

CHRONIC WOUND DETECTION USING MACHINE LEARNING

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ABSTRACT

A chronic wound is a wound that fails to respond to treatment after months that increases the risk of complications to health of patient such as diabetes, circulation problem, cancer and infections. The existing system is unable to classify the wounds accurately because it classifies the periwound (area surrounding the wound) as infected area which leads to wrong diagnosis, it includes costly scans and takes long time to classify the wounds. Thus the proposed system reduces the medical fee for diagnosis and it classifies the wounds without calculating the periwound and has higher accuracy. Support vector machine (svm) and Fuzzy K-Means (FKM) are used for classification of granulation tissue from extracted haemoglobin images. Also the system identifies the depth and height of the wound, stage of the infected wound and also provides solutions to heal the wound. Results obtained indicate an overall accuracy of 96.88% which is better than the existing systems.

General Terms

Granulation tissue, chronic wound, periwound

Keywords

Chronic wounds, support vector machine, Fuzzy K-Means

1. INTRODUCTION

Skin is vital organ in a sense that loss of the substantial fraction of its mass immediately threatens life of an individual. Such a loss can result suddenly, either from a fire or mechanical accident, but can also occur in a chronic manner, as in skin ulcers. A chronic wound is a wound that does not heal in an orderly set of stages and in a predictable amount of time the way most wounds

do; wounds that do not heal within three months are often considered chronic.

The aims of our study are to determine effects of the wound, patient and treatment attributes on the wound healing process and to propose a system for prediction of the wound healing rate. Only after undergoing further more scans and painful treatments, the prediction of wound is found and further treatment is given by doctor. Even though, the doctor could not access the depth of the wound affected, it is only possible through scans. The healing capacity of the wound can only be observed through scans and upon the health condition of the individual and the diagonalization of the wound time.

1.1 Problem Statement

To develop a pervasive system to identify the stage, depth, height and the solutions for the chronic wounds.

2. LITERATURE SURVEY

When a person is infected with chronic wound, he has to undergo a prolonged process of scans and painful treatment. This technique would cause a lot of pain and will cost money. In few scenarios the infections get aggravated due to manual methods and usage of needles to remove granulating tissues around the infections. Prediction of wounds through semi-automatic system is a very slow process since the results are given in 3-4 days. Manual and disease treatments can be done causing wrong prediction of the type of wound, which could further exfoliate the infection to various pains and diseases treatments can be done causing wrong prediction of the type of wound, which could further exfoliate the infection to various pains. Only after undergoing further more scans and painful treatments, the prediction of wound is found and further treatment is given by

doctor. Eventhough, the doctor could not access the depth of the wound affected, it is only possible through scans. The healing capacity of the wound can only be observed through scans and upon the health condition of the individual and the diagonalization of the wound time.

[1] The mobile app is the part of the growing field of mobile health. The mobile app replaces the paper based documentation in a health care facility with an electronic records is taken as a concept in this paper. SVM algorithm is used here for segmentation process and for enhanced quality of image, dual lens cameras are user in this application which is a disadvantage.

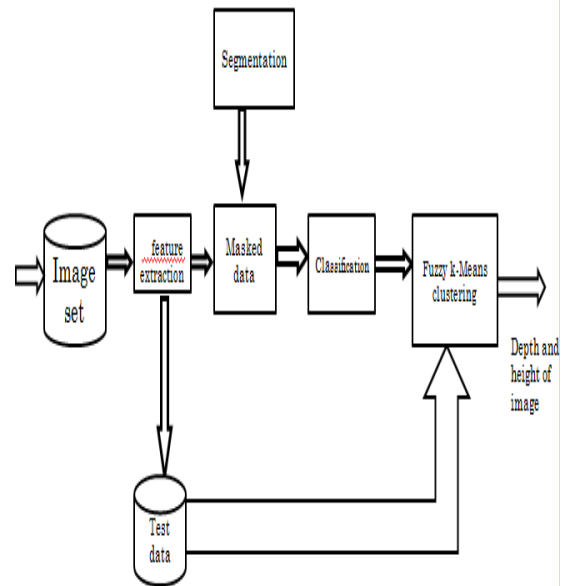
[2] To differentiate healthy skin from affected skin, this paper used regression and classification tree algorithm. High interclass similarities, variations and patient's ethnicity, lightning conditions were considered as the Major drawback of this system.

[3] The paper uses CNN algorithm that works down by the multilayer preception, in which only minimal processing is done. The disadvantage of this paper is that utilising additional semi automatic systems like CT SCAN, MRI, X-RAY for detection that may be inaccurate, delay of time and painfull. This paper is only concerned with the foot ulcer.

[4] In this paper, for the first time investigation on classification of 7 wound tissue types that works on DNN algorithm is done. Using this algorithm, leads healthy tissues to be considered as inflected tissues for the treatment and the main drawback was the image can be captured only from a distance of 30cm.

3.SYSTEM ARCHITECTURE:

The proposed system is used to detect the wound by machine learning methodology by using support vector machine and fuzzy k-means for segmentation and classification respectively. There are 3 stages namely preprocessing, segmentation and classification.



3.1.Preprocessing

Initially, the system finds it difficult to locate the infection in the image apart from background features. Preprocessing involves RGB normalizations which is used to improve the quality of the image. Preprocessing also involves conversion of RGB image to gray image. Denoising is done to remove the background noise and enhance the quality of the image. Each image is calibrated and pixelated that involves multiplexing each pixel with respective original pixel that results in threshold value 1 or -1. The process is repeated to identify each infection without any chaos.

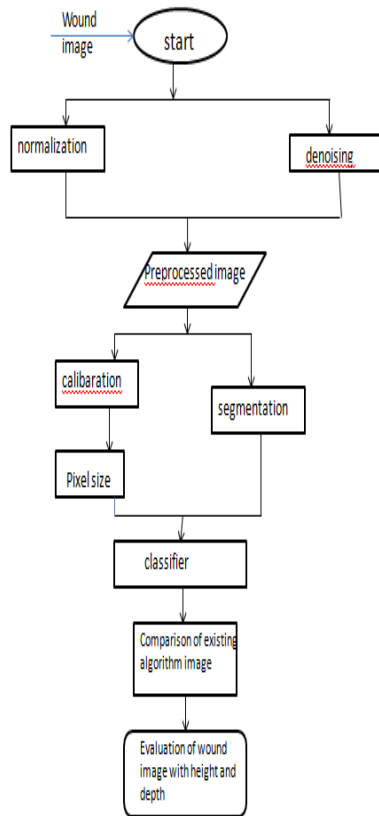
3.2.Segmentation

In the proposed methodology, the implementation of support vector machine (svm) involves training of positive and negative images which generates a strong feature of the image. From the rgb image, the histograms of the RGB are pixelated. The masking and filter stage is done from the histogram pixel values to find the threshold rate.

3.3.Classification

In the classification stage, by using classifier Fuzzy K-Means, the borders are smoothed and the best threshold value image that has the maximum value will be uploaded and RGB band for each unique image is found. The band holding the best threshold value is compared with the original image

and the infected portion is shown with height, depth and type of wound with high accuracy. The output image gives the 3D geometry of the image without including the periwound (area surrounding the wound).



4. EVALUATION OF SYSTEM

4.1 Advantages

The system is fast and provides accuracy up to 92 percent. It also provides solutions to the problems and provides a painless method to treat the infected wounds. The system does not involve any additional scans or additional costs. It accepts the image up to 100 cms.

4.2 Applications

This idea can be used extensively in medical industry where the infected wound can be identified using the system as it does not involve additional scans and reduces the medical fees also.

5. FUTURE ENHANCEMENTS

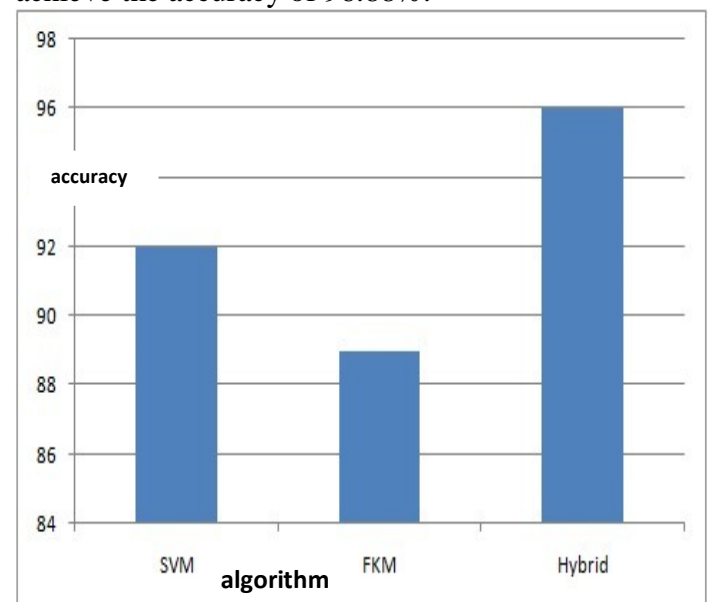
In addition to the current prototype system, new features and further technical improvements will be made for smarter and better wound care management in the future: 1) Smarter technologies for wound care management: improvement of the precision of wound edge detection to optimize the human-computer interaction efficiency. In some cases, the wound edge is obscure, similar to the skin color surrounding the wound, resulting in imprecise recognition of the wound edge.

2) More intuitive HCI design: There exist some intuitive human-computer interaction features, such as smart assessment records based on smart measurements and photographing the dressing package to fill in the dressing type and name automatically. However, since the clinical bedside situation is complex and diverse, there will be more improvements in the human-computer interaction when it is trialed in clinical practice.

3) Optimized visual design for user experience: The current prototype system was developed with a priority of functions and features, UI layout and flow confirmation. Visual design optimization will be carried out in the next stage. Nurses will be involved in user-participatory design to develop and prioritize the visual elements for easy recognition, improving the human-computer interaction usability.

6. EXPERIMENTAL RESULTS

In the experimental result, we have taken accuracy as the parameter. The x-axis contains the algorithm used and y-axis contains the accuracy. The support vector machine achieves 92% accuracy and fuzzy k-Means has achieved 89% accuracy. In order to achieve higher accuracy, we have combined both the support vector machine and fuzzy k-Means to achieve the accuracy of 96.88%.



7. CONCLUSION

To develop a highly usable smart wound care management system for nurses and doctors, this paper provides a systematic review on the general requirements of wound care in clinical practice. By analyzing the daily task flow, the existing challenges and the needs in current wound care processes, we designed a smart system for chronic wound care management. This system provides a practical solution addressing several challenges in wound care, including precise wound measurement, wound healing monitoring, standard and comprehensive wound assessment and integrated wound case management in the existing clinical information system context of general hospitals. The system applies an iterative design approach with user inputs and feedbacks to ensure the system's functions and work flow fit into real clinical practice. The system's effectiveness was validated through presentation, a prototype trial and satisfaction evaluation feedback from 5 wound care nurses in different clinical departments of Hindu mission hospital, Tambaram.

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