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Wound Assessment System for Foot Ulcer Patient with Diabetes Identification Based On Very Deep Residual Network

Kirandharshini.D [1], Keerthana.D[2], Lakshmi Priya.P[3], Geetha.P[4.]
[*1]*UG scholar, Department of Electronics and Communication Engineering, Hindusthan college of Engineering and Technology, Coimbatore.*
[*2]*UG scholar, Department of Electronics and Communication Engineering, Hindusthan college of Engineering and Technology, Coimbatore.*
[*3]*UG scholar, Department of Electronics and Communication Engineering, Hindusthan college of Engineering and Technology, Coimbatore.*
[*4] *Associate Professor, Department of Electronics and Communication Engineering, Hindusthan college of Engineering and Technology, Coimbatore.*

Abstract
In this paper, a determining method for the foot ulcer by digital image processing (DIP) has been presented using MATLAB. The diabetic foot syndrome is defined by the presence of infections, ulcers, and/ or gangrene associated to the diabetic neuropathy, and different levels of peripheral vascular disease, as a result of the complex interaction of several maintained hyperglycaemic induced factors. There are several problems with current uses for treating diabetic foot ulcers. First, patients must go to their clinic on a daily basis to have their wounds checked by their physicians. Second, a clinician wound analyses process is based on visual examination. The diabetic foot complications constitute a huge challenge for patients, caregivers, and the healthcare system. Technology employing image analysis techniques is a probable solution to both these problems. The identification of the foot ulcer by using the k-means clustering algorithm with deep learning. The morphological operation is used to extract the feathers of the image.
Keywords: *Digital Image Processing, MATLAB, Image Analysis Techniques, k-means clustering algorithm, Deep Residual network,*

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I. INTRODUCTION

Diabetic foot ulcers may cause due to the temperature variations in the feet. This mainly includes neuropathy, peripheral arterial diseases, and infections. The temperature factor which influences the variation in foot plantar Temperatures, should not less than 4 °C. In most of the cases, the increment of DF disorders avoided or gradually delayed by proper treatments that are given at an early stage. It describes the importance of an early detection and diagnosis of diabetic foot treated by specialized medical doctors in the health care centers or hospitals. In diabetic foot, the treatments are related with footwear of therapeutic and education of diabetic foot However, in the serious complications such as happening of ulcer, reduced. Most of the research is concerning about diabetic and the temperature difference between the Feet should not be more than 1°C. This research work concentrates on the two factors, primarily to improve the early detection, diagnosis of DF in hospitals, and another one is to reduction of chances of ulcers and related amputations in the diabetic foot. The Ulcer foot is important with serious complication of diabetes mellitus (DM). The aim of this work is to prevention of Ulcers by close monitoring on regular basis which reduces the surgical operation compel frequencies 50 to 90%.

1.1 K MEANS CLUSTERING

k-means clustering is a method of vector quantization, initially from signal processing, which is popular for cluster analysis in data mining. It points to division of n observations into k clusters in which each observation belongs to the cluster with the nearest mean, serving as a prototype of the cluster. This results in a partition of the data space into Voronoi cells. The issue is computationally difficult (NP-hard); however, there are efficient heuristic algorithms that are commonly employed and converge quickly to a local optimum. These are close to the expectation-maximization algorithm for mixtures of Gaussian distributions via an iterative refinement approach employed by both algorithms. In addition, they both use cluster centers to model the data; however, k-means clustering tends to find clusters of comparable spatial extent, while the expectation-maximization mechanism allows clusters to have different shapes.

The algorithm has a loose relationship to the k-nearest neighbor classifier, a popular machine learning technique for classification that is often confused with k-means because of the k in the name. One can apply the 1-nearest neighbor classifier on the cluster centers acquired by k-means to sort new data into the existing clusters. This is called as nearest centroid classifier or Rocchio algorithm.

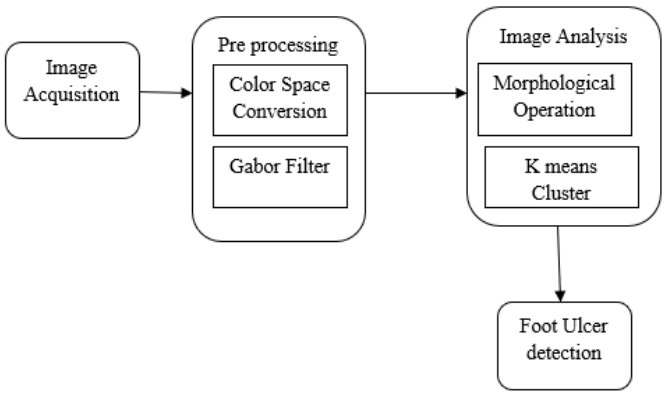
1.2 Deep Residual Networks

Residual networks workout degradation problem by shortcuts or skip connections, by short circuiting shallow layers to deep layers. We can stack Residual blocks more and more, in the absence of degradation in performance. This enables very deep networks to be built. A deep residual network (deep ResNet) is a type of unique neural network that helps to handle more advanced deep learning tasks and models. It has collected quite a bit of attention at recent IT conventions, and is being considered for helping with the training of deep networks. A residual network consists of residual units or blocks which have skip connections, also known as identity connections. The skip connections are shown. The output of the previous layer is further added to the output of the layer after it in the residual block. Such residual blocks are repeated to structure a residual network.

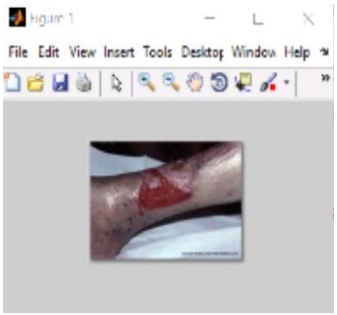
II. EXPERIMENTAL WORK

This study is to become the first link to optimize the diabetic's foot evaluation through the introduction of digital image processing techniques. Because of the use of up-to-date object segmentation techniques and a parameter that adjusts the system's sensibility until attaining the desired results it was achievable to apply an algorithm to a series of trial images provided effective results for wound and location detection. This stage is processes re-dimension, space color conversion, Gabor filter, and region of interest delimitation. The contribution is an evaluation system of the diabetic's foot that can be a useful tool for the physician with the advantages of allows the automatic detection of ulcers and wounds on the patient's foot. It is a non-invasive method and it allows an easy handling of the obtained results. Diabetic foot ulcer is predicted without skin tones. Image acquisition is a technique which involves a dataset consists of Skin disease images, among those images anyone of the image is selected to get classified. In pre-processing, two plane conversions are done by converting into gray format if the taken image as supposed to be three plane images. The values will be varied up to 256. Image pre-processing is a necessary step of detection in order to remove noises and enhance the quality of original image. It required to be applied to limit the search of irregularities in the background influence on the result. Thresholding is a technique for adjusting image intensities to enhance contrast. Because of this enhancement visual quality will be little bit better and easy to analysis. By using morphology technique, the noises will be reduced for the classified images and we will obtain as desired one and text will be used to mention the classified type on images. Image de-noising is an essential step in pre-processing of an image. It is extremely hard to apply an effective de-noising algorithm for different types of noisy images. The necessary property of a good image de-noising method is to suppress the noise as well as preserving the edges. Clustering is one of the most usual experimental data analysis technique used to get an instinct about the structure of the data. It can be explained as the task of identifying subgroups in the data such that data points in the same subgroup (cluster) are very homogeneous while data points in different clusters are very different. In other words, we try to find similar subgroups within the data such that data points in each cluster are as close as possible according to a similarity measure such as correlation-based distance or Euclidean-based distance. K-means algorithm is a repetitive algorithm that tries to divide the dataset into k-pre-defined distinct non-overlapping subgroups (clusters) where each data point belongs to only one group. The foot ulcer detection using image processing techniques is done. The entire steps of the proposed method are presented by the block diagram.

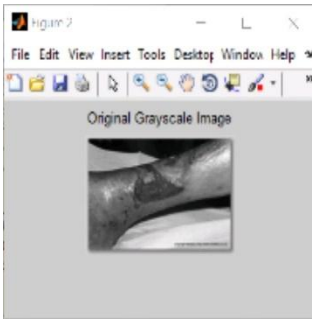
BLOCK DIAGRAM



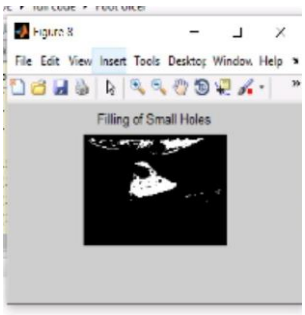
The results of the input image at each stage of preprocessing technique are shown in the following figure.



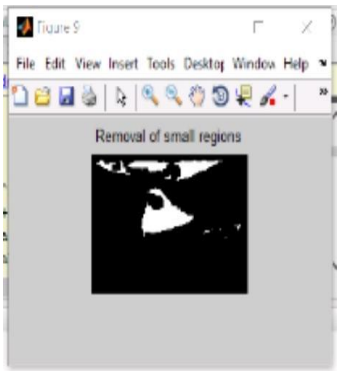
a) Colored input image



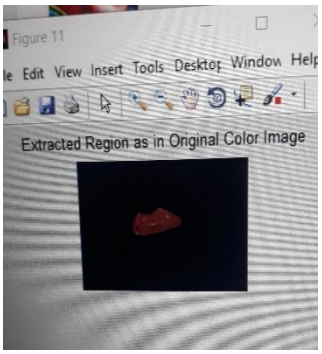
b) Original grayscale image



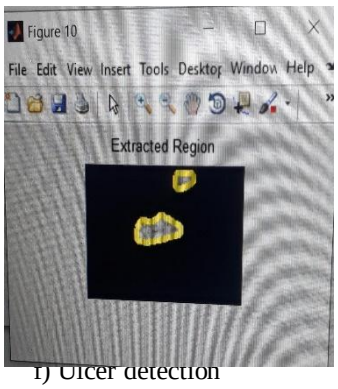
c) Filling of small holes



d) Removal of small region



e) Extracted region



f) Ulcer detection

III. RESULTS

With this work, stages necessary for foot ulcer identification using image processing are scrutinized. Gabor filter is used for the segmentation purpose as it provides optimal joint localization in both frequency and special domain. With the usage of very deep residual network, the foot ulcer for the patient with diabetes is detected. The output values of the signal-to-noise ratio and the peak signal-to noise ratio are presented in the table.

PSNR_org	4.9934
SNR_org	3.5673
PSNR_dct	5.2770
SNR_dct	3.5623

The count for red, black and yellow pixels in order of granulation slought and nacrotics are presented in the table.

Count_red	17	13	10854
Count_black	85	56	10848
Count_yellow	28	5	10854

IV. CONCLUSION

In this paper, analyses the global diabetic foot ulcers treatment market in terms of treatment type, grade, type of ulcer, end user, and region. Key segments under each criteria have been studied at length, the entire paper comprises an exhaustive collection of output images and tables that are appropriately interspersed in the entire compilation. Pictorial representation of projected and actual values of key segments is visually appealing to readers. This also allows comparison of key segments of the market shares in the past and at the end of the forecast period. The results present a good performance on foot ulcer detection.

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