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Foot Ulcer Detection Using Image Processing Technique

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Abstract - This paper deals with computation tool to analyze the diabetic foot ulcer. Normally foot ulcer means the underlying skin of the foot will be broken down and you will see the tissue over that damaged area due to diabetes. The wound should heal in normal condition due to diabetes the healing process will take place slowly so to identify whether the ulcer is healing or not. In this paper an image processing technique is proposed to identify weather ulcer is healing or not.

Keywords **- Foot Ulcer, Image Processing Technique.**

1. Introduction

Now a days, diabetic patient are more prone to have foot ulcer. Diabetes affects the foot generally by two ways, such as breaking of nerves and weakening of blood vessels. Strange increase of glucose in the blood results in nerve injury, termed as diabetic neuropathy. Lack of sensation and hardening of the foot may indicate nerve injury. Due to this, diabetic patients would not sense a small wound or an inflammation on foot. Lack of sensation in the foot may cause abnormal walking and standing. Flattered arches fractures and non-healing blisters may occur due to improper balance of foot. Diabetes also has an effect on blood vessels. Thin blood vessels carry a lesser amount of blood to the foot. Oxygen is conceded to the blood cell. When the blood vessels are tapering, less blood and oxygen reaches the foot. This can delay wound healing. Insufficient blood will not carry sufficient oxygen and nutrient to the foot for healing and fight against infection. Gangrene may also affect the diabetic patient due to lack of blood supply. Treatment may require an amputation of the foot. The infected part of the foot was removed surgically. Initial finding, care and treatment can avoided the need of amputation. Symptoms such as redness, swelling, and increase temperature are the indication of foot ulcer.

Table 1. Review Table

Sr. No	*Name, Volume & Year*	*Content*
1	Wild et al., 40, 2008	In this paper they have developed a computer-based wound healing analyzing tool (WHAT) for size measuring and tissue recognition of chronic wounds.
2	Mary Juliet, 7, 2015	Here they used image segmentation and feature extraction, based on feature the reflexology position is determined.
3	Sicco et al., 25, 2002	In this study the subjects were consider to take MRI imaging, based on thickness. Trail TE & TR output is determined for quantitative analysis.
4	Prabhu et al., 39, 2001	Prabhu et al., suggested that based on the foot pressure imaging a new parameter is determined called power ratio. Based on power ration the early stage of neuropathy can be detected**.**
5	Sridhar et al., 5, 2013	Author discussed in this paper that when it is in initial stage by usage of sobel edge detection method can assess the vulnerability and start the treatment accordingly.

2. Methodology

The method used in this paper is the image of foot ulcer is taken from patient and that image processed by various preprocessing technique then the output of the preprocessing is followed by image segmentation to segment the ulcer of the foot then it is followed by various morphological operation.

2.1 Preprocessing

In preprocessing the original image is converted into gray scale image (Fig.1&2). Then for that gray scale image filtering and image enhancement technique is applied to enhance the contrast of the gray scale image (Fig.3-6).

2.2 Image Segmentation

In image segmentation the preprocessed image is taken, the ulcer in the image is segmented separately by thresholding technique and edge detection technique (Fig.7).

2.3 Morphological Operation

In morphological operation the segmented ulcer image will be taken. The output of segmented image will be not clear so we use various function of morphological operation to know the accurate morphology image of foot ulcer. The segmented image is followed by opening then closing finally the output of closed operation is have some holes in the image so by using hole filling technique the image will become so clear. Then by using remove operation we can remove the other parts of unwanted information present image (Fig.8). The finally we will get the accurate output of ulcer image. Then by using area function and perimeter function can find the area and perimeter of ulcer present in the image (Fig.9).

Fig.1. Original image of foot ulcer.

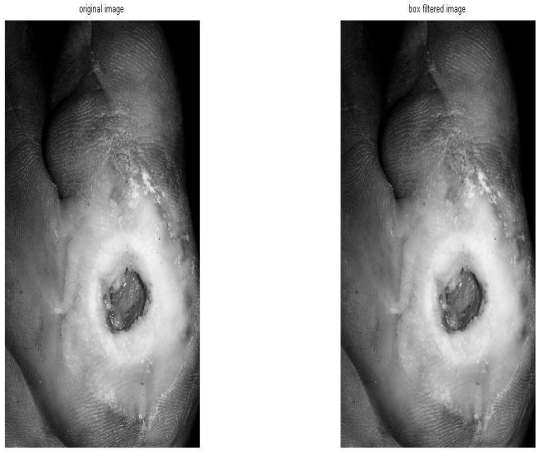

Fig.2.Output image of RGB-Gray and Box filter (Preprocessing).

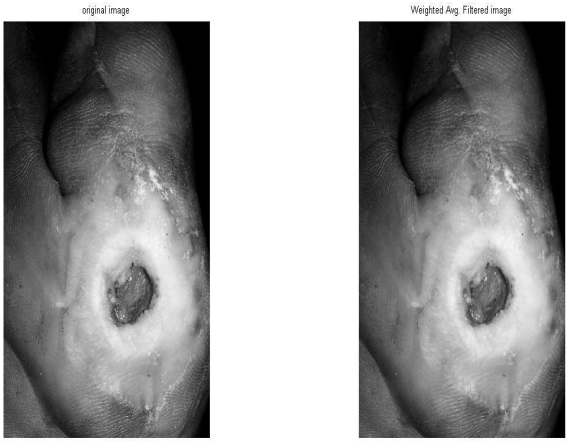

Fig.3. Output image of weighted average filter (Preprocessing)

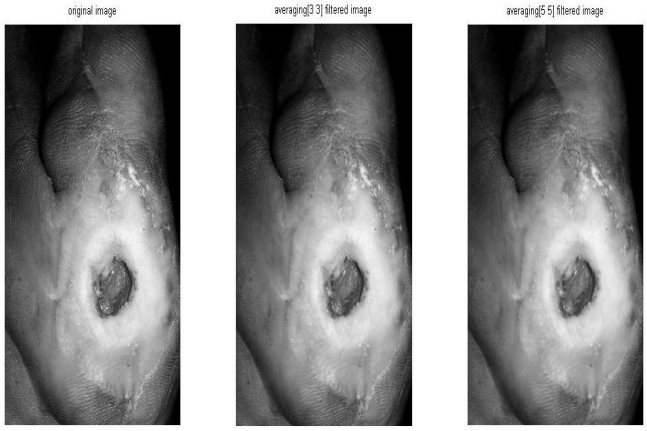

Fig.4. Output image of average filter (Preprocessing)

Fig.5. Output image of contrast enhanced using histogram equalization (Preprocessing).

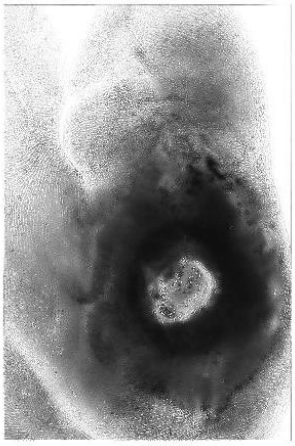

Fig.6. Output image of Contourlet transform (Preprocessing).

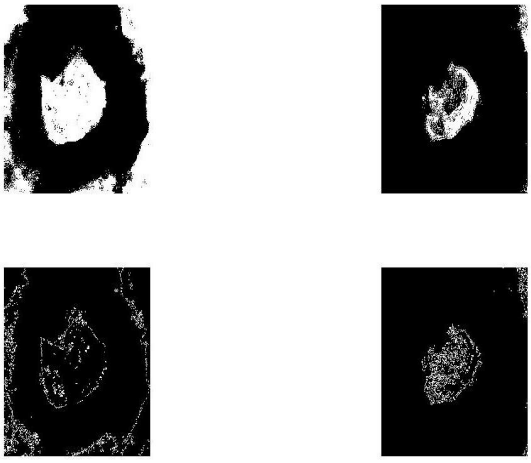

Fig.7. Output image of Image Segmentation.

Fig.8. Output image of Morphological operation.

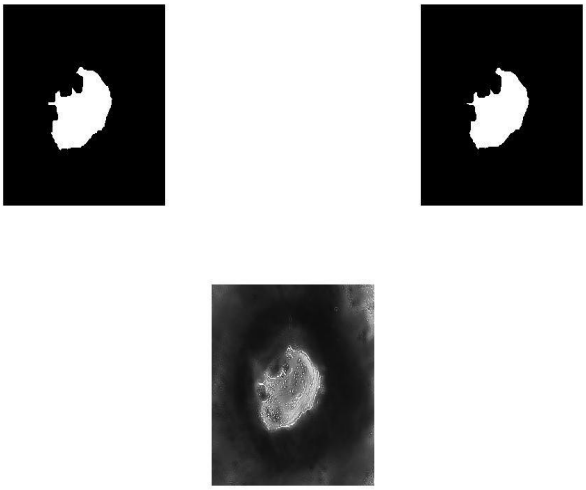

Fig.9. The area and perimeter of the ulcer can be determined by using this image.

Then this result will be stored in a separate file. Normally the foot ulcer will heal slowly due to diabetes. Due to slowness, we cannot see the healing of ulcer in normal eye. Therefore, at first visit to clinic they will take the photo and compute it to find the present state of foot ulcer area and perimeter. Then the clinician will recommend medication for few days after that the patient will come for second visit during that time the image is taken and processed it to find area and perimeter of the foot ulcer. So finally, they will compare the previous result and present result if the ulcer is healing the area and perimeter of the ulcer will be reduced. Based on this the clinician will go for further process and testes.

3. Result and Discussion

The foot ulcer is segmented and morphology of image is restored then the area and perimeter of the image is calculated. This technique is applied two times for a one patient to compare the result of privies visit and the next visit. Based on this, the area of ulcer is healing or not healing can be determined.

4. Conclusion

This is the simplest technique in order to determine the healing process foot ulcer, it comprises of digital camera and a computer system installed with MATLAB starter application. With image processing tool, this is the well-known mathematical tool, which is widely used, compared to other technique this tool is very cheap, highly accurate,

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