Wound Image segmentation using Fuzzy logic

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Abstract:- Chronic wounds are a annoying problem in the healthcare .It is a critical task to perform an accurate diagnosis and to select a suitable treatment. Clinical studies have shown that the reduction of a wound size is a good indicator of healing in most chronic wounds. Additionally, colour may provide relevant information about tissue type and inflammation. Therefore, monitoring the size and aspect of the wound at regular intervals is part of the standard clinical practice. Wound color detection is a crucial method for several biometric applications of computer vision. Recently the growing of interest in the problem of skin segmentation, which aim to detect wound on skin regions in an images. The skin segmentation is a very effective because it involves amount of computation and can be done selected pose. The existing skin segmentation algorithm involves classification of different image pixels into wound and no wound techniques on the basis of pixel colour .

In this paper, emphasis has been to develop a very simple & small but a very efficient, fuzzy rule based segmentation algorithm to abridge the concepts of artificial intelligence and digital image processing. The algorithm and associated GUI has been developed in MATLAB environment.

Introduction:- The ability to determine the efficacy of wound management techniques is dependent on the capacity to accurately measure and record the changes that occur in a wound as a function of a specific treatment. Wound assessment parameters are well understood, yet the ability to accurately measure the total size of a wound and its sub-components has presented clinicians and researchers with a practical challenge due to the irregular shape of many chronic wounds such as venous leg ulcers. Wound color detection is a crucial method for several biometric applications of computer vision [3]. Recently the growing of interest in the problem of skin segmentation, which aim to detect wound on skin regions in an images. The wound segmentation is a very effective because it involves amount of computation and can be done selected pose. The existing wound segmentation algorithm involves classification of different image pixels into wound and non-wound techniques on the basis of pixel color [1],[3]. At present the skin colors in the original image are initially detected using skin color model on the Bayesian decision method for cost and nonparametric threshold estimation. In this proposed work the image segmentation is plays main role of this wound detection. Different segmentation techniques available are-

- Histogram based segmentation.
- Neighborhood based segmentation.
- Surface fitting based segmentation.
- Physically based segmentation.
- Threshold values based segmentation.

Fuzzy logic is relatively young theory. Major advantage of this theory is that it allows the natural description, in linguistic terms, of problems that should be solved rather than in terms of relationships between precise numerical values. This advantage, dealing with the complicated systems in simple way, is the main reason why fuzzy logic theory is widely applied in technique. It is also possible to classify the remotely sensed image.

In this proposed methodology consists of following stages. Wound image database, fuzzification, rule based segmentation and de-fuzzfication.

Methdology:- The work of this paper is concerned with the development of a fuzzy logic rules based algorithm for the segmentation of wound image.

The propsed work is done in following steps-

1) Read the image
2) Fuzzification is done.
3) Membership functions developed
4) Rules are generated based on colors segmentation
5) De-fuzzificaton is performed using the Centroid method.

(I) Fuzzification

Fuzzification is an important concept in the fuzzy logic theory. Fuzzification is the process where the crisp quantities are converted to fuzzy (crisp to fuzzy). By identifying some of the uncertainties present in the crisp values, we form the fuzzy values. The conversion of fuzzy values is represented by the membership functions.

(II) Membership functions

There are various methods to assign the membership values or the membership functions to fuzzy variables. The assignment can be just done by intuition or by using some algorithms or logical procedures. Intuition is based on the human's own intelligence and understanding to develop the membership functions. The thorough knowledge of the problem has to be known, the knowledge regarding the linguistic variable should also be known.

Type of variable	Name	Range
Input_R	Dark Red	0-0.4
	Light Red	0.3-1
Input_G	Dark Green	0-0.2
	Light Green	0.1-0.9
Input_B	Dark Blue	0-0.8
	Light Blue	0.5-1
Output	Wound	0-0.12
	No wound	0.15-1

(III) Rules

With the FIS Editor, the Rule Editor allows you to construct the rule statements automatically, From the GUI, you can:Create rules by selecting an item in each input and output variable box, and one Connection item and clicking Add Rule. You can choose none as one of the variable qualities to exclude that variable from a given rule and choose not under any variable name to negate the associated quality.

Delete a rule by selecting the rule and clicking Delete Rule.

Edit a rule by changing the selection in the variable box and clicking Change Rule.

Specify weight to a rule by typing in a desired number between 0 and 1 in Weight. If you do not specify the weight, it is assumed to be unity (1).

1. If R is Dark Red and G is Light Green and Blue is Dark Blue then status is No wound.
2. If R is Light Red and G is Light Green and Blue is Dark Blue then status is wound.
3. If R is Dark Red and G is Dark Green and Blue is Dark Blue then status is No wound.
4. If R is Dark Red and G is Dark Green and Blue is Light Blue then status is No wound.

(IV) De-fuzzification

The input for the defuzzification process is a fuzzy set (the aggregate output fuzzy set) and the output is a single number. As much as fuzziness helps the rule evaluation during the intermediate steps, the final desired output for each variable is generally a single number. However, the aggregate of a fuzzy set encompasses a range of output values, and so must be defuzzified in order to resolve a single output value from the set. The fuzzy results generated cannot be used as such to the applications, hence it is necessary to convert the fuzzy quantities into crisp quantities for further processing. This can be achieved by using defuzzification process. The defuzzification has the capability to reduce a fuzzy to a crisp single-valued quantity or as a set, or converting to the form in which fuzzy quantity is present. Defuzzification can also be called as "rounding off" method. Defuzzification reduces the collection of membership function values in to a single sealer quantity. Centroid defuzzification method is used.

Conclusion:-

The fuzzy segmentation method has been successful in obtaining the segmented image after its implimentation and execution with the number of images . Sample output is shown to understand the accuracy of algorithm .

Thus the method has extreme scope in the area of digital image processing.

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Simulation Results:-