCTION

An ideal face recognition system should recognize new images of a known face and be insensitive to nuisance variations in image acquisitions. But in most instances the images are not taken in a controlled environment. Even the smallest changes in light or orientation could reduce the effectiveness of the system, so they couldn't be matched to any face in the database, leading to a high rate of failure.

Thus, Robust face recognition is a challenging goal because similarity of all human faces compared to large differences between face images of the person due to variations in lighting conditions, view point, pose, age, health and facial expression.

Skin detail analysis exploit local skin irregularities as features for face identification. It is a methodology for detection and evaluation of skin marks to determine a person's identity based on only a few well chosen pixels.

The process, called Surface Texture Analysis, works much the same way facial recognition does. A picture is taken of a patch of skin, called a skinprint. That patch is then broken up into smaller blocks. Using algorithms to turn the patch into a mathematical, measurable space, the system will then distinguish any lines, pores and the actual skin texture. It can identify differences between identical twins, which is not yet possible using facial recognition software alone. According to Identix, by combining facial recognition with surface texture analysis, accurate identification can increase by 20 to 25 percent. This calls for an innovative approach for face recognition and verification.

2. LITERATURE REVIEW

Flook, 2013 [1], Alan and Clark, 2013 [2], Sahoo *et. al.,* 2012 [3] have reviewed different approaches for biometric identifications. According to Woodward *et. al* [4], biometric is any automatically measurable, robust and distinctive physical characteristic or personal trait that can be used to identify an individual or verify the claimed identity of an individual. Biometric identification is the automatic recognition of a person using distinguishing traits [5, 6, 7].

The *robustness* of a biometric refers to the extent to which the characteristic or trait is subject to significant changes over time. These changes can occur as a result of age, injury, illness, occupational use, or chemical exposure. A highly robust biometric does not change significantly over time while a less robust biometric will change.

According to Brian C. Lovell and Shaokang Chen, "Robust Face Recognition for Data Mining" [8], face recognition is a type of biometric software application that can identify a specific individual in a digital image by analyzing and comparing patterns. Facial recognition systems are commonly used for security purposes but are increasingly being used in a variety of other applications. Most current facial recognition systems work with numeric codes called face prints. Such systems identify 80 nodal points on a human face. In this context, nodal points are end points used to measure variables of a person's face, such as

- Distance between the eyes
- Width of the nose
- Depth of the eye sockets
- The shape of the cheekbones
- The length of the jaw line

According to Turk, M. and Pentland, A. (1991). Eigenfaces for recognition. Journal of Cognitive Neuroscience [9], face recognition techniques can be broadly divided into three categories: methods that operate on intensity images, those that deal with video sequences, and those that require other sensory data such as 3D information or Infra- red imagery.

According to Jean-Sebastien Pierrad, Thomas Vetter *Skin Detail Analysis for face recognition* [7], a novel framework is to localize in photograph prominent irregularities in facial skin, in particular nevi (moles, birthmarks). Their characteristic configuration over a face is used to encode the person's identity independent of pose and illumination. This approach extends conventional recognition methods, which usually disregard such small scale variations and thereby miss potentially highly discriminative features. The system detects potential nevi with a very sensitive multi scale template matching procedure. The candidate points are filtered according to their discriminative potential, using two complementary methods. One is a novel skin segmentation scheme based on gray scale texture analysis that developed to perform outlier detection in the face. Unlike most other skin detection/ segmentation methods it does not require color input. The second is a local saliency measure to express a point's uniqueness and confidence taking the neighborhood's texture characteristics into account.

3. RESEARCH GAP

The face recognition problem can be formulated as follows: Given an input face image and a database of face images of known individuals, how can we verify or determine the identity of the person in the input image?

Face recognition system is computer application for automatically identifying images for verification purpose. At present such approaches robust in nature as they largely rely on complete scanning of images in there all details consuming much of space, time, energy and resources. The biggest challenge in computer application in future would be to minimize the time and space consumed for such verification. Therefore the indentified research gap is how to reduce the time and scanning/ image space for identification and verification. This identified research gap could be reduced by hybrid approach for robust face recognition on the basis of concerning and relevant literature review we introduce the concept of hybrid approach PISM the acronym for permanent identification of skin marks.

4. RESEARCH DESIGN

In the present paper, Qualitative biometric research design is followed and this because the PISM approach is based on attributes that gives the permanent identification for skin marks.

5. PROPOSED METHOD

In this paper we propose a hybrid technique for robust face recognition the technique includes skin detail analysis and surface texture analysis.

Skin detail analysis is detection and validation of various small scale structures in the surface (wrinkles, scars) and the texture (nevi – a general term for pigment lesions like birthmarks and moles) that stand out from normal skin appearance and represent potentially valuable references for individual distinction. Their predictable appearance, also under changing illumination, facilitates detection. And their numerous appearance in conjunction with unique distribution patterns scales well with extensive galleries. Furthermore such marks require no abstract encoding, in contrast to most other facial features. This fact could be exploited to query a database without having to provide a sample face, e.g. "search all faces with a birthmark near the upper right lip".

In Surface Texture Analysis a picture is taken of a patch of skin, called a skin print. That patch is then broken up into smaller blocks. Using algorithms to turn the patch into a mathematical, measurable space, the system will then distinguish any lines, pores and the actual skin texture. It can identify differences between identical twins, which is not yet possible using facial recognition software alone. The surface texture analysis (STA) algorithm operates on the top percentage of results as determined by the local feature analysis. STA creates a skinprint and performs either a 1:1 or 1:N match depending on whether you're looking for verification or identification. In verification, an image is matched to only one image in the database (1:1).

For example, an image taken of a subject may be matched to an image in the Department of Motor Vehicles database to verify the subject is who he says he is. If identification is the goal, then the image is compared to all images in the database resulting in a score for each potential match (1:N). In this instance, you may take an image and compare it to a database of mug shots to identify who the subject is.

The steps involved in facial recognition are as follows:

Acquire the image of person in digital format. Get picture of patch of skin of a person for surface texture analysis.

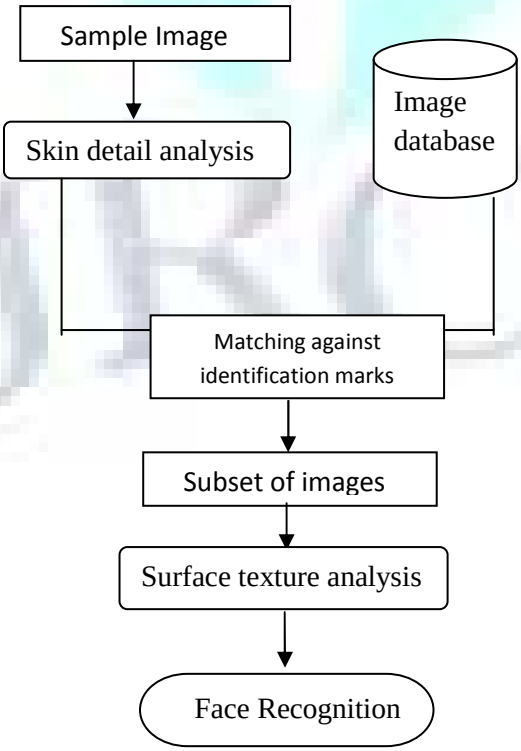
For performing skin detail analysis, analyze the picture taken to get the skin irregularities (marks) such as birth marks, moles or scars on face. This analysis will help us to localize the skin regularities in numerical terms.

Match the image against image database on the basis of localized marks this will give a subset of images matching the given criteria.

The resulting images are then subjected to surface texture analysis.

The final step is to determine whether any scores produced in step 4 are high enough to declare a match.

FIG. 1



6. RESULT

High identification accuracy can be achieved by PISM as the face recognition technique (surface texture analysis) is applied on the small subset of images obtained from the image database after skin detail analysis.

7. LIMITATIONS

Human faces carry skin marks by which identification and verification are made. The PISM approach is designed for such naturally occurred skin marks present for identification. In case of any make-up, manipulation or concealment of skin mark PISM approach will have certain limitations. However these limitations could be reduced by identification with original faces in the image or combining other approach for identification.

8. FUTURE ENHANCEMENTS

To cover up limitations PISM approach could be modified to identification of other approaches. Thus the future enhancement could be in terms of Integrated PISM i.e. I-PISM. Future work would comprise refinements in the comparison of local skin features (e.g. valuing the absence of salient moles as exclusion criterion) as well as fusion with other face recognition methods to support cases where no nevi (moles or birthmarks) are present.

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