

# Wound Assessment System Patients of Foot Ulcer Diabetes Identification Based on Smartphone

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**ABSTRACT:** Our System a novel wound image analysis System implemented solely on the android Smartphone. Now-a-day's many people face to Foot ulcer. The Aim is to identify foot ulcer by Smartphone the camera on the Smartphone with the assistance of an image that captured the wound image using Smartphone, it is easy to capture wound image at that time patient are active participants in their own care. After that by using mean shift Algorithm Smartphone performs wound segmentation. Doctor can easily analyze the problem through image & Segmentation. According to patients with diabetes these technique is easy to use Smartphone device for self management of foot ulcer. The outline of foot ulcer & accurate wound area are detected by the image segmentation. The processing algorithm of mean Shift Algorithm & K-mean Algorithm both are Accurate & well suited for the available hardware & computational resource that can be provided by the candidate through image capture & image processing.

**KEYWORDS :** Android-based Smartphone, mean-shift, Image of patient with diabetes, Wound Analysis.

## I. INTRODUCTION

There are several problems with current practices for treating diabetic foot ulcers. First, patients must go to their wound clinic on a regular basis to have their wounds checked by their clinicians. This need for frequent clinical evaluation is not only inconvenient and time consuming for patients and clinicians, but also represents significantly health care cost because patients may require special transportation, e.g., ambulances. Second, a clinicians wound assessment process is based on visual examination. He/she describes the wound by its physical dimensions and the color of its tissues, providing important indications of the wound type and the stage of healing. Because the visual assessment does not produce objective measurements and quantifiable parameters of the healing status, tracking a wounds healing process across consecutive visits is a difficult task for both clinicians and patients. The wound image is captured by the camera on the Smartphone with the assistance of an image. After that, the Smartphone performs wound segmentation by applying the accelerated mean-shift algorithm. Specifically, the outline of the foot is determined based on skin color, and the wound boundary is found using as implementation connected region detection method. Within the wound boundary, the healing status is next assessed based on red-yellow-black color evaluation model. Diabetic wound management requires long-term, repeated measurements to ensure therapeutic effectiveness. As the number of patients requiring wound management increases, the available doctor patient time for simple wound tracking becomes insufficient. As such, there is a need to provide a means to accurately track diabetic wounds outside of a clinical setting. Current clinical approaches have limited accuracy for wound size measurements. The mobile application prompts a patient to take an image of their wound, and then it sends the image to the host server. The server outputs the calculated surface area to the application where the data points are stored. The principal components of the solution include the Phone Application, Wound Measurement Code, and Host Server. Our principal objective is that our complete mobile application functions with 90% accuracy regardless of the user's skin type, regardless the angle that the image is taken, whether or not flash is used, or the distance from the wound.

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## II. LITERATURE SURVEY

There are multiple wound assessment methods. The most inaccurate method involves measuring the width and lengths of the wound with a ruler and then applying a formula that assumes elliptical shape to the wound. The less inaccurate method is placing a sterile transparent sheet on the wound and tracing the wound. The sheet is placed on metric graph paper and by counting the squares the area is found. The most accurate method involves taking a photograph of the wound with a ruler or size marker in the picture. The image then gets transferred to a computer and evaluated by software. The method is accurate provided the wound is (a) photographed correctly (camera perpendicular to the wound), (b) the ruler or size marker are at the same distance from the camera as the wound and (c) the wound is flat and not curved.

All the above methods make contact with the wound and they can therefore be painful and carry the risk of infection. Volume measurements by filling the wound either with a fast setting alginate paste or with saline. In both cases it is important to get the right amount of substance into the wound which requires skill experience and a lot of luck (alginate setting too fast or too slow thus flowing out, saline not contained between wound and covering „cling film“ sheet, saline not absorbed too rapidly by the wound). The volume is measured by weighing the alginate once it has set or, in the case of the saline, by administering it with a calibrated syringe. Again, the methods make contact with the wound and risk infection. On top of that they are very messy, especially when material which may be contaminated by puss or wound exudates escapes.

## III. PROPOSED SYSTEM

**Image acquisition:** Firstly, the wound images are acquired using a digital camera with good resolution for better quality. The image database constructed for the application is responsible for the better efficiency of the classifier which in turn decides the robustness of the algorithm. Image compression is done by using Ycbr color space model.

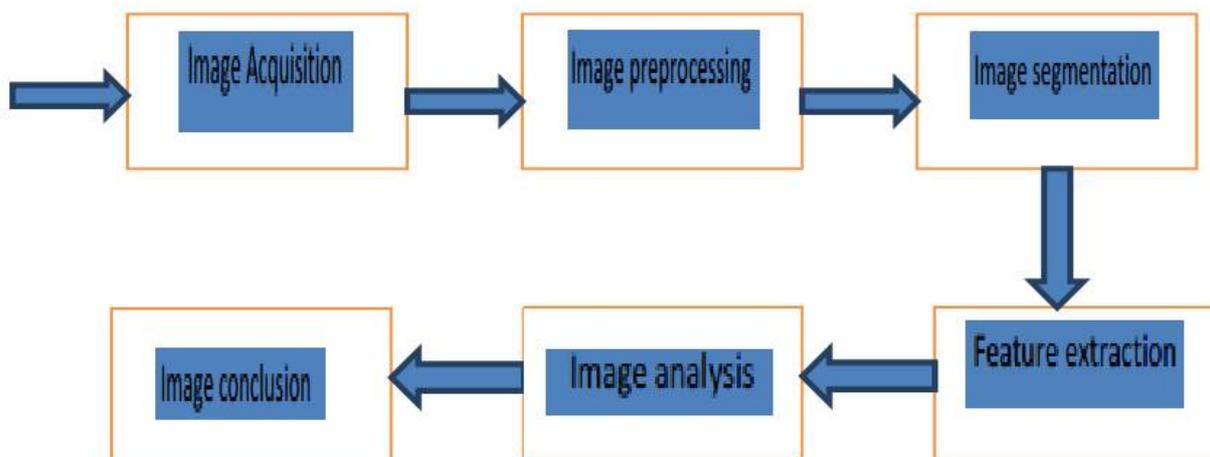


Figure 1 : Proposed System Flow

**Image preprocessing:** In the second step, this image is pre-processed to suppress undesired distortions and enhance some image features giving a quantitative image data. The RGB images of wound are converted into Hue Saturation Intensity (HSI) color space representation. This is a standard process to specify colors in color space presentation. As RGB is used for color generation and HSI for color descriptor. HSI model is an ideal tool for color perception. A pure color perceived by an observer is called as “hue”.

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**Image segmentation :** In Region based segmentation, the pixels of an object are grouped together. Thus system can easily identify the boundary. Once all the color changes and textures are identified, the edge flow is converted into a vector. In Edge based segmentation, segmentation identifies the boundaries and edges help to detect the image discontinuities.

Support Vector Machines (SVM) or adaptive algorithms carry out the classification. In Threshold based segmentation, the threshold values of the histograms of the image help to perform image segmentation. The accuracy is high if the edge detection is done correctly. It is advantageous in terms of fewer computations involved. However, it is not accurate for complex images. In feature based clustering, the images are clustered using K-mean algorithm. It makes use of unsupervised Fuzzy C logic. The technique forms cylindrical decision elements of color space and the image surface is detected by using threshold values of the histogram. The related pixels are clustered and the image is segmented and the color components are changed if required. The difference between the image intensities and color values also form an important characteristic of feature clustering. Virtual and real time clustering can be done. The image can then be refined and can be adjusted using Fuzzy logic. Clustering technique can be used for multispectral images making it different from other segmentation techniques.

**Feature extraction :** The next step is to extract the features of the captured images and then draw inferences of the images. The process classifies wound tissues within a wound as red, yellow, black or mixed tissues, which represent the different phases on the continuum of the wound healing process. Specifically, red tissues are viewed as the inflammatory (reaction) phase, regeneration, or maturation phase; yellow tissues imply infection or tissue containing slough that are not ready to heal; and black tissues indicate that the wound is not ready to heal. Based on the RYB wound evaluation model, wound analysis task is to classify all the pixels within the wound boundary into the RYB color categories and cluster them. Therefore, classical clustering methods can be applied to solve this task.

**Image analysis and conclusion:** The image is analyzed and is sent for expert review. The experts may then make various treatment decisions.

### Algorithms

Here system proposes to find similarity of two vectors using K-Means algorithm

vectors:  $\vec{a} = (a_1, a_2, a_3, \dots)$  and  $\vec{b} = (b_1, b_2, b_3, \dots)$ , where  $a_n$  and  $b_n$  are the components of the vector (features of the image object, or values and score ) and the  $n$  is the dimension of the vectors:

$$\vec{a} \cdot \vec{b} = \sum_{i=1}^n a_i b_i = a_1 b_1 + a_2 b_2 + \dots + a_n b_n$$

The training database having multiple train objects, in testing phase system can apply the k-means classification and finally denote the system is affected or not with the disease using sub classes.

## IV. RESULTS AND DISCUSSION

The results for the image analysis is done and shown the Figure 2 and figure 3. The input image is uploaded and its hue content is developed. Clustering is performed using thresholding. The final output image with mean shift is also shown here.

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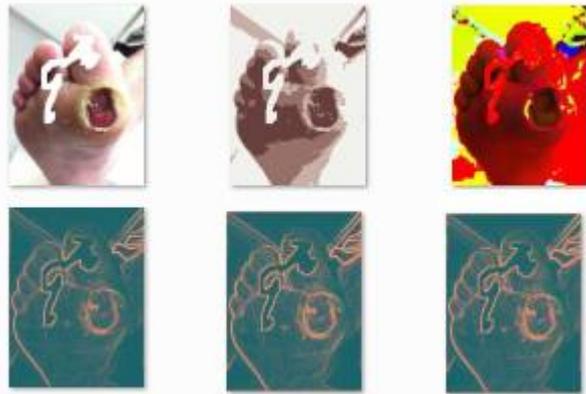


Figure 2: Lab conversion and final segment with edge detection group



Figure 3: Detected after LAB and segmentation

### V. CONCLUSION AND FUTURE WORK

From the above discussion, it is concluded that a self managed wound image analysis system for patients with type 2 diabetes suffering from foot ulcers is designed and implemented successfully. The mean-shift-based wound boundary determination algorithm provides a good accuracy, consistency and precision. The device setting allows one to obtain optimal resolution with ease and comfort. This product is an affordable device and can be purchased by patients or their caregivers, and in turn helps them to reduce both the frequency and the number of wound clinic visits.

In future work, the plan is to connect this system, from the smartphone to a server, which will allow more complex and computationally demanding wound boundary detection algorithms to be used. It is also planned to apply machine learning methods to achieve better boundary determination results with less restrictive assumptions. Furthermore, the aim is to compute a healing score to be assigned to each wound image to support trend analysis of a wound's healing status. Many a times some elderly patients may not be comfortable with operating a smartphone, but this concern could be addressed by further simplifying the image capture process to a simple voice command. The next plan it to facilitate clinicians with remote access by creating cloud-based server support and creating a database to store the wound data for patients.

### REFERENCES

- [1] L. Wang, P.C. Pederson, D. Strong, B. Tulu and E. Agu, "Smart phone based wound assessment system for diabetic patients", presented at 13th Diabetes Technology Meeting, San Francisco, CA, USA, Oct. 2013.
- [2] Georgina Gethin (2006) the importance of continous wound monitoring.
- [3] V. Falanga, "The chronic wound: Impaired healing and solutions in context of wound bed preparation", Blood Cells Mol. Dis., vol. 32, no. 1, pp. 88-94, Jan 2004.
- [4] Hazem Wannous, Yves Lucas, Sylvie Treuillet, "Efficient SVM Classifier based on colour and texture region features for wound tissue images".
- [5] P. Plassman and T.D. Jones, "MAVIS: A non-invasive instrument to measurement of area and volume for wounds", Med. Eng. Phys., vol. 20, no. 5, pp. 332-338, Jul. 1998.



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- [6] A. Duarte, A. Sanchez, F. Fernandez, and A.S. Montemayor, "Improving image segmentation quality through effective region merging using a hierarchical social metaheuristic", *Pattern Recog. Lett.*, vol.27, pp.1239-1251, Aug.2006.
- [7] A. Malian, A. Azizi, F. A. Van den Heuvel, and M. Zolfaghari, "Development of a robust photogrammetric system for monitoring the healing of bedsores", *Photogrammetric Rec.*, vol. 20, no. 111, pp. 241- 273, Jan.2005.
- [8] D. Pascale, RGB coordinates of the Macbeth Colour checker, Babel Colour Company, Montreal, Quebec, Canada. (2006, Jun.). [Online]
- [9] H. Wannous, Y. Lucas, Sylvie Treuillet, "Robust tissue classification for reproducible wound assessment in telemedicine environment," *J. Electron. Imag.*, vol. 19, no. 2, pp. 023002-1-023002-9