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Detecting Initial Stage Wounds in Diabetes Patients Based on Mean Shift Algorithm

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Abstract:
Diabetic foot ulcer is a major complication of diabetes mellitus, and probably the major component of the diabetic foot. Wound healing is an innate mechanism of action that works reliably most of the time. A key feature of wound healing is stepwise repair of lost extracellular matrix (ECM) that forms the largest component of the dermal skin layer. There is need for technology innovation for communication between diabetic patients and doctors. 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 analyse 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: Diabetic foot ulcer, foot wound, wound healing, android phone, mean shift algorithm.

Introduction:
A diabetic foot ulcer is an open sore or wound that occurs in approximately 15 percent of patients with diabetes and is commonly located on the bottom of the foot. Of those who develop a foot ulcer, 6 percent will be hospitalized due to infection or other ulcer-related complication.Ulcer evaluation should include documentation of the wound's location, size, shape, depth, base, and border. Successful treatment of diabetic foot ulcers consists of addressing these three basic issues: debridement, offloading, and infection control. And frequent consultation with doctor is necessary.

Existing System:

• 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 a significant health care cost because patients may require special transportation, e.g., ambulances.

• Second, a clinician's 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 wound's healing process across consecutive visits is a difficult task for both clinicians and patients.

• The wound boundary determination was done with a particular implementation of the level set algorithm; specifically the distance regularized level set evolution The principal disadvantage of the level set algorithm is that the iteration of global level set function is too computationally intensive to be implemented on smart phones, even with the narrow band confined implementation based on GPUs.

Proposed System:

• In this paper, we replaced the level set algorithms with the efficient mean-shift segmentation algorithm.

• While it addresses the previous problems, it also creates additional challenges, such as over-segmentation, which we solved using the region adjacency graph (RAG)-based region merge algorithm.

• In this paper, we present the entire process of recording and analyzing a wound image, using algorithms that are executable on a smart phone, and provide evidence of the efficiency and accuracy of these algorithms for analyzing diabetic foot ulcers.

Problem Definition:

Diabetic foot ulcers represent a significant health issue.The prevalence of smart phone with a high-resolution digital camera, assessing wounds by analyzing images of chronic foot ulcers is an attractive option. In this, we propose a novel wound image analysis system implemented solely on the Android Smartphone. The wound image is captured by the camera on the Smartphone with the assistance of an image capture box. After that, the smart phone 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 a simple connected region detection method. Within the wound boundary, the healing status is next assessed based on red–yellow–black color evaluation model. Moreover, the healing status is quantitatively assessed, based on trend analysis of time records for a given patient. Experimental results on wound images collected in UMASS—Memorial Health Center Wound Clinic (Worcester, MA)following an Institutional Review Board approved protocol show that our system can be efficiently used to analyze the wound healing status with promising accuracy.

Modules Description:

1. Wound Image Analysis System overview.
2. Mean-Shift-Based Segmentation Algorithm.
3. Wound Boundary Determination and Analysis Algorithms.

Wound Image Analysis System overview:

In this module, we carry out a Wound boundary determination based on the foot outline detection result. If the foot detection result is regarded as a binary image with the foot area marked as “white” and rest part marked as “black,” it is easy to locate the wound boundary within the foot region boundary by detecting the largest connected black” component within the “white” part. If the wound is located at the foot region boundary, then the foot boundary is not closed, and hence the problem becomes more complicated, i.e., we might need to first form a closed boundary.

When the wound boundary has been successfully determined and the wound area calculated, we next evaluate the healing state of the wound by performing Color segmentation, with the goal of categorizing each pixel in the wound boundary into certain classes labeled as granulation, slough and necrosis. The classical self-organized clustering method called K-mean with high computational efficiency is used. After the color segmentation, a feature vector including the wound area size and dimensions for different types of wound tissues is formed to describe the wound quantitatively. This feature vector, along with both the original and analyzed images, is saved in the result database.

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The Wound healing trend analysis is performed on a time sequence of images belonging to a given patient to monitor the wound healing status. The current trend is obtained by comparing the wound feature vectors between the current wound record and the one that is just one standard time interval earlier (typically one or two weeks). Alternatively, a longer term healing trend is obtained by comparing the feature vectors between the current wound and the base record which is the earliest record for this patient.

Mean-Shift-Based Segmentation Algorithm:

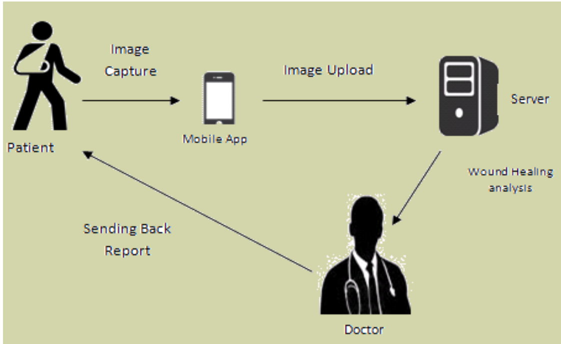
In this module we implement mean-shift-based segmentation, the mean-shift algorithm belongs to the density estimation based nonparametric clustering methods, in which the feature space can be considered as the empirical probability density function of the represented parameter. This type of algorithms adequately analyzes the image feature space (color space, spatial space or the combination of the two spaces) to cluster and can provide a reliable solution for many vision tasks.

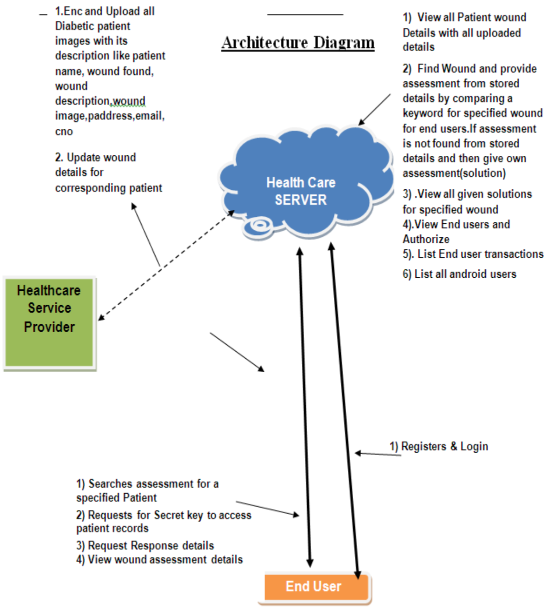
Wound Boundary Determination and Analysis Algorithms:

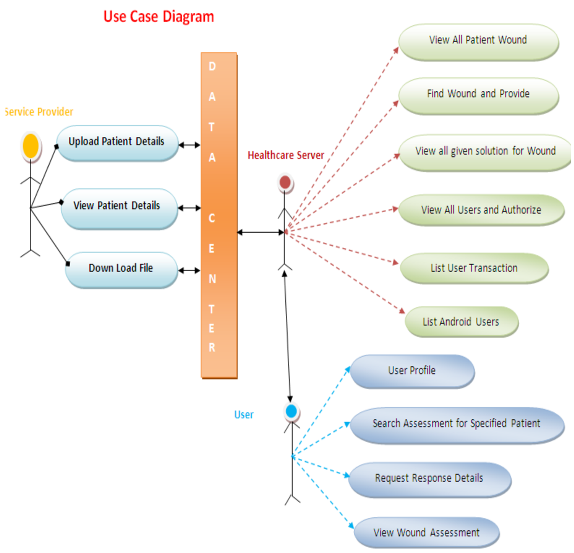
In this module we implement wound boundary determination, because the mean-shift algorithm only manages to segment the original image into homogeneous regions with similar color features, an object recognition method is needed to interpret the segmentation result into a meaningful wound boundary determination that can be easily understood by the users of the wound analysis system.

As noted, a standard recognition method relies on known model information to develop a hypothesis, based on which a decision is made whether a region should be regarded as a candidate object, i.e., a wound. A verification step is also needed for further confirmation. Because our wound determination algorithm is designed for real time implementation on the smart phones with limited computational resources, we simplify the object recognition process while ensuring that recognition accuracy is acceptable.

System Architecture:







Conclusion:

The goal of proposed system is to provide good wound image analysis through the Smartphone. The wound image analysis algorithm is implemented on Android Smartphone using both CPU &GPU. We use the mean shift based boundary determination algorithm to analysis of accurate wound boundary detection result. This technique Patients are active participants in their own care. For each individual patient manually find an optimal parameter setting based on single sample image taken from the patient before the practical application. The wound analysis systems whereby clinicians can remotely access the wound image and result.

All result are store in database. Patient"s travel exposure is considerably reduced. Also it will reduce the patients stress. Doctor can easily analyze the problem through images and its segmentation. The proper report can be given to the patient on time. It"s avoided high cost, complexity, and lack of tissue classification. It is easy to use device for self-management of foot ulcer for patients with diabetes. The image segmentation can be determining the outline of foot ulcer and accurate wound area are detect.

The processing algorithms are both accurate and well suited for the available hardware and computational resources that time Patient for image capture and image processing provided. For real-time wound analysis that Design a highly efficient and accurate algorithm. That is able to operate within the computational constraints of the Smartphone.

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