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SYSTEMATIC FOOT ULCERS ANALYSIS SYSTEM FOR DIABETES PATIENT

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Abstract--General analysis of the Diabetes foot ulcers is done using the visual examination and review from the surgeons and physician. This process seems restless for the sufferer as he require to visit the hospital frequently for the examination. This existing process does not include the sufferer to take ideal part in the assessment process either complete dependency on physician for the report. Adaptation of proffer system which helps the sufferer to take the picture of the foot sores using his mobile phone camera then analyzing the same on the application based on proffer framework makes the life easy for the assessment. This algorithm scrutinizes the wound ulcers using the image processing algorithms and classifies them according to their attributes and generates the report. These reports can be used for matching the results in the next assessment so that the sufferer gets the better idea of the healing status of the wound.

Keywords: Diabetes, foot ulcers, physician, Image processing, healing status

I. INTRODUCTION

There are minor concerns with present enactment for treatment of diabetic foot sores. First, patients must visit their examination center frequently to check their sores by clinicians. This requirement for sequential clinical validation is tedious for patients and clinicians, additionally speaks to significantly social insurance cost. Second, a clinician's wound evaluation process depends on visual studies. They narrate the injury by its physical measurements and the shade of its tissues, giving vital signs of the injury sort and the phase of mending. Since the visual appraisal does not deliver target opinion and quantiable values of the recuperating status, following a wounds mending process crosswise over sequential visits is a troublesome assignment for both doctors and patients. The injury is caught with the camera on the Smartphone. Cell phone performs twisted division by applying the quickened segmentation. In particular, the sores is resolved in view of skin shading, and the injury limit is discovered utilizing as usage associated locale location technique. Inside the injury limit, the mending status is next evaluated in view of red–yellow–black shading assessment show. Diabetic injury administration requires long haul, rehashed estimations to guarantee restorative viability. As the number of patients requiring wound administration expands, the accessible doctor patient time for straightforward injury following winds up plainly lacking. All things considered, there is a need to give a way to precisely track diabetic injuries outside of a clinical setting. Present clinical methodologies have restricted precision for wound size estimations.

II. OBJECTIVES

The objective of the proffer system is given below

(a) Design an algorithm for assessment of diabetic foot sores based on color and texture attributes.

(b) The algorithm which can run on the android smartphone which helps the sufferer for self-assessment of the foot sores and get basic medication.
(c) The healing score can be maintained by comparing time to time assessment report stored in application server which gives clear idea to sufferer about the healing status of the foot sores.

III. RELATED WORKS

In literature, the previous techniques of ulcer detection system are described.

Lei Wang et.al states that a structure that Design a very productive and exact calculation for continuous injury investigation that can work inside the critical computational limitations of the mobile. The model result demonstrates that calculation shows signs of improvement likelihood with the assistance of wound picture and recuperating status investigation. This paper proposed a framework that makes difference clients consequently twisted limit has been totally decided and the injury range ascertained. [1]

The purpose of this study was to examine the impact of digital images on the assessment and recommendations of a WOC nurse who was providing remote nurse-to-nurse consultations on home care patients with wounds. WOC nurses who provide remote nurse-to-nurse consultations without directly visualizing the patients' wounds through digital images are at risk for under- or over treating patients' wounds[7].

They have designed a wound image analysis system, based on a smart phone and PC collaborative hardware platform. In the system, the DRLSE algorithm was applied to the image to determine the boundaries for all wound areas and measure the size of each wound by pixel. To achieve further efficiency improvement, the DRLSE algorithm was parallelized and implemented on a GPU. Finally, the wound areas were classified to different color tissues based on RYB wound evaluation model. [8].

IV. PROPOSED SYSTEM

The above figure shows the algorithm flow of the proffer system. The complete foot sores analysis consists of the different image processing algorithms at each stage.

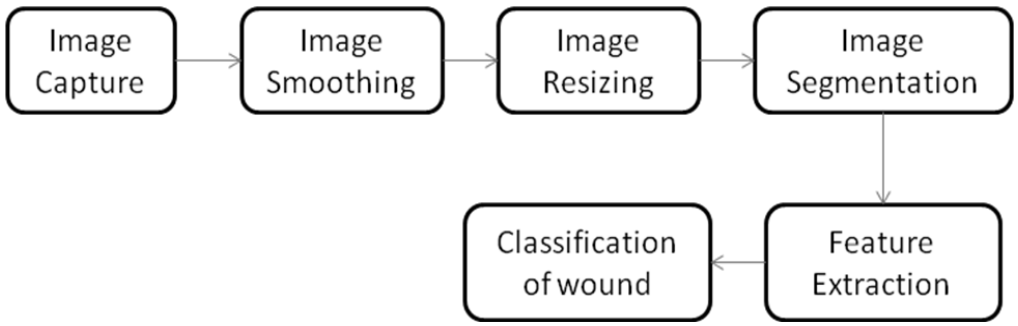

Fig 1: Proposed system

Below are the steps included in the procedure.

A. Image Capture

The sufferer can capture the foot sores image using his own mobile phone camera. This picture will be of different size and pixel based on the camera quality and specification. This requires the resizing of

the image. But before that the image capture will contain some noise due to the light conditions and stability which need to be removed before further processing.

B. Image Smoothing

The captured image is processed to remove noise and clean the picture without losing the base pixels and the content. We used the Median filter for the smoothing as the pixel information is saved which is further required for detail analysis.

C. Image Resizing

After the Image is smoothen it need be resize. There are different feature smartphone cameras with the high resolution and large pixel images but it gets issue to process the same on the mobile phone so they need to be down-sampled.

D. Image Segmentation

On the resize output the segmentation algorithm is applied to separate the wound part and the leg part. The color segmentation is used for the analysis purpose. The RYB (red–yellow–black) wound classification model, proposed in 1988 by Arnqvist, Hellgren and Vincent, is a consistent, simple assessment model to evaluate wounds [09].
The final segmented output is converted to the grayscale format which is used for the further processing.

E. Feature Extraction

The following features are being extracted for the analysis purpose.
The Color features red, yellow, and black pixel values are being obtained which gives the status of the sores which are inflammatory, not ready to heal or slough according to RYB color model. These pixel values changes phase by phase as the wound structure changes.
Other features are the texture features which completely depend on the structure and texture of the pixels. The mean and standard deviation of the color pixel is calculated. The Gabor filter is used for the edge detection.

F. Classification of Image

The final block is classifier to classify the image. Normalized minimum distance classifier is used in this system. The dataset of some images obtained from web are trained using this algorithm. Then the input image is being processed and its obtained feature values are matched to the trained images file and the result is displayed accordingly for different level of foot ulcers.

V. RESULTS AND DISCUSSION

The proffer system objective is to analyze the sufferer soars and generate the result. This is done sing the attribute analysis of the soar image taken frequently at different visits to the sufferer. We have taken the three different pictures of the same sufferer and applied the algorithm to check the healing status of the soars. The mean and standard deviation for the pixel values of the image were calculated and the variable change was found in different stages. We have mentioned the output of each visit separately in the preceding section.

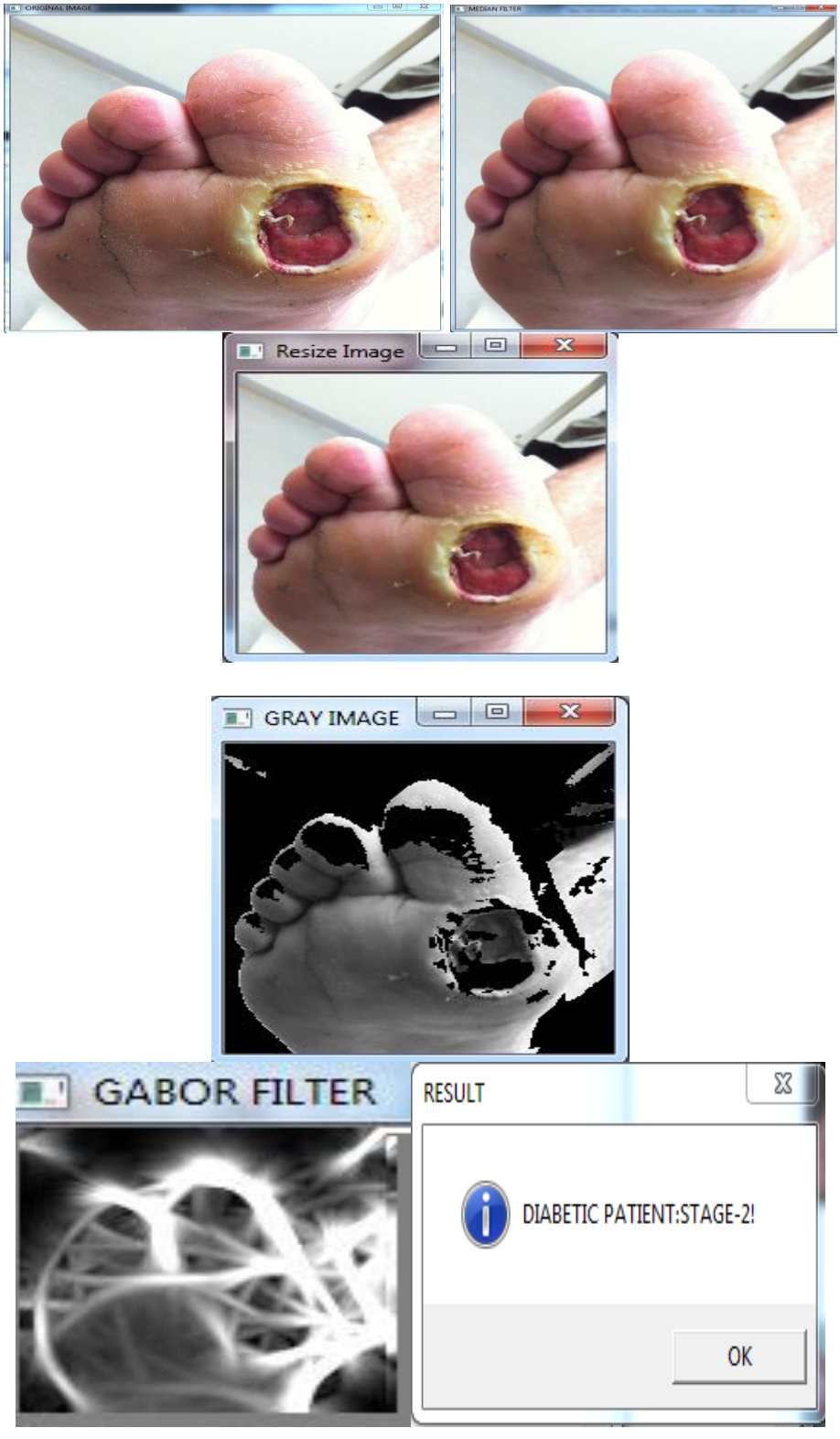

Fig 2: Wound analysis using the proffer algorithm during first visit.

Fig 3: Wound analysis using the proffer algorithm during second visit.


ORIGINAL IMAGE
MEDIAN FILTER
Resize Image

Fig 4: Wound analysis using the proffer algorithm during third visit.

The above fig 2, 3 and 4 presents the analysis and result of different visit to the patient. According to the healing attributes of the soars the analysis get changed. The values deviation for each pixel in the wound is listed below in the table.

Table 1. Pixel values obtained during each visit

Visits	Pixels		
	Red	Yellow	Black
Visit 1	62.698525	124.1847	73.23843894
Visit 2	106.75315	123.4033	57.37990428
Visit 3	50.192175	97.1226	51.63589492

From the above table and the analysis it come to picture that at frequent time the pixel values for different color changes and wound is in progress to heal. Generally, red pixels indicates reaction phase or remodeling phase, yellow pixels indicate infection or slough, and black pixel indicate necrotic phase or tissue not ready to heal[7]. With the same understanding one can learn the status of the soars.

Our system is applied and checked on the different images collected from the web sources and found better result every stage. To determine the accuracy of the proffer algorithm 45 different images were tested and the result was noted.

Table 2. Accuracy Analysis of Algorithm

No. of Images	Diabetes Stage 1 Detected	Diabetes Stage 2 Detected	Diabetes Stage 3 Detected	Accuracy
45	15	12	08	78%

VI. CONCLUSION

The objective of proffer frame system is to give the better wound image and healing status investigation through the Smartphone. The different images of the same patient were captured frequently and the results were compared to come at the conclusion point i.e. the healing status of the diabetic soars. The accurate results were received using the proffer algorithm.

In future work, we can look forward to deeply analyze the different types of diabetic soars dependant on their attributes with recommendation from the physician.

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