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Study and development of algorithm of different skin diseases analysis using image processing method

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Abstract

Tele-dermatology is a system in the medical field of dermatology where telecommunication technologies are used to exchange information concerning skin conditions over a distance. The advantage of tele-dermatology is that the patients need not to be physically present in consultation room of doctor(s). We have collected (i) eczema, scabies, pyoderma, ringworm, psoriasis, MRSA skin disease images from the American Academy of Dermatology website. Our study found that Feature Extraction is an important aspect to aid the doctors or Automatic decisions making by computer algorithm to find the diseases of the skin amongst the all possible skin diseases. Our approach was Artificial intelligence based computer algorithm that would be able to make diagnostic decision to a good degree of accuracy. We found features namely, contrast, correlation, energy, maximum probability, entropy, smoothness, homogeneity based on STATISCAL THEORY. We computed the features from the digital images of skin. We found many of the above mentioned features do vary with good degree of margin for Different Skin diseases, but few of them are barely indistinguishable.

Keywords: Tele-dermatology, Feature extraction, Statistical theory, Skin images.

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Introduction

In Tele-dermatology, telecommunication technologies are used to exchange information concerning skin conditions over a distance using visual image, data and audio communication [1,2]. The patients need not to be physically present in consultation room of doctor(s) in tele-dermatology. Though online tele- dermatology system has virtual feeling of presence of patient and doctor, societies like in Bangladesh with large percentage of populations are conservative, where women do feel embarrassed to expose themselves or their inner parts of body to the doctors, especially to male doctors. An offline tele-dermatology system may overcome this problem, where doctors will diagnosis the skin diseases based on sent images of diseased skin, without patient's inner parts of diseased skin being exposed to doctors [3,4].

Table 1. *Texture descriptors based on Statistical moments for different diseases affected skin images*

Image of the diseases	Smean	Scontrast	Reverse smoothness	entropy
dengue	147.34	48.61	0.035	6.85
scabies	158.9	26.26	0.0105	6.74
eczema	208.28	32.23	0.0157	6.52
Chicken pox	206.12	19.68	0.0059	6.1013
MRSA	140.73	53.48	0.0421	7.399
pyoderma	131.92	23.513	0.0084	6.5029
Candidiasis of skin	131.20	36.96	0.0206	6.8048
psoriasis	163.60	32.062	0.0156	6.7420
ringworm	139.7	23.69	0.0086	6.27
Malignancy of skin	153.47	34.13	0.0176	6.69
ACNE(white heads)	163.64	28.4054	0.0123	6.18
Acne(black heads)	181.42	23.8	0.0086	6.55

In such cases a computer based algorithm needs to be developed, which is capable of Automatic Analysis of the skin diseases and make diagnostic decisions, this will help dermatologists, especially in offline system as well as in online system. The above said computer algorithm requires an intelligent and smart method by which normal skin and different diseased skin can be distinguished to a good degree of accuracy Figures 1 and 2.

From the above graph of Smean, it has been noticed that there is a slight variation among different diseases. So, it may be difficult to differentiate them.

Texture analysis concerns mainly with feature extraction. Feature extraction identifies and selects a set of distinguishing features to characterize a texture in an image. By representing a complex texture with a small number of measurable features or parameters, texture analysis archives great dimension-reduction and enables automated texture processing. In the present work, different parameters of texture analysis are calculated of the normal image and Skin diseases affected images and compared. We use some matlab functions to calculate some of the above mentioned features and attributes of digital images of normal and different types of Skin diseases (Figures 3-5) [5,6].

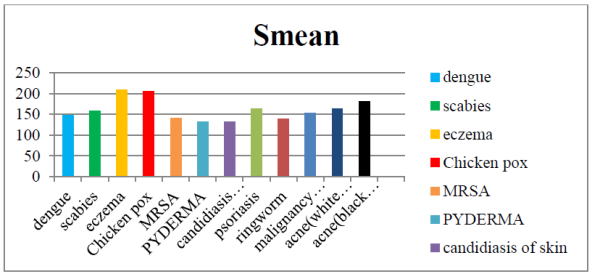

Figure 1. *Bar chart of Smean of different diseases affected skin vs. normal cheek*

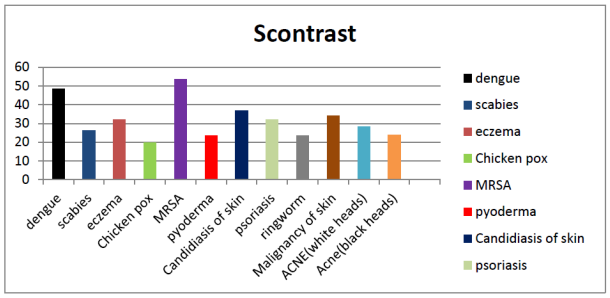

Figure 2. *Bar chart of Scontrast of different diseases affected skin vs. normal cheek skin*

From the above graph of Scontrast, it has been noticed that there is a big variation among different diseases. So, it may be possible to differentiate them.

Materials and Methods

In this present works, we have computed the different parameters from the skin images which characterize the textures of Images (texture descriptors) of skin. The features of skin(s) may be computed /estimated based statistical moments based features. We have computed skin features of as mentioned above for the diseased skin.

We collect 12 different types of diseases skin from American Telemedicine Association's website and cropping them and select only the diseases affected image. Then we determine the descriptors based on the statistical moments which are shown in the Table 1. Then we make Bar Charts for different descriptors from the graphs we see the parameters of the diseases skin are different to each other. So it a great achievement which is very helpful for doctors in making decisions about the diseases.

From the above graph of reverse smoothness, it has been noticed that there is a large variation among different diseases. So, it may be possible to differentiate them.

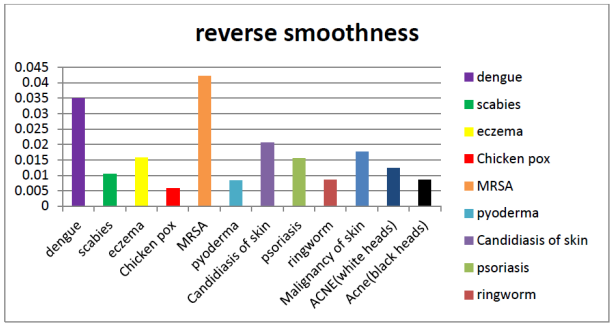

Figure 3. *Bar chart of reverse smoothness of different diseases affected skin vs. normal cheek*

Discussion

To test our proposed concepts and Algorithm for Skin diseases analysis for intelligent teledermatology system, we have collected diseased skin images namely: eczema, scabies, pyoderma, ringworm, psoriasis, MRSA , chicken pox, malignancy of skin, candidacies of skin from the American Academy of Dermatology website. We have found that Feature extraction is another very important aspect in skin diseases analysis from digital skin images.

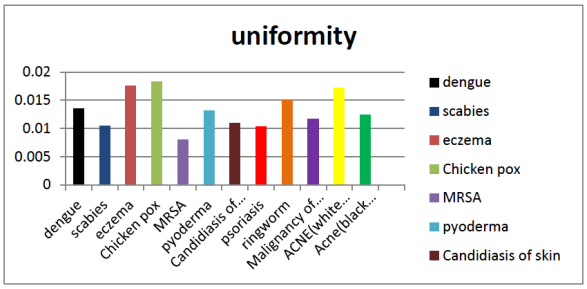

Figure 4. *Bar chart of uniformity of different diseases affected skin vs. normal cheek*

From the above graph of uniformity, it has been noticed that there is a big variation among different diseases. So, it may be possible to differentiate them.

Our Statistical moments based algorithms were used to compute the following characteristics and features of Digital skin images namely: Smean, Scontrast, uniformity, contrast, correlation, energy, maximum probability, entropy, smoothness and homogeneity. It was found that many of the above mentioned features & Characteristics of images of different

skin diseases are different, but some are very close in values, and may not use as differencing properties. However, since many of the above mentioned features are distinguishable for different skin disease, our Algorithm may be used for Automatic Analysis & Diagnosis for skin diseases to a good degree of accuracy or may help dermatologists in making his or her decisions.

From the above graph of entropy, it has been noticed that there is a slight variation among different diseases. So, it is difficult to differentiate them.

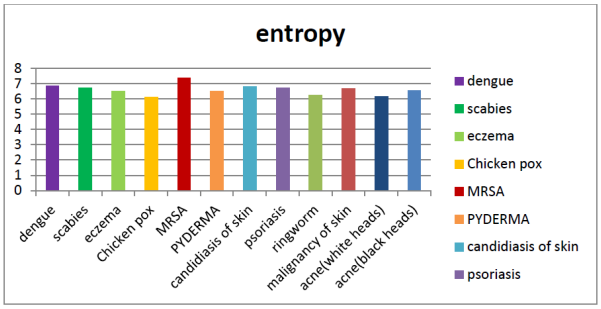

Figure 5. *Bar chart of entropy of different diseases affected skin vs. normal cheek.*

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We use different books related image processing system. The books are Digital Image Processing, Third Edition by R.C. Gonzales and R.E. Woods, Computer Graphics, Principles and Practice edited by J.D. Foley, A. van Dam, S.K. Feiner and J.F. Hughes. Introduction to Pattern Recognition: Statistical, Structural, Neural, and Fuzzy Logic Approaches edited by Menahem Friedman and Abraham Kandel, Fundamentals of Digital Image Processing edited by Anil .K Jain etc. These books are helpful to complete our paper.

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