Foot ulcer detection using super pixel and faster R-CNN algorithm

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***Abstract*: In recent years researches made on diabetic foot ulcer (DFU) which is caused by increase of blood glucose results nerve injury and leads to amputation. This paper represent a noval method for wound identification of diabetic foot ulcer for early detection. an automatic 3D segmentation method for transrectal Foot images, which is based on multi-Foot Ulcer registration and region extraction. The database is created to store 2400 images of ulcer grade and no ulcerative images out of that 1920 images are subjected for training phase and 480 images for testing phase. The work explains about the process of foot ulcer detection of previous detection techniques and the research made on foot ulcer detection. It explain briefly about the pre-processing, feature extraction, segmentation and stages of ulcer affected in the foot.**

***Index Terms*: Diabetic foot ulcer (DFU), Super pixel algorithm, Faster R-CNN algorithm.**

I. INTRODUCTION

Diabetic foot ulcer (DFU) is the complication of Diabetic mellitus (DM) where it affects the foot by two ways, such as breaking of neuropathic (nerves) and weakening of vascular (blood vessels). A diabetic foot ulcer is an open sore or wound that occurs in the bottom of the foot. Persons who has diabetes can develop a foot ulcer and also being overweight, using alcohol and tobacco also play a role in the development of foot ulcers. The combination of factors, such as lack of feeling in the foot, poor circulation, foot deformation, irritation and trauma diabetes leads to the formation of ulcer. The nerve damage often can occur without pain, and the person may not even be aware of the infection. The use of colour images for diagnosis of foot ulcer improve speed of response and efficiency. The color image can get through digital cameras is affordable and does not have any acquisition protocal. Low contrast image is also been processed for effective detection. The trained system is helpful to find ulcer of the individual person .About 62 million diabetics people, 25% develop DFUs, of which 50% become infected, requiring hospitalization while 20% need amputation. DFUs leads to approximately 80% of all non-traumatic amputation condition. Many researchers proposed a algorithm to detect ulcer by segmentation, thresholding, edge detection and transformation of image. But by processing in a 3D segmentation the location will be marked clearly and along with the depth occurred in the foot. By our work we overcame with the new concept for detecting ulcer in a user friendly manner and can be able to handle by their own knowledge.

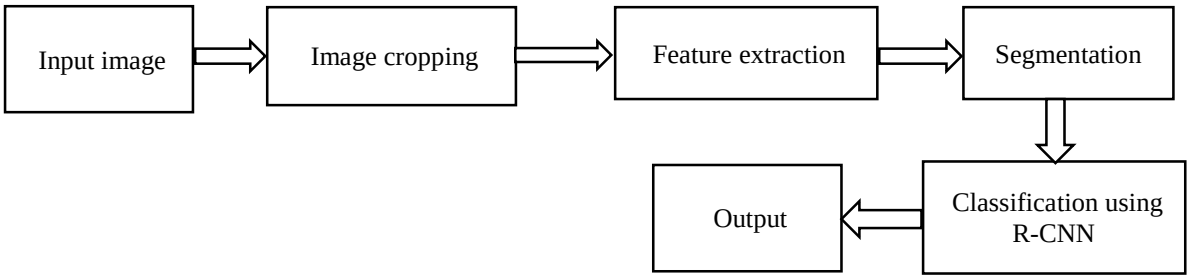
II. RELATED WORK

Too many researches are done on foot ulcer detection. Nowadays there are different imaging techniques are taken for diagnosis such as CT, MRI and PET used in diagnosis of human body. Among from that Infrared thermography is best method for interpreting the pathophysiologic information on metabolic, thermal and vascular conditions of human body. This method of scanning is non-invasive, non-destructive and do not require any physical contact with the person who subjected under diagnosis. Studies and clinical observations proves that IR thermography detection of the diseases in early ulcer phase and provides the information for suitable therapeutic treatment. It is a fact that accuracy of foot ulcer diagnosis in IR imaging depends on segmentation of Region of Interest (ROI). Image segmentation algorithms automatically detect the region of interest in IR input images and optimize the result for accurate extraction of measurements when compared to other methods. In order to test and verify each image segmentation techniques a graphical user interface is designed. In the first step the thermal images of feet are taken. In the second step the image is performed with pre-processing steps like conversion of RGB image into gray scale image and plotting the gray image in [0, 1], histogram and represents in the probability occurrence of gray level values. In order to assess the risk occurrence of ulcer causes the SVM classifier is used in two terms as low risk and high risk. The image segmentation techniques employed in the carried work are thresholding method as global and multiple, edge based segmentation methods as sobel, canny and Robert operators used for gradient edge based methods. Region based segmentation as region growing and region splitting and merging, watershed segmentation as continuous for boundaries and last method is clustering based as hard and soft clustering The Graphical user interface (GUI) designed for segmentation step is carried out with thresholding algorithm in two ways such as global and multiple thresholding. The overall output is executed as a temperature extraction to compare with the average temperature reading and execute the output based on level of comparison.

IV. PROPOSED MODEL

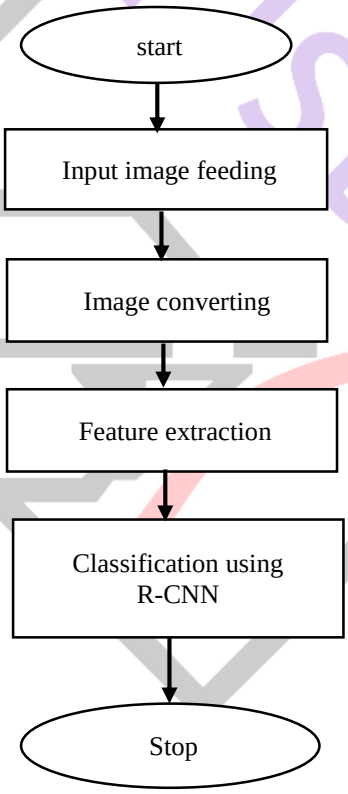
The working of the proposed method consist of acquiring of image, preprocessing, color segmentation, feature extraction of the image and then classification using R-CNN algorithm. The work has been splitted as training phase and testing phase .In training phase, the tool is trained using recurrent neural network algorithm to classify the ulcer stages. The background work has several

steps to acquisition of image and further processing. The overall process is to give the input image and the result shows the segemented region and the percentage of ulcer affected in the foot.



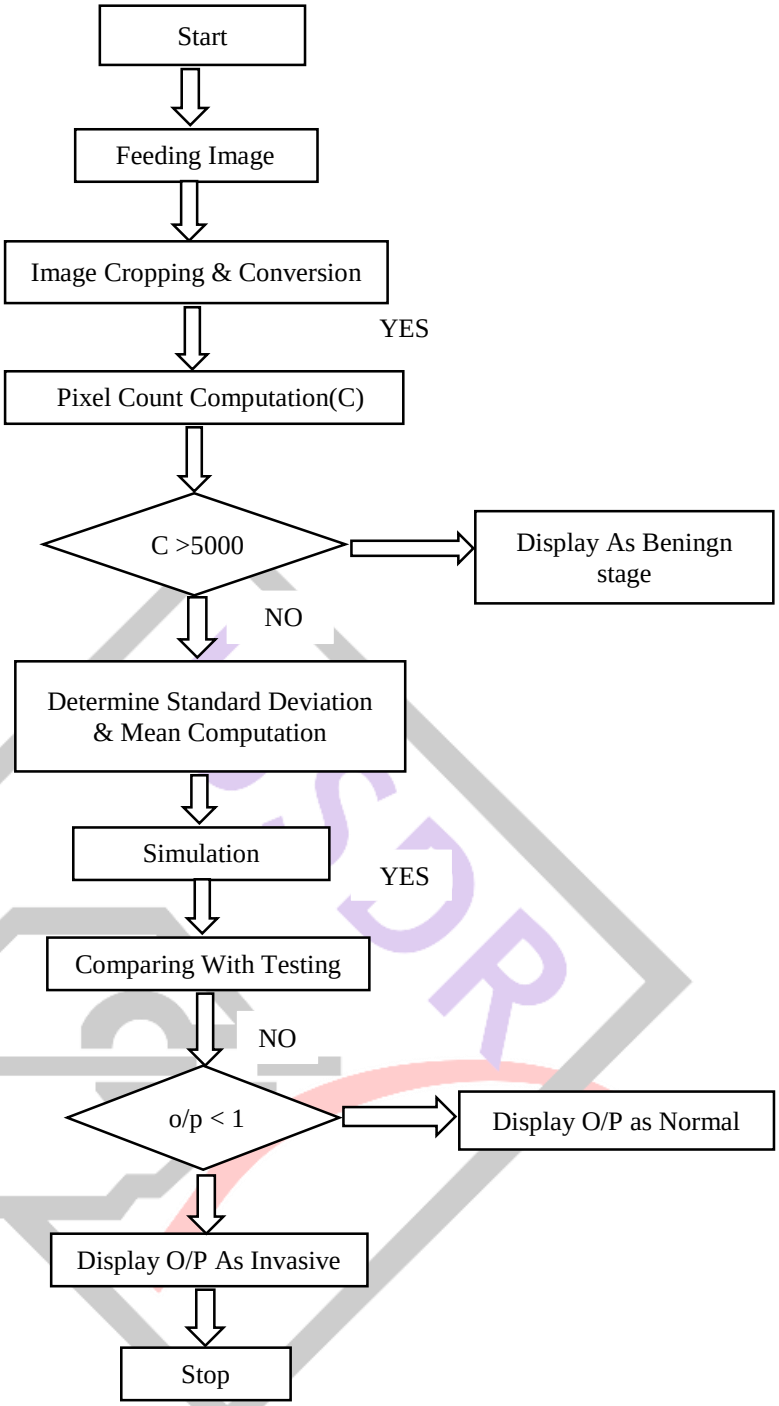
III. TRAINING PHASE:

In training phase, MATLAB tool is trained with recurrent neural network algorithm. The initial step has image feeding as ulcer image non ulcer image and partially affected ulcer image. Then coded for cropping the image for same histogram level and converting into grey shaded image. the converted grey image is subjected to convert as digital image for calculating the pixel count and form as a matrix. The digital image is coded for features extraction for the segmentation of the region affected by foot ulcer. The features are mean, standard deviation, variance, contrast, homogeneity etc., Then the super pixel algorithm is applied over the features extracted to separate the digitally converted image into three cluster regions. The entire process has been trained with Region based Convolutional Neural Network(R-CNN) to classify the stages of ulcer in the detection process. The entire process is modelled as GUI concept for framework and trained with many ulcer and non ulcer images.



VI. TESTING PHASE:

In testing phase, the captured foot image of the person is loaded for testing of foot ulcer. The image is loaded for further processing. Initially the image is cropped and converted into digital image. The converted image is processed in the Matlab tool and extract the feature of the input image and segment into clusters. The segmented cluster image is uploaded for classify the stage of ulcer formed and with the percentage with segmented ulcer region.



IV. CONCLUSION

In this project we discussed about the methods of detecting foot ulcer in 3-D segmentation. It is helpful for easy diagnosis of foot ulcer and can be able to find ulcer at its initial stages. The entire training dataset is classified according to their disease stages to classify the input image. Super pixel algorithm is applied to extract the affected region in the foot. Technology development is exponentially increasing for the last few decades and developments in Digital image processing field are also increasing and are marching towards motion detection, creating robots enabled with the capability of human eye. Embedding these types of processes and application can make the work of analyzing and detecting not only Foot but also other Ulcers can be made possible. Further this process can be implemented in the form of an application so that we can give any Thermal Image image and it provides with pre diagnosis result for Ulcer detection. The aim of this project is to provide stress free diagnosis and help to reduce the annual medical cost of the diabetic patients. The accuracy is increased by training the tool using Region based Recurrent Neural Network to classify the stages of disease and the percentage of ulcer formed in the foot.

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