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SKIN ULCER IMAGE SEGMENTATION BASED ON GROW CUT METHOD

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ABSTRACT

In this specific paper, we have suggested an algorithm for synergistic segmentation of skin ulcer images of the diseased. If a small number of user pixels are provided, then by using Grow Cut method, we can automatically segment the rest of the images. User can sharply observe the segmentation procedure and guide the algorithm whenever the segmentation becomes difficult. In particular areas, where the segmentation is done automatically, no extra effort by the user is necessitated. The segmented skin ulcer images are presented.

Keywords: skin ulcers, ROI, foreground extraction, image editing, interactive image segmentation.

1. INTRODUCTION

Ulcers are caused as a result of the deficit in blood circulation in veins, or due to a cancerous tumor. It can be associated with tumors, infections etc. Image segmentation has a number of wide applications in the field of medical imaging [1, 11]. It is implemented for the detailed study of medical images and for editing the photos. Medical experts in the field of dermatology does the recognition of the skin abrasion mainly on the basis of visual study of the infected regions, and the analysis of the macroscopic characteristics. This concept clearly shows us that the precise diagnosis depends on the medical expert's experience and perceptual experience. Ulcers, tumors, chronic wounds or lesions due to venous insufficiency mainly have a inhomogeneous composition of yellow fibrin, red granulation and black necrortic eschar (scar) tissue. Medical experts use such a type of RYK model (red-yellow-black) as a descriptive tool. The extended model may be referred to as the RYKW model if the hyperkeratotic lesions composed of white blood cells are also included.

A number of computational vision algorithms can also be benefitting from the presence of authentic and effective image segmentation techniques [11]. There are a number of intermediate level vision problems which includes shape formed from an outline, stereo and object tracking could make use of trusted segmentation techniques so that the region of interest is masked from the rest of the scene. A number of fully automated segmentation techniques exists and are being constantly ameliorated. Contrarily, there doesn't exist any image analysis techniques which can be employed without any external control and ensured results. Hence semi-automatic image segmentation techniques are gaining popularity among the users that allows solving moderate and hard segmentation tasks by small effort. Recently, based on random walker [5, 10] and graph cut [9, 3], a number of powerful interactive image segmentation techniques have been proposed. They appear to outstandingly surpass the older methods in the required user effort and the quality of the resulting segmentation [2].

2. ULCER

Skin ulcers can be the outcome of a cancerous tumor, or it could be due to an infection, or may be due to a pressure sore, or by vein problems. It can also be caused due to prolonged pressure on tissues or as an result of the increase of the UV Radiation due to the ozone depletion. There are two types of skin ulcer; 1) Benign, and 2) Malignant. Malignant ulcers lead to cancer if it is left untreated which can also result in death. Benign ulcers does not lead to death even if left untreated. Medical experts in the field of dermatology do the recognition of the skin abrasion mainly on the basis of visual study of the infected regions. The experience of the dermatologist's and perceptance also plays a vital and important role. There is a need of computer vision algorithms to precisely detect and classify the skin ulcers, due to the complexity and the irregular variations of the skin ulcers.

Skin ulcers are nearly 100% curable, if these are discovered and treated at an early phase. The types of skin ulcers are shown in the diagram below.

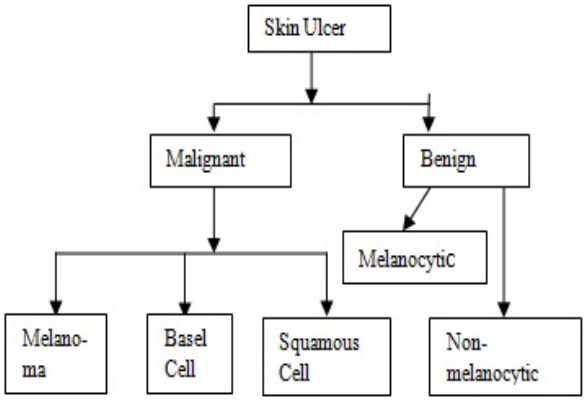

Figure-1. Types of skin ulcers.

3. CLASSIFICATION METHODOLOGY

In this section we have discussed the reason of using an integrated computer-based vision system for the characterization of skin ulcers. Major advantage of using

computer based classification is that, patients do not have to undergo many painful diagnosing techniques like Biopsy and patient does not need to go to hospital. Biopsy is used in hospitals to detect skin ulcer. It involves removal of skin and the sample undergoes various laboratory tests. Laboratory sampling can cause inflammation or even spread of lesion. So, computer based detection is less dangerous and less time-consuming. Moreover it speeds up the procedure of diagnosis of the disease according to the images.

4. RELATED WORK

a) Graph cut technique

This approach was used by Boykov and Jolly [9], [6] for the task of partitioning the images developed. It is a type of combinatorial optimization technique. The acquired image is considered as a graph and each and every image pixels are treated as a graph node. Min-cut/max-flow algorithms are used to estimate very efficiently, the optimal pixel labelling in reference to the cost (mentioned as a function). This process can be used on N-dimensional images in a very adept way [10]. If the seed pixels of the background and the intended object are given, then the labelling of the rest of the pixels are carried out automatically.

b) Grab cut technique

The basic idea of the graph-cut technique was widened by Rother *et al*. [7], upon the exordium of frequent segmentation scheme which employs graph-cut technique for intermediate stages. Bounding boxes(which are rectangle in nature) are drawn by the user, around the region of interest, which gives us the first rough estimate of the final object/ background labeling. Color statistics as per the current segmentation are gathered in each and every looping step, the image graph is re-weighted and then the graph-cut technique is applied to compute the freshly refined partitioning. The segmentation results can be fine-tuned when the iterations stop, by citing the additional seeds, alike the original graph-cut.

5. PROPOSED METHOD

Image segmentation is a significant yet an extremely riveting task in medical image anatomizing. With the abetment of completely automatic segmentation techniques, befitting outcomes can be obtained; nevertheless, preciseness can differ significantly in perfection for an entirely self-governed task. Indeed the process of rudimentary segmentation may differ among the physicians, in the field of medical imaging. Hereafter, interactive segmentation methodologies have commanded a step-up in modishness.

An interactive segmentation technique is inferred by us, which relinquishes the users who are capable of parting the ulcers in an alacritous and effective manner. Our approach engages with the statistical seed allocations to trade prosperously with the affiliated bias followed in the conventional cellular automata architecture. An epiphanous user commune scheme is proposed by us where a user specifies some image pixels (seed pixels) familiar to the objects which should be partitioned from each other. The duty is to ration labels to the rest of the image pixels spontaneously, desirably acquiring the segmentation outcome which the user is anticipating for. Cellular robot to figure out the pixel tagging task is habituated by our proposed method [4]. This is reprising, providing answer to the research carried out by the user whilst the segmentation is computed. There is an attribute of natural input (involuntary) in our propounded approach during the tagging course, to deliver robust relation and feedback establishment amongst a user and the algorithm. Our outgrowth shows ameliorated delicacy, wholesome, and competitive functionality.

The indispensable characteristics of our suggested approach that we would like to explain are as follows:

1) Ability to resolve the intensely hard segmentation job.

2) Additional groups of segmentation algorithms, which are contrived with certain features are allowed.

3) Segmentation process can be differed with each reiteration or renewal by the user, which is interactive in nature;

4) Easier to comprehend and apply.

5) Cellular automaton allows quick corresponding performance.

6) Images of size N >=1 is passable.

7) Functions multi-label image partitioning.

We have reasoned the labels i.e., the objects and background for being adroit on user communing. Please appertain to the medical image partitioning in Figure-2 and the developed partitioning outcome indicated by Figure-3.

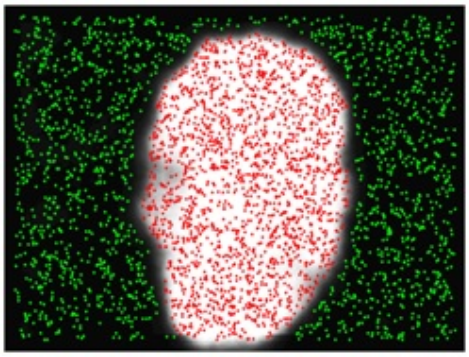

Figure-2. Medical image segmentation.

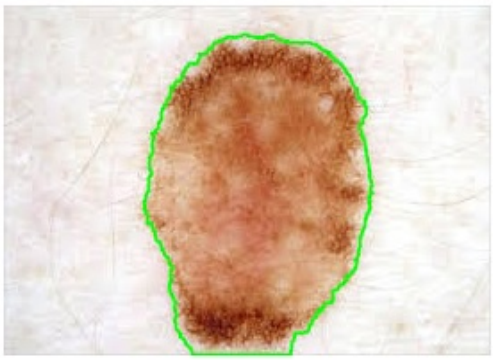

Figure-3. Medical image segmentation results.

According to our view, this is the most constantly appearing event in the partitioning task affiliated with the image revising. However, this is only for the purpose of clear understanding, everything expressed over here is certifiable for the case with labels K greater than 2. The partitioning of the image is pioneered by assigning the earliest seeds. This is achieved by the usage of "background" and object" brushes by the user. Each paint stroke of a pre-defined set of brush can be used to set the power of seed pixels and the labels in the earlier stage. The unfinished user marking at the commencement is often abundant to allow the entire partitioning process to be finished spontaneously (not mandatory).

The user can keep an eye on the advancement and communicate at the appropriate time as well as lead the labeling operation, if it is essential, when the cell labels are being computed. The segmentation constraints are included whenever there is an editing carried out by the user. Every modern paint strokes influences the pixel states, those which are underneath. As a result, the automaton progression is influenced. The aloft suggested approach permits extracting or obtaining the region of interest from convoluted backgrounds by the use of simple strokes of a paint brush, which are carried out by the abetment of a mouse.

6. RESULTS

a) Grow cut region growing algorithm

Grow Cut region algorithm is presented as a replacement for Grow Cuts algorithm. The process is very fundamental and can be envisioned using a biological source. Every image pixel is considered to be a cell of a specific class. These cells can be closer to the observer i.e. important position, or in a spacing i.e., undefined, backdrop. These cells assert to control the image domain while the algorithm proceeds further. The command of the cells to permeate is appertained to the intensity of the image pixel.

b) Segmentation results

Once the grow cut process is successfully administered, this is an impressive way to obtain partitions. This initialization step is perceived from intuition and the process is perfectly smooth. Let us consider these pictures of skin ulcer given below:

Figure-4. Original skin ulcer image.

Figure-5. Segmented image.

The following indispensable characteristics of our suggested approach are being reflected:-

1) Shows ameliorated, enhanced precision rates.
2) Potent in calculating.
3) Competitive usability is shown.
4) Hale in nature.

It can be observed that the obtained output image is not of a very good quality, but it is a decent one. The seed points are refined interactively to ameliorate the results of segmentation based on the response to the user's input. Histogram depicting the ulcer affected area is given below:

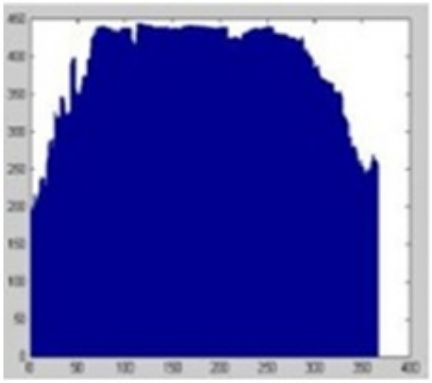

Figure-6. Histogram of ulcer affected area.

7. CONCLUSIONS

The results of the experimental procedure shows that the suggested method gives more proficient and efficacious results when compared with the previous image partitioning approach. Our suggested system is communicative in nature as the segmentation procedure can be remodeled with each and every looping by the use, thus making it easy to administer and infer. Depending on the results, we can infer that the proposed strategy considerably lessens the applied effort needed for partitioning of image when compared with the existing methodologies such as Graph Cuts and Grab Cut. Our proposed method mixes the features of the above mentioned techniques and relinquishes furthermore dynamic interaction between the algorithm and the user. Both chromatic and textural characteristics are used for developing the map from the ulcer image of the affected patient. A far better segmentation using the Grow cut technique is obtained.

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