# A Survey on Criminal Identification using Multi Biometric Traits in Image Processing

M. Ganga Eswari[1*], S.Dhanalakshmi[2] and .S.Karthik[3]

*[1]PG Scholar, Department of CSE,
SNS College of Technology, Coimbatore, India*

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*Abstract—* In recent years image processing gained the attention of many researches for criminal identification, medical science and Meteorology. This paper discussed about multi biometrics traits such as Face recognition, finger knuckle, RPPVSM, finger print, and vein pattern. Proposed work in this paper   RPPVSM fusion with Vein pattern and finger knuckle for criminal identification. RPPVSM are different from birthmarks since birthmarks are congenital but RPPVSM can be congenital or acquired. The two main sections in RPPVSM i.e.) detection, matching. Then vein pattern is impossible for duplicate evidence. finger Knuckle biometrics is one of such promising modalities. Texture pattern produced by the finger knuckle bending is extremely unique and makes the surface a distinctive biometric identifier.

*Keywords—Biometric traits, Vein pattern, Finger Knuckle, RPPVSM*

## I. INTRODUCTION

Image processing is a set of mathematical operation used to process and obtain certain characteristics of an image.
Now a day's criminal skin marks in evidence images can be detected manually by investigators or expert witness, it is impossible to process criminal databases manually due to their large size and complexity. Existing scenario an automated RPPVSM (Relatively Permanent Pigmented or Vascular Skin Marks) detection, matching and fusion with vein patterns. In this project addition of Finger knuckle pattern also fusion with RPPVSM.

RPPVSM are also different from birthmarks since birthmarks are congenital (i.e., appear at birth or shortly after birth) but RPPVSM can be congenital or acquired. In fact, most RPPVSM are acquired. Nevi develop during childhood and adolescence, lentigines occur on body sites with a long history of sun exposure. Some other biometrics (such as finger print) has created a duplicate and changes the evidence but vein pattern is impossible to create a duplicate and change the evidence by criminals. Finger knuckle pattern also impossible to create a duplicate the evidence and mostly a kidnap crime scene images have visible only the finger knuckle image patterns.

Accessing the large database is easier but it does not give more attention to uniqueness of biometric traits and accuracy level. The feature work as that problem, a multi biometric traits such as Vein pattern, finger knuckle pattern, and fusion with RPPVSM. So that increases the uniqueness and accuracy level of criminal identification and to identify the criminals in very short duration. So that investigators

work is easier and time consuming to identify the criminals. Biometric traits for identification of Gunmen, terrorists and rioters often cover their faces with masks or clothing, making face recognition impossible. So those identify the other parts of the body such as finger knuckle patterns, vein patterns and RPPVSM.

The Score-level fusion method using for RPPVSM detection purpose in heir identification accuracies compare than the existing skin mark detection. Existing detection method as "Preliminary methods, single space LOG filter and FRST based method (Fast Radial Symmetry Transform).non-rigid Coherent Point Drift (CPD) point method using for RPPVSM matching purpose. The uncovered vein patterns are extracted using a Gabor filtering-based vein pattern extraction method and represented in a point set for matching. Once RPPVSM detection is representation after that have matching the crime scene and database images have been fusion.

## II. BIOMETRIC TEHNIQUES

The biometric identification system are useful in several application such as commercial and law enforcement application, especially in criminal identification, recognition of human faces, finger prints, vein patterns, finger knuckle and many  such biometric images.

### A. Finger Print
Fingerprint recognition is one of most prominent and efficient Biometric technologies.[1] Nowadays, it is used in many real   time applications. But still recognizing fingerprints in poor quality images is a complicated

problem. In recent years, many methods, exemplary are given to improve the accuracy of recognition system. Nowadays, fingerprint recognition is one of the most essentially biometric technologies based on fingerprint distinctiveness, constancy and ease of acquisition. Though many  applications use this technology, its problems are still not fully solved, especially in poor aspect fingerprint images and  low-cost acquisition devices with a small area are adopted.
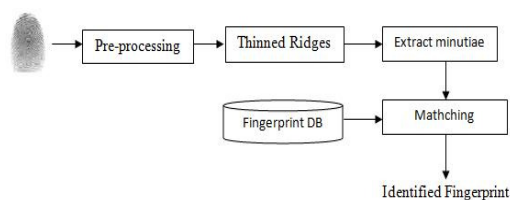


*Fig.1 Fingerprint Recognition process*

The important step which disturb on system accuracy is identical between template and  fingerprint. Many solutions are proposed to increase the accuracy .This matching algorithms may be segregated into three types: minutiae-based approach, correlation-based approach and feature-based approach. [9] However, as evaluated, the score of these method is not high (exclusively in case fingerprints are of the carbon finger but they are pivoted or the interchange is too small). So, it's necessary to design a model to standardize the fingerprint trait in order to increase the matching score.

In this paper, we recommend a *standardize fingerprint model* to incorporate fingerprints which produce for all fingerprint templates stored in database when matching. Fingerprint- based identification is the oldest and a well established method.

## B.   Face Recognition

Face recognition presents a challenging problem in the field of image analysis and computer vision.[2] The surveillance of information is becoming very compelling and difficult. Security cameras are presently common in airports, Offices, University, ATM, Bank and any other locations with a care system. Face recognition is a biometric system used to identify or verification a person from digital images. Face recognition system should be able to automatically detect a face in an image. This associate extracts its features and then notices it, regardless of lighting, expression, illumination, aging, transformations and pose, which is a difficult task. Face recognition systems find human by their face images. Face recognition systems enact the presence of an authorized person. **Feature-based Methods:**   local feature such as eyes, nose and mouth are first of all extracted and their regions and local data are fed into a structural segregate. A huge challenge for feature extraction methods is feature "renovation", this is when the system

tries to recover features that are invisible due to large deviations, e.g. head mien when we are matching' a frontal image with a profile image.[5] characterize between three different extraction mechanism such as

▪        Generic methods based on edges, lines, and curves
▪        Feature-template-based methods .

▪        Structural matching methods that take into consideration geometrical Constraints on the features.

[3] Image normalization is the first step of all face recognition systems. First the face area is detected in the image and used template matching to localize a face and the iris centers should be detected because the distance  is used as a normalization element. We located the eyes in facial images of different size using the luminance fundamental. It needed the eyes must be open in input images. The gray-scale image was handled  by an edge detector (we used Sobel).

[4]describe a preprocessing step that endeavor to identify pixels affiliated with skin independently of face-related features. This Technique represents a sensational reduction in computational requirements over previous methods.
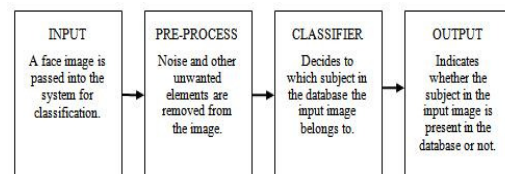


*Fig. Representation of a face recognition system*

[3]Since skin color in humans varies by individual, research has declared that intensity rather than chrominance is the main distinguishing characteristic. The perception step typically uses an gray-scale portrayal of the image compressed by the 2D-DCT for further processing. This gray-scale version consist of intensity values for skin pixels.

## C.   Finger Knuckle

Each and every common biometric identifier has its own advantages and disadvantages. There lies a broad scope for researchers in searching new kinds of biometric identifiers. Hand-based biometrics has attracted lot of attention for personal identification by making use of palm print, hand geometry, 3-D finger geometry and hand vein. But these systems have certain limitations. Palm print recognition systems have not yet been expanded for civilian applications, because of its large physical size.[5]One of the current trends in biometric human identification is the development of emerging modalities and Knuckle biometrics is one among them. Texture pattern produced by the finger knuckle bending is extremely unique and serves as a distinctive biometric identifier. The feature based identification methods for an emerging biometric identifier known as Finger-Knuckle-Print (FKP). 2D Gabor filters extracts local orientation information of the image. This information is then employed to extract and represent the

FKP features. The angular distance is used to measure the similarity while performing knuckle pattern matching
[6] The texture finger knuckle bending is a distinctive biometric identifier. As result of complex interaction among bones, muscles, skin and issues there are several hand features which remain relatively unexplored for their potential in biometric especially in the case of forensic application. The minor finger knuckle patterns can either be used as independent biometric identifier patterns or can be used to improve the performance from the major knuckle patterns, A completely automated approach for finger knuckle identification with key steps as region of interest segmentation, image normalization, enhancement and robust matching.

While in some humans the major finger knuckle pattern can be overlapped by hair, the minor finger knuckle pattern does not suffer from such problem. There are several forensic images, when only minor finger knuckle patterns are detectable for possible suspect identification. In addition, the matching results from the minor finger knuckle pattern to improve the reliability and accuracy of traditional major finger knuckle based biometric identification.
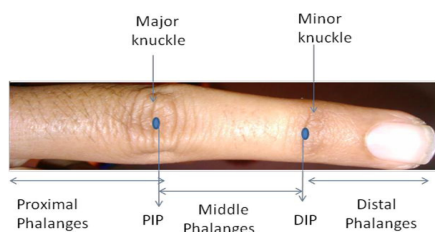

*Fig.Finger Knuckle Anatomy*

### D. RPPVSM

[7]Recent advances in multimedia technology, the involvement of digital images/videos in crimes has been increasing significantly. Identification of individuals in crime images/videos can be challenging. For example, in cases of child sexual abuse, child pornography, and masked gunmen, the criminals face victims are often hidden or covered and some body organs (e.g., back, thigh, and arm) can be noticed from the digital evidence. Although tattoos and scars use for identification in some criminal cases, they are neither universal nor unique skin marks named Relatively Permanent Pigmented or Vascular Skin Marks (RPPVSM) as a biometric trait for forensic identification.(1) Analyzing spatial distribution statistics of RPPVSM, (2) increasing an uniqueness model for independently and uniformly distributed RPPVSM patterns, (3) upward RPPVSM matching algorithm,( 4) analytically validating the model, and (5) estimating potential error rates for verification and identification. Several skin marks change rapidly at the same time as some others tend to be stable. Skin marks caused by provocative circumstances (e.g., eczema and psoriasis), skin upset, skin allergy, or insect bites have a transient nature while skin marks are stable over time (six months or longer).These skin marks occur as

a result of improved pigmentation (e.g., nevi and lentigos) or vascular explosion (e.g., cherry hemangiomas),The category of skin marks named as **"Relatively Permanent Pigmented or Vascular Skin Marks"( RPPVSM)**.This statement of "relatively permanent" skin marks uses in some atypical cases (e.g., halo nevi) several skin marks can become visible or fade away over a period of many years.[8] Personal identification is an important process in forensic departments and also Law enforcement agents , forensic laboratories around the world use fingerprint, palm print, facial recognition and voice recognition regularly for criminal and victim identification. On the other hand, these biometric traits are not applicable to the cases where only evidence images showing non-facial body parts, To our understanding, even though facial skin marks utilize as a soft biometric trait to enhance the performance of automatic personal identification systems, there is no scientific or systematic study about personal identification solely based on small skin mark patterns. The discriminative power of skin marks is not yet known - how many skin marks are enough to uniquely identify one person, as with a fingerprint? Here, we study the basic statistical properties of small skin marks to finally understand their discriminative power for personal identification so that they could be used in legal cases. Multimedia technology, small skin marks recognizable on bare skin in photographs that lack faces could become an important tool for law enforcement.

### E. Vein pattern

Vein pattern recognition is one of the latest biometric techniques research today.[10] whereas the concept behind the technique is quite simple, there are different challenges to be found throughout the design and implementation of a vein scanning device relating to the hardware lighting system and the actual algorithms use for processing the acquire images. In order to minimize the scanning errors the image from the camera should be noiseless and also algorithms should be able to detect the vein pattern in several real life conditions. Many implementations of this method are used in a commercial phase and there is a need for a system that can detect, analyze and extract the accurate human vein pattern and reducing the computational needs of the image processing algorithms. A biometric system is fundamentally a pattern-recognition system that identify a person based on a feature vector that is derived from specific physiological or behavioral features that the person possesses. A vein pattern detection has been verified to fully comply with this definition and it provides many significant biometric features:

1. uniqueness and permanence of the pattern
2. non-contact detection procedure
3. Almost impossible to forge or copy.
4. The biometric parameter is hidden from general view
5. The vein pattern is intricate enough to allow sufficient criteria for positively detecting various subjects' even

identical twins.

[9]The vascular patterns of an individual's hand as personal identification data are taken for vein based authentication. Compared with finger , the back  side of a hand or a palm has a broader and more complicated vascular pattern and contains a large quantity of differentiating features for personal identification. The features of vein pattern are given below

- Unique and universal.
- Carry deoxidized blood towards the heart except umbilical & pulmonary veins.
-Developed before birth and persist throughout the life, well into old age.
- Differ even between matching twins.
- Internal attribute protected by the skin.
- Less susceptible to damage.

## CONCLUSION

The accuracy level of multi biometric traits is slightly increased than the previous individual biometric methods. This paper surveys about the introduction and various biometric techniques based on the different biometric traits, related work on existing biometrics have been used which aims to identify the criminals in a short term. The duplicate evidence is the major disadvantage in finger prints and face recognition. So in order to overcome it is fuse with multi biometric techniques

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