

# Impact of Skin Diseases on Fingerprints Which Causes Rejection in Biometric Verification Base System

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## ABSTRACT

Now a day's Fingerprints recognition through biometrics is most often used technology around the globe. The main aim of this research paper is to discuss the various diseases of the skin and loose skin (old age effect) which affect the fingers skin and rejected in the acceptances of the biometrics fingerprints verification bases system, these skin diseases which affect the fingers are discuss mainly from medical analysis. The paper also shows different samples of fingers which were affected with diseases or loose skin (age effect) which is the major causes in the acceptance of the verification system.

**KEYWORDS:** Mobile Computing, Skin Diseases, Biometric fingerprints.

## 1. INTRODUCTION

An automated method of an individual's identity is biometric verification which is confirmed by considering some unique physiological characteristics such as fingerprints or retinal scan. The physiological characteristics are stable like iris patterns and palm prints. The measurement of these types of physiological traits is essentially unalterable [2]. Biometrics is very secure and automatic methods of personal identification which is receiving much attention now days. Fingerprints biometrics systems are deployed for many purposes in different organization depend on their requirements like government applications at borders or other large scale examples are US-VISIT's IDENT program and FBI for IAFIS service [3].

All diseases but specially Skin diseases can overwhelming effect on a person's psychological and physical wellbeing [1]. The enquiry report of "THE PSYCHOLOGICAL AND SOCIAL IMPACT OF SKIN DISEASES ON PEOPLE'S LIVES, London 2013" highlighted the influence of skin diseases can affect the person's lives that include relationships, schooling, self-esteem, career and social life activities which make them frustration, desperation and at the end isolation. Skin diseases are very common but people often ignore them [4][5]. But when it comes to fingerprints acquirement, the disadvantages are then comes in front of people that how these diseases affect the skin's valuable parts like hand palm and fingertips.

Biometrics is the process of identifying an individual's physical and behavioral characteristics like iris scanning, hand palm recognition, fingerprints, face recognition etc. the purpose of this is to provide a much more secure way to physical and logical levels. It cannot be duplicated because every individual have unique physical characteristics like fingerprints. On the other hand passwords and pin codes which are less secure because password can be guessed or forgotten and pin codes or smart cards can be stolen while biometrics are highly secure because it can neither be changed nor other individual have same characteristics[9].

## 2. Characteristics of Skin

Skin is a sensitive organ of our body which performs some vital functions. It has the ability to feel pain, hot and cold, pressure, a delicate touch and the most special and dedicated communicator of brain and outside environment, which we call the nervous system. To perform these activities, skin has some functions which are:

1. **Sensitivity:** skin has nerve endings which identify touch, pain, cold, heat and light pressure.
2. **Heat regulation:** skin has the ability to regulate temperature of the body according to outside environment. When its cold skin creates "goose bumps" by shivering. Pores in skin are closed with the help of shivering. When it is hot, skin regulates body temperature with the help of sweating to get body temperature low when it is overheated.

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3. **Absorption:** sun rays have much amount of ultraviolet rays which is absorbed by skin and form vitamin D from it, which is helpful in formation of bone. Some medicines like anti-smoking patches are also absorbed by skin into blood stream.
4. **Protection:** our body is protected by skin from ultraviolet light by producing pigmented color which is called melanin. Because excessive amount of ultraviolet is dangerous for body. Skin also protects body from incursion of germs and bacteria because it forms an acid-mantle (skin sweat and sebum).
5. **Excretion:** the process of eliminating toxins and waste products from body via sweat gland occurs through skin. And this function is much important because it helps to clean the body from inside.
6. **Secretion:** when sweat and sebum are secreted to the surface of the skin. Sebum is used to keep the skin soft and lubricated, and sebum also combines with sweat forming an acid mantle that keeps creating a right pH-balance with the help of which the skin fights against infection [8].

### 3. Impact of Diseases on Fingerprints

The fingerprints are not accepted in the biometric verification because of the following factors of skin diseases on figures skin which affect the fingertips and palm of the hands and are divided into three main categories[5][6].

#### 3.1 Diseases that affect papillary line structure

Major diseases which affect the structure of papillary lines are Furuncle, Pitted Keratolysis and Fingertip Eczema. Furuncle is a tender, acute and round staphylococcal infection which results in central suppuration. Pitted Keratolysis is an infection caused due to bacteria. Fingertip eczema, chronic type of eczema which affects fingertips due to which skin becomes very dry, cause of this disease may be an allergic reaction [5].

#### 3.2 Diseases due to which only skin color changes

Diseases which affect the color of the skin are Hand-Foot-Mouth disease (HFMD), Infective endocarditis and Tinea of palm. Hand-Foot-and Mouth disease is commonly a mild illness. Infective endocarditis, septic and sepsis shock, very serious infections having high associated mortality and morbidity rates. This disease mainly attack on people in the age between 30 to 40 years. Tinea of palm, another skin disease in which skin becomes dry. It attacks soles of foets and palm of the hands [5].

#### 3.3 Diseases due to which both skin color and papillary line structure changes

Examples of such diseases which affect both papillary line structure and also skin color are Hand eczema, Pompholyx also known as dyshidrosis, Psoriasis and Raynaud's phenomenon. Hand eczema is an inflammatory disease which attack hands and its common to people who work in industries. Pompholyx is a distinguishing reaction of unknown etiology which is presented as symmetric vesicular foot and hand dermatitis. Psoriasis is also a skin disease which is due to a hereditary disorder. Raynaud's phenomenon is a digital ischemia which occurs either due to emotional stress or because of exposure to cold [5].

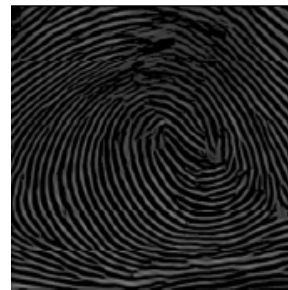
### 4. Fingerprints Recognition

Fingerprints recognition through biometrics is most often used technology around the globe. So with this major use of biometrics technology we must know about the process that how fingerprints are being recognized when they are acquired. This recognition process of fingerprints involves main five steps.

1. **Fingerprint acquirement:** Fingerprints are scanned i.e. the biometric peculiarity of physical humans are digitized by digitizers and then transferred to the computer with the help of sensors as shown in the figure 1.
2. **Image enhancement:** In this step, quality of the acquired image is enhanced. Enhancement of image qualities can be done by several ways like filtering by frequency spectrum; edge filters etc as shown in the figure 2.



**Figure 1:** Normal fingerprint scanned image



**Figure 2:** Enhanced image

3. **Thresholding:** Normally the image is acquired by 256 gray levels, but here we need binary representation. Several thresholding schemes are used (e.g. regional thresholding or adaptive thresholding) to separate background (valleys) from papillary lines (ridges) as shown in the figure 3.

4. ***Skeletization or Thinning:*** When the papillary lines are separated, they have a variety of thickness throughout the lines. To make algorithm simple and efficient for extraction of minutiae, the thickness of papillary lines should be just one pixel as shown in the figure 4.

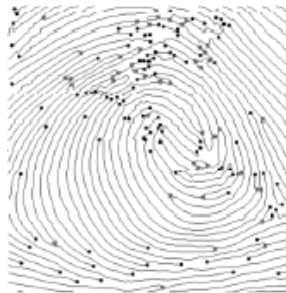


**Figure 3:** Thresholding Image



**Figure 4:** Thinning image

5. ***Minutiae extraction:*** In the figure 5, minutiae detection algorithm extracts each and every minutiae point that is found in fingerprint.[7]



**Figure 5:** Minutiae points' image

## 6. RESULT AND DISCUSSION

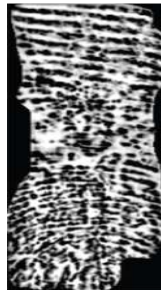
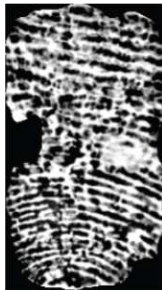
In this section different scenarios are been represented. Each scenario presents a single issue which majorly affected the fingerprints acceptance in biometrics verification.

### 6.1 SCENARIO 1

In this scenario we discuss some common diseases which majorly affected the acceptance of fingerprints in biometric verification.

#### 6.1.1 Hand eczema

The most common type of skin disease is hand eczema which affects the epidermis and upper dermis of the skin layers. Hand eczema is very common in many kinds of industrial occupations. Its typical example is common in construction and cement workers which is hand dermatitis. Hand eczema was mostly common in the people whose hands were exposed to occupational work. People include hairdressers, housewives, nurses and those workers whose hands were exposed to repeated work of cement. We have several forms of hand eczema like irritant dermatitis, atopic eczema, allergic dermatitis and hyperkeratotic dermatitis. One kind is fingertip eczema which is dry chronic form of eczema which affects the palmer surface of fingertips. In this type of eczema there may be the involvement of one or several fingers. Initially the skin is moist and wet and then become cracked, dry and scaly. The skin peels off from the fingertips and leaves very painful surface without skin lines [4].



**Figure 6:** shows samples of a special type of hand eczema called atopic eczema

### 6.1.2 Pitted keratolysis

Pitted keratolysis is common in the people whose hands are exposed to the hot environment and they also use rubber gloves in that hot environment. This disease is common in those people who do work in chemical industries or they do labor work in hot and humid environment and they wear rubber gloves. The most regularly noticed symptom in these people is Hyperhidrosis. The cause and origin of this disease is bacteria namely *Corynebacterium* species. This disease leaves on skin many circular and also punched out depressions on the surface of the skin. Due to this disease the skin lines are vanished [4].



**Fig 7:** Sample shows affected finger because of Pitted Keratolysis

## 6.2 SCENARIO 2

In this scenario we discuss finger skin loose because of elder age affect which majorly affected the acceptance of fingerprints in biometric verification.

### 6.2.1 Age above 60

There is a difference between the results of the fingerprints of younger people and old people although most common issue is that people whose age is above 60 years have much problems in biometric verification. And the problems are due to loss of collagen in elder people because aged skin is loose and dry. When skin firmness is decreased it affects the quality of the fingerprints acquired by the biometric sensors. There are two main causes due to which the quality of aged fingerprints become very low and poor are non-uniform and irreproducible.

#### 6.2.1.1 Non-uniform

When the skin of presented fingers is dry or too wet, the quality of the image is known as non-uniform [12].

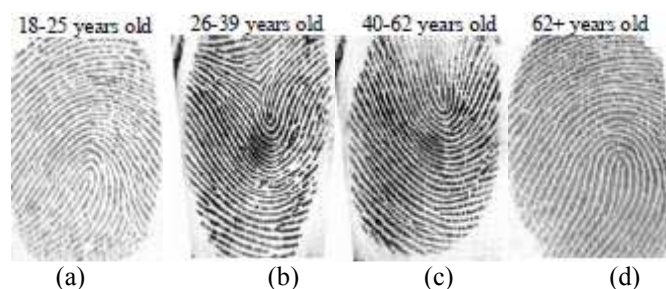
#### 6.2.1.2 irreproducible

When the ridges of presented fingerprints are changed permanently or semi-permanently cause irreproducible contact and it is due to injuries, scars, and manual labor work and other issues like wrinkled or loose skin. The result of these issues introduces wrong minutiae points to the sensors of biometrics [12].

### 6.2.2 Fingerprints Comparisons on age wise

In figure 8 and 9 we have a comparison of fingerprint images of different age's from 18 to 62+. Figure 8(a) shows a high quality image of age group 18 to 25 years while figure 9(a) shows poor quality image of the same age group. But in both cases we can read the papillary lines and fingerprint is acceptable in verification system. Similarly figure 8(d) and 9(d) represents fingerprint image of age 62+ of good quality fingerprint image and low quality of fingerprints images, in both cases the papillary lines are not clearly visible.

So that people having age of 62+ years are facing problems with biometrics fingerprints acceptance because of very loose and dry skin due to which their minutiae points are either vanished or displaced [13].



**Fig 8:** High quality fingerprints images of different age groups

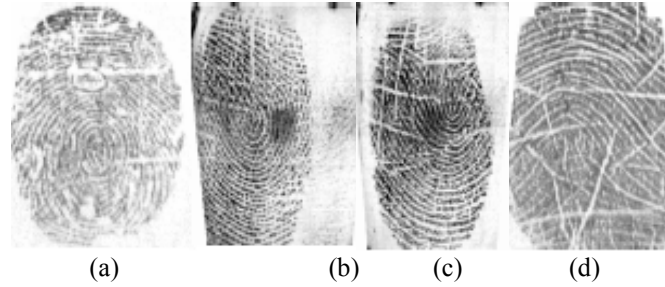


Fig 9: Low quality fingerprints images of different age groups

## Conclusion

Biometrics is the means of identifying and verifying personal identity by analyzing and measuring some unique characteristics like iris patterns and fingerprints and most secure, efficient, easy to use and cost effective technologies used for the authentication and authorization purposes and has become the first choice of government and non-government organizations.

To conclude this research work presents biometric technology which is very reliable means of identification but has certain lacunae's due to which issues were raised in the acceptance of fingerprint at biometric systems technology. In scenario 1, the overall discussion is about the skin diseases which majorly affect the fingerprints while in scenario 2 comparison of the age affect on the fingerprints skin is completely discuses.

## REFERENCES

- [1] <http://www.appgs.co.uk/publication/view/the-psychological-and-social-impact-of-skin-diseases-on-peoples-lives-final-report-2013/>
- [2] Sravya. V, Radha Krishna Murthy, Ravindra Babu Kallam and Srujana B (2012) 'A survey on fingerprint biometric system', *international journal of advanced research in computer science and software engineering*,
- [3] Feng, J., Jain, A. K., & Ross, A. (2009). Fingerprint alteration. *Submitted to IEEE TIFS*.
- [4] Drahansky, M., Dolezel, M., Urbanek, J., Brezinova, E., & Kim, T. H. (2012). Influence of skin diseases on fingerprint recognition. *Bio Med Research International*, 2012.
- [5] Drahanský, M., Brezinova, E., Orság, F., & Lodrová, D. (2009). Classification of Skin Diseases and Their Impact on Fingerprint Recognition. In *BIOSIG* (pp. 173-176).
- [6] Drahansky, M. (2008). *Fingerprint Recognition Technology: Skin Diseases, Image Quality and Liveness Detection* (Doctoral dissertation, Habilitation Thesis, FIT BUT).
- [7] Dolezel, M., Brezinova, E., Urbanek, J., Drahansky, M., & Kim, T. H. (2012). *Influence of Skin Diseases on Fingerprint Quality and Recognition*. INTECH Open Access Publisher.
- [8] Drahansky, M., Brezinova, E., Hejtmankova, D., & Orsag, F. (2010). Fingerprint recognition influenced by skin diseases. *International Journal of Bio-Science and Bio-Technology*, 2(4).
- [9] Penny, W. (2002). Biometrics: A double edged sword-security and privacy. *SANS Institute*.
- [10] Jain, A., Ross, A., & Prabhakar, S. (2001). Fingerprint matching using minutiae and texture features. In *Image Processing, 2001. Proceedings. 2001 International Conference on* (Vol. 3, pp. 282-285). IEEE.
- [11] Fernando Alonso-Fernandez, Josef Begun, Julian Fierrez, Hartwig Fronthaler, Klaus Kollreider and Javier Ortega-Garcia (no date) Fingerprint Recognition. . Inline citations.
- [12] Sickler, N. C., & Elliott, S. J. (2005, October). An evaluation of fingerprint image quality across an elderly population vis-a-vis an 18-25 year old population. In *Security Technology, 2005. CCST'05. 39th Annual 2005 International Carnahan Conference on* (pp. 68-73). IEEE.
- [13] Modi, S. K., Elliott, S. J., Whetsone, J., & Kim, H. (2007, June). Impact of age groups on fingerprint recognition performance. In *Automatic Identification Advanced Technologies, 2007 IEEE Workshop on* (pp. 19-23). IEEE.