Modern Trends on Facial Skin Disease Detection System

Priyanka Banerjee[1], Samir Kumar Bandyopadhyay[2]

[1]Department of Computer Science, The Bhawanipur Education Society College, Kolkata, India

[2]Academic Advisor, The Bhawanipur Education Society College, Kolkata, India

Abstract: ***Human skin provides an insulating shield protecting the body against temperature fluctuations, harmful chemicals and so on. Human skin also absorbs Vitamin D for converting calcium into healthy bones and permits the sensations of touch, heat and cold. The paper reviewed the effects of human facial skin diseases.***

Keywords: Hypodermis, Skin Disease, Image Processing and Detection System

1. Introduction

In human anatomy, skin is the largest organ of the body with a total area of about 20-22 square feet and its weight lies between six and eight pounds. Skin is made up of three layers-

1) The skin's base layer is the hypodermis is made of fat and connective tissues.
2) Above hypodermis there is another skin layer called dermis contains connective tissues, hair follicles and sweat glands.
3) The outermost layer is the epidermis provides a waterproof obstacle and creates skin tone.

In human anatomy, facial skin is the most sensitive part. The human death can occur sometimes due to health conditionssuch as infections or genetic illness. It can cause several facial skin diseases like Acne, Eczema, Moles, Melanoma, Rosacea, Vitiligo and many other fungal infections. With the continuous development of medical cosmetology and upgraded technology now a day's people are very much concerned about the care of facial skin.

In recent days most of the men, women even children are also suffering from various facial skin related diseases. Not only skin diseases harm the human skin but also decreasing person's confidence and turn to depression. So it is important to diagnose skin diseases seriously and detect it at early stage, if possible. It is also necessary to prevent it from spreading in other parts of the body.

Recently medical science using modern computerized techniques can identify diseases more accurately for better medical treatment. Image Processing Technology is widely used in medical science to assists doctor. Image Processing Technology is used to detect various skin diseases by using different process like feature extraction, segmentation, classification, prediction, filtering and many more. All these process require method for implementation.

Generally Image Processing models take some images or video clip as input then perform the necessary image pre-processing techniques which provide noiseless enhanced images. The pre-processed images can be further used by different necessary image processing methods and produce output that is also another image having some special characteristics. The systems detect various skin diseases of different ages using image processing techniques. It can also provide high accuracy level of the detection methods.

This paper presents a review of different skin disease detection system using image processing techniques. A relative study of a various methods of skin diseases detection system is made and performance analysis of those systems is also discussed.

2. Literature Review

Xiangyi Kong et al.[1] proposed an automatic detection of acromegaly from facial photographs using machine learning methods. They used various accepted machine learning algorithms to train a dataset consisting of 527 acromegaly patients and 596 normal patients and to test a dataset consisting of 128 normal patients and 114 acromegaly patients. At first they used OpenCV to discover the face from the images. Then using image pre-processing techniques the images were cropped and resized to the same pixel dimensions. The researchers then used some Image processing techniques to extract facial features like locations of facial landmarks that having the potential clinical indicators from the detected faces. Then to improve the performance, Frontalization was used to synthesize frontal facing views. Several popular machine learning methods including Linear Models, K-nearest neighbours, Support Vector Machines, Forests of randomized trees, Convolutional Neural Network and Ensemble Method were used to identify facial images, extracted facial landmarks, and synthesized frontal faces. Sensitivity and specificity, positive predictive value (PPV) and negative predictive value (NPV), and f1-score were used as different classical metrics to measure the quality of acromegaly detection. The best result of their proposed method using CNN was represented a PPV of 96%, a NPV of 92%, a sensitivity of 91% and a specificity of 96%. The F1-score for acromegaly patients was 0.75 and the F1-score for normal patients was 0.77.

J. Y. Sun et al.[2] proposed an automatic facial pore analysis system using multi-scale pore detection and optimal scale selection methods to detect different sizes of pores and calculate the pore score representing the size of pore enlargement by exploiting the relationship between the pore-related features and the clinical reference. Using the methods the researchers extract pore-related features like total area, average size, depth, and the number of pores from the facial images. By the researchers a correlation analysis were also conducted between the facial features and clinical grading. They also compared their analysis result with conventional pore-analyzing devices. According to the researchers, the proposed system achieved better performance showing stronger correlation i.e. ρ =0.765 with the clinical grading having correlation ρ = 0.569.

Zhen Wang et al.[3] proposed a facial pore detection algorithm based on characteristics of skin pigment distribution. In their experiment the researchers divide the entire process into three steps. At first two feature detection algorithms namely speeded up robust features (SURF) and scale-invariant featuretransform (SIFT) were used by the researchers to detect and describe the skin features from images on different pigment layers and DBSCAN algorithm was used to calculate the threshold value. Then, for the description of the similar positions of the same detected points on different pigment layers the Euclidean distance was introduced. At the last step, boundary thresholds with the optimal scales were put to eliminate the interferences from all skin features except pores. They compared the proposed method with the original skin image and skin melanin layer image for the confirmation of the accuracy of facial pore detection and effectiveness of filtering interferences. The average accuracy of their proposed system was 92.1987.

Zhe Wu et al.[4] described a comparative studies on different CNN algorithms for face skin disease classification based on clinical images. They used a dataset consist of 2656 face images belonging to six skin diseases such as seborrheic keratosis (SK), actinic keratosis (AK), rosacea (ROS), lupus erythematosus (LE), basal cell carcinoma (BCC), and squamous cell carcinoma (SCC). They used five mainstream CNN algorithms include ResNet-50, Inception-v3, DenseNet121, Xception and Inception-ResNet-v2. Using these five network algorithms the diseases were classified in the dataset for comparison purpose. The Inception-ResNet-v2 structure achieved the highest performance i.e. 67.2% and 63.7% as the mean recall and precision value respectively. Then the researcher pre-trained this model with another dataset of the same disease type, but from other body parts and performed transfer learning method. The Inception-ResNet-v2 model achieved 92.9%, 89.2%, and 84.3% recalls for LE, BCC, and SK, respectively, and the mean recall and precision reached 77.0% and 70.8% respectively.

T. Zhao et al[5] proposed a deep learning model for assessing Facial Acne Severity from Selfie Images. By using a ResNet-152 pre-trained model, they implemented a transfer learning method by extracting features from the images. Then added and trained a fully connected layer to learn the desired level from labelled images. The researchers also used OpenCV models to find facial landmarks that can be used to extract key skin patches from the selfie images. For addressing the spatial sensitivity of Convolutional Neural Network models, they also set up a new image rolling augmentation approach. Their trained model gets a Root Mean Square Error (RMSE) of 0.72 on the test images without skin patch rolling on the training images but with the application of the skin patch rolling on the training images the RMSE on the test images dropped to 0.482.

Fabiola Becerra-Riera et al.[6] proposed a new algorithm to detect automatically facial marks including moles, freckles, pimples, warts, birthmarks, enlightened, darkened areas and pockmarks. Their experiment has three parts - the detection of facial marks, face image verification and identification using facial marks. Their experiment was conducted on two dataset namely DB1 (two images per person) and Celebrities Facial Marks[CFM] (3 and 9 images per person) . The Researchers compared their proposed detection algorithm (FM_Canny) with existing algorithms FM_Sobel, FM_SURF and FM_V&J. In terms of facial marks detection in the CFM dataset their proposed detection algorithm (FM_Canny) achieved 13.62%, 16.24% and 14.82% of Precision, Recall and F-measure respectively i.e. higher than all existing algorithms. But for the DB1 dataset their proposed detection algorithm (FM_Canny) achieved 73.13%, 57.02% and 64.08% of Precision, Recall and F-measure respectively i.e. higher than all existing algorithms except the Recall value which is lower than the value achieved by FM_Sobel algorithm. They also compared their detection algorithm FM_Canny with other facial mark detection algorithms in the Celebrities Facial Marks dataset, in terms of verification accuracy and identification accuracy separately.

3. Conclusion

Dermatology is the branch of medicine that deals with skin, hair and nails in the widest sense. A dermatologistdetects dermatological and cosmetic diseases of the skin. Detection of diseases is very important in today's worldscenario because the epidemics of skin diseases cause severe losses to people all over the world. This paper reviews works on skin disease.

References

[1] Kong, X., et al. , "Automatic Detection of Acromegaly From Facial Photographs Using Machine Learning Methods", EBioMedicine (2017), https://doi.org/10.1016/j.ebiom.2017.12.015
[2] J. Y. Sun, S. W. Kim, S. H. Lee, J. E. Choi, S. J. Ko, "Automatic facial pore analysis system using multi-scale pore detection", Skin Research and Technology 2016; 0: 1–9 , doi: 10.1111/srt.12342
[3] Zhen Wang, Ruoxuan Li, "Facial Pore Detection Based On Characteristics Of Skin Pigment Distribution", 978-1-5386-6249-6/19/$31.00 ©2019 IEEE
[4] Zhe Wu, Shuang Zhao, Yonghong Peng, Xiaoyu He, Xinyu Zhao, Kai Huang, Xian Wu, Wei Fan, Fangfang Li, Mingliang Chen, Jie Li, Weihong Huang, Xiang Chen, Yi Li, "Studies on Different CNN Algorithms for Face Skin Disease Classification Based on Clinical Images", volume 7,2169-3536 ©2019 IEEE

[5] Tingting Zhao, Hang Zhang, Jacob Spoelstra, "A Computer Vision Application for Assessing Facial Acne Severity from Selfie Images"
[6] Fabiola Becerra-Riera, Annette Morales-Gonzalez, Heydi Mendez-Vazquez, " Facial Marks for Improving Face Recognition", Pattern Recognition Letters (2017), doi: 10.1016/j.patrec.2017.05.005