Implementation Diabetic Foot Ulcer Types Detection using Neural Networks

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ABSTRACT

Diabetic Foot Ulcer Infection is one of the essential causes that reduces quantity and degrades quality of the Medical Diagnosis merchandises. Diabetic Foot Ulcer Infections have turned into a terrible as it can cause significant reduction in both quality and quantity of Medical Diagnosis products. Images form important data and information in biological sciences. Until recently photography was the only method to reproduce and report such data. It is difficult to quantify or treat the photographic data mathematically. This project, classifies the Diabetic Foot Ulcer at hand into infected and non-infected classes. The developing software provides a fast and accurate method in which the Diabetic foot Ulcer Infections are detected and classified using k-means based segmentation and neural networks-based classification. Most common Infections seen in the foot of Tapioca and Mango are discussed here for this approach. In this paper, respectively, the applications of K-means clustering and Neural Networks (NNs) have been formulated for clustering and classification of Infections that effect on Diabetic Foot Ulcer foot. Recognizing the Infection is mainly the purpose of the proposed approach. Thus, the proposed Algorithm was tested on three types of diabetic foot ulcer described namely neuropathic, neuroischaemic, and ischaemic. The experimental results indicate that the proposed approach is a valuable approach, which can significantly support an accurate detection of Diabetic foot Ulcer Infections in a little computational effort. This project gives 95% of efficiency using MATLAB simulation results.

Keyword *Diabetic foot Ulcer, K-means clustering and Neural Networks, RGB, HIS, etc.,*

1. INTRODUCTION

Digital image processing and image analysis technology based on the advances in microelectronics and computers circumvent these problems associated with traditional photography. Digital image processing is the use of computer algorithms to perform image processing on digital images. As a subcategory or field of digital signal processing, digital image processing has many advantages over analog image processing. It allows a much wider range of algorithms to be applied to the input data and can avoid problems such as the build-up of noise and signal distortion during processing. Since images are defined over two dimensions (perhaps more) digital image processing may be modeled in the form of multidimensional systems.

Using this new tool helps to improve the images from microscopic to telescopic range and also offers a scope for their analysis. It, therefore, has many applications in biology. However, as is the case with any new technology, imaging technology also has to be optimised for each application, since what each user is looking for in an image is quite unique. Images of the foot, captured by a camera or a scanner for Colour image analysis for estimation of normal Diabetic foot Ulcer, infected Diabetic foot Ulcer and chlorophyll. Many times a viral or a fungal attack on Diabetic Foot Ulcers results in degradation of chlorophyll pigments in foot. Such infected foot have patches of green and yellow colour. In Diabetic Foot Ulcer breeding, it is important to quantify the Diabetic foot Ulcer infection. Thus the extent of infection can be quantified without much efforts. Diabetic Foot Ulcer Diabetic foot Ulcer colour is also commonly used as an indication of health status of Diabetic Foot Ulcers. The loss of chlorophyll content of foot occurs due to nutrient imbalance, excessive use of pesticides, environmental changes and ageing. In this project, we develop a software for the automatic identification & classification of Diabetic Foot Ulcer Diabetic foot Ulcer Infections and provide advice for specific Infections. Here the end-user is the farmer.

2. LITERATURE SURVEY

Following is the work done carried out in various article by the authors

The determination of the presence of a pathological process in a Diabetic Foot Ulcer organism made it possible to redefine Diabetic Foot Ulcer Infection in a new way and to conceive it not as a static condition but as a dynamic process that arises and develops as a result of interaction of the Diabetic Foot Ulcer with its environment. Noninfectious Diabetic Foot Ulcer Infections are caused mainly by abiotic factors in the environment: disruptions in the regime of mineral feeding, most often by a deficiency (rarely, a unilateral excess) of macroelements (nitrogen, phosphorus, potassium, and magnesium) or a deficiency of microelements, especially boron, zinc, iron, copper, and molybdenum; an unfavorable water regime (deficiency or excess of water in the soil, prolonged rains, or high relative humidity of the air), causing "bleeding" of Diabetic Foot Ulcers, premature drying up, premature withering of Diabetic Foot Ulcers, or foot falling under conditions of water deficiency; or the effects of high or low temperatures on Diabetic Foot Ulcers, Causes of noninfectious Diabetic Foot Ulcer Infections may be harmful impurities in the air and soil (blight and falling of foot from the effects of sulfur dioxide gas, for example, in the vicinity of metallurgical and chemical Diabetic Foot Ulcers); residual effects of certain herbicides carried into the soil; an unfavorable light regime, mainly a deficiency of light in greenhouses and hothouses (chlorosis and lodgment or dwarfing with a shortened day); ionizing radiation (alpha, beta, and gamma rays, X rays, and neutrons) and some higher Diabetic Foot Ulcers.

3. DESIGN METHODOLOGY

The underlying approach for all of the existing techniques of image classification is almost the same. First, digital images are acquired from environment around the sensor using a digital image. Then image-processing techniques are applied to extract useful features that are necessary for further analysis of these images. After that, several analytical discriminating techniques are used to classify the images according to the specific problem at hand. This constitutes the overall concept that is the framework for any vision related algorithm. Figure 3.1 depicts the basic procedure of the proposed vision-based detection algorithm in this research.

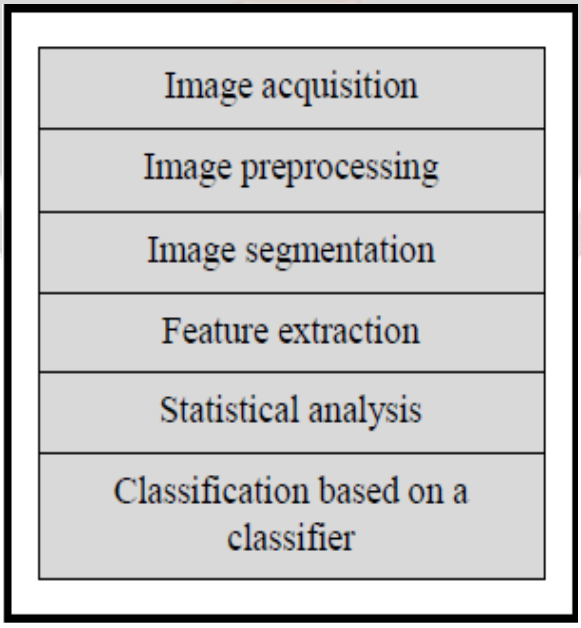

Figure 3.1: The basic procedure of the proposed techniques

The first phase is the image acquisition phase. In this step, the images of the various foot that are to be classifies are taken using a digital camera. In the second phase image preprocessing is completed. In the third phase, segmentation

using K-means clustering is performed to discover the actual segments of the Diabetic foot Ulcer in the image. Later on, feature extraction for the infected part of the Diabetic foot Ulcer is completing based on the specific properties among pixels in the image or their texture. After this step, certain statistical analysis tasks are completed to choose the best features that represents the given image, thus minimizing feature redundancy. Finally, classification is completed using neural network based algorithm.

The detail step-by-step account of the image acquisition and classification process is shown in figure 3.2. In the initial step, the RGB images of all the Diabetic foot Ulcer samples were obtained. Some samples of Infection Diabetic foot Ulcer images are taken.

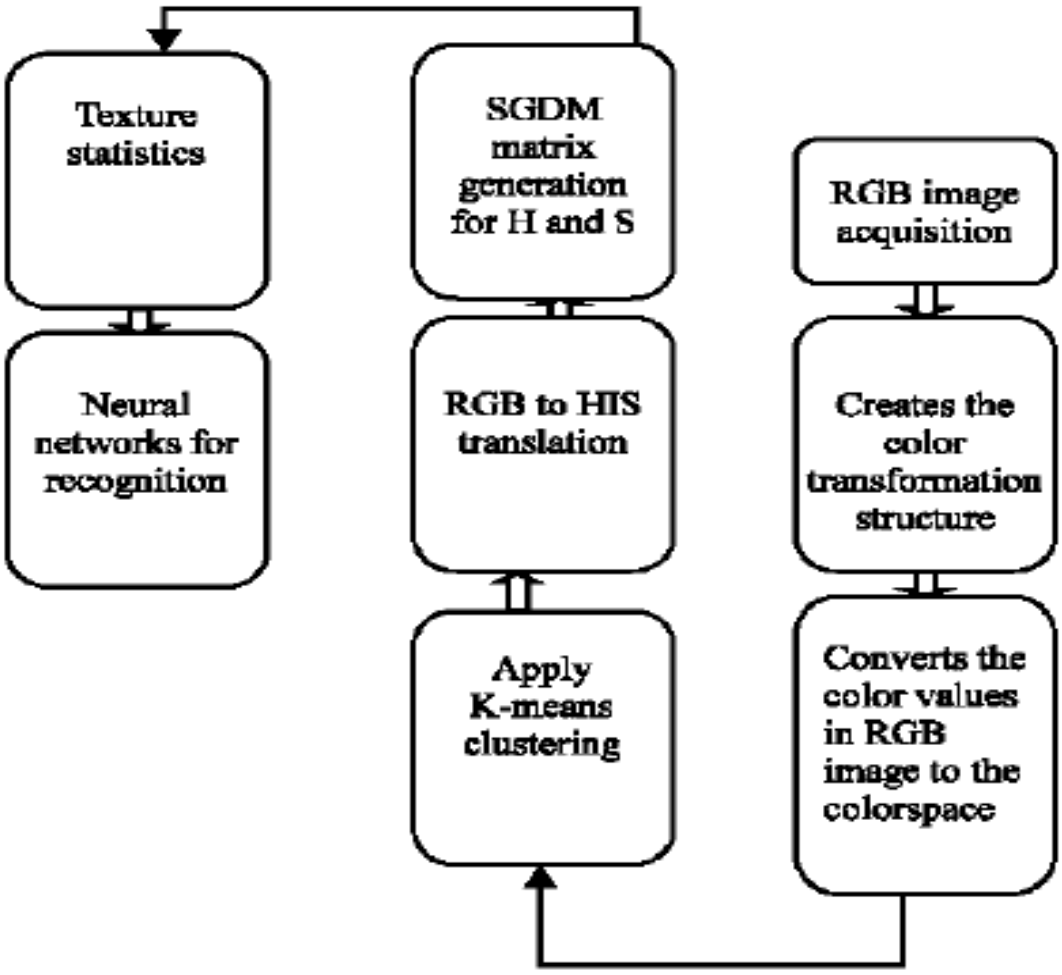

Figure 3.2: Image acquisition and classification

Once the infected objects is determined. The image is then converted from RGB format to HSI format. The SGDM matrices are then generated for each pixel map of the image for only H and S images. The SGDM is a measure of the probability that a given pixel at one particular gray-level will occur at a distinct distance and orientation angle from another pixel, given that pixel has a second particular gray-level. From the SGDM matrices, the texture statistics for each image were generated. A software routine is written in MATLAB that would take in .mat files representing the training and test data, train the classifier using the train files and then use the test file to perform classification task on the test data. Consequently, a MATLAB routine will load all the data files (training and test data files) and make modifications to the data according to the proposed model chosen.

We propose an image processing - based software for the automatic Diabetic foot Ulcer Infections identification and classification. We test our software on five Infections which effect on the Diabetic Foot Ulcers. There are three types of diabetic foot ulcer described namely neuropathic, neuroischaemic, and ischaemic. Identification and recognition of foot Infections are likely to give better performance and provide solutions to treat the Infections in its

early stages. Visual interpretation of Diabetic Foot Ulcer Infections manually is both inefficient and difficult, also it requires a trained botanist. A closer inspection of the Diabetic Foot Ulcer Infections images reveals several difficulties for the possible foot Infections identification. The developed system classifies the foot into infected and non-infected classes.

The proposed system can:

- Identify Infection type
- Deal with other Infections
- Identify and classify Infections that infect Diabetic Foot Ulcer foot
- Provide advice to treat the Infections in its early stages

First, the images of various foot are acquired using a digital camera. Then image-processing techniques are applied to the acquired images to extract useful features that are necessary for further analysis. The steps involved in recognition and classification are image acquisition, pre-processing, feature extraction, segmentation and classification.

4. RESULTS AND DISCUSSION

Following are the screenshots of the Diabetic Foot Ulcer Diabetic foot Ulcer Infection detection techniques

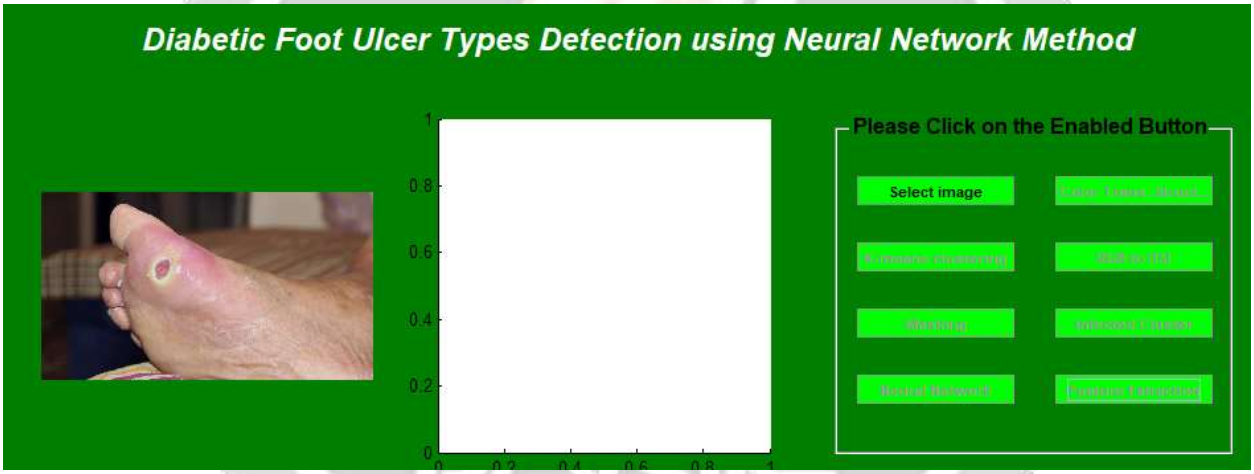

Fig 4.1: GUI File

Fig 4.2: Data Sets of various types of Diabetic Foot Ulcer

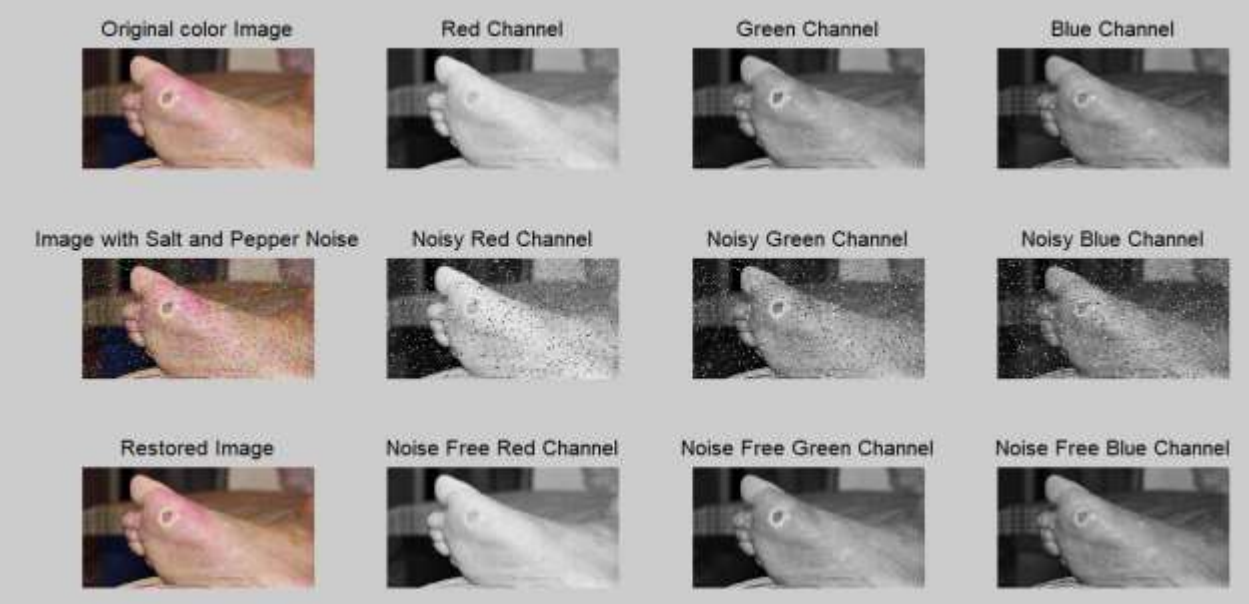

Fig 4.3: Filter results with Red, Green and Blue Channel color transformation structure from RGB

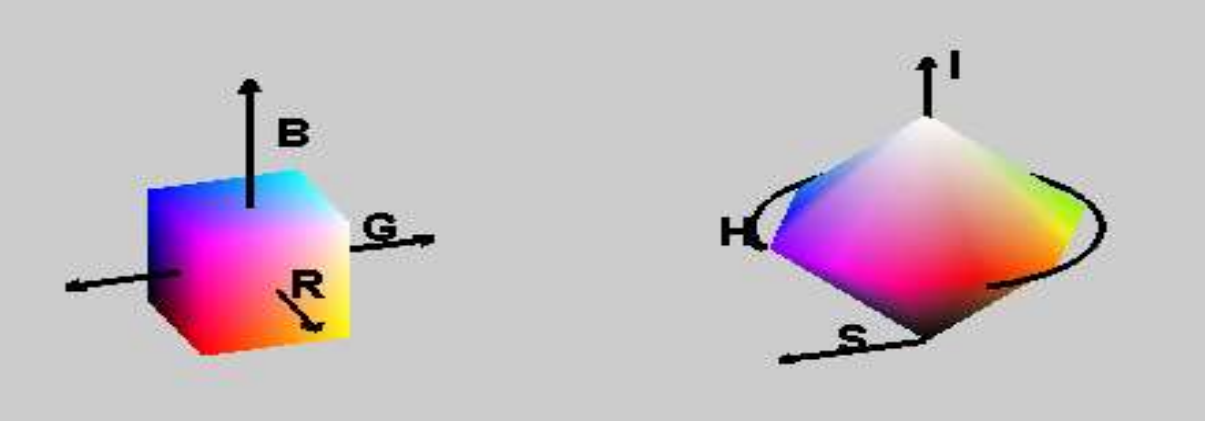

Fig 4.4: RGB and HIS representation

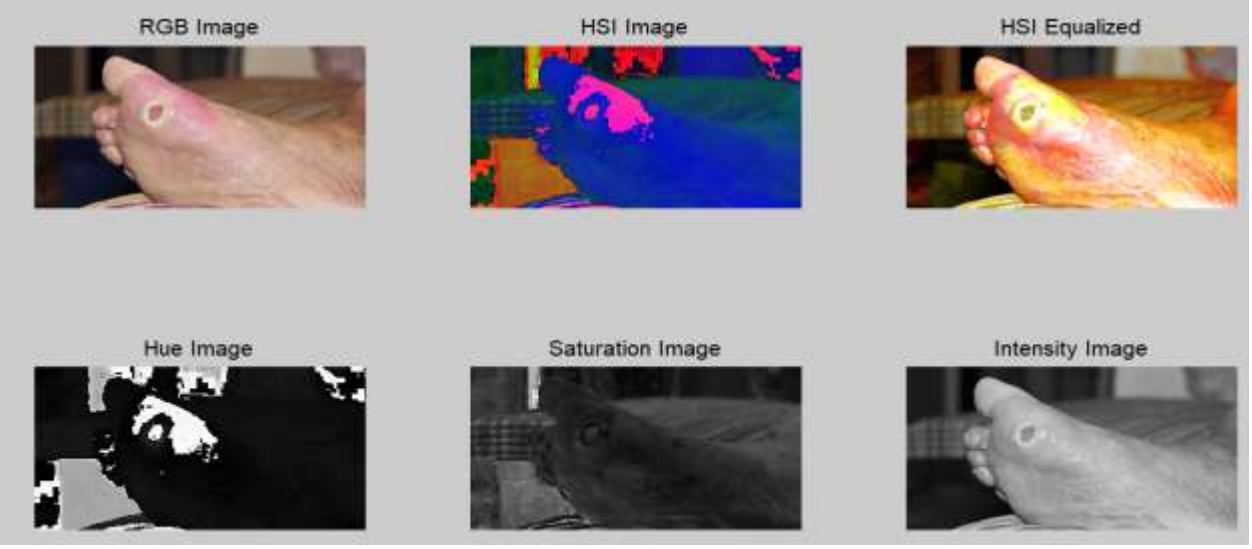

Fig 4.4: HIS Image and HIS Equalized representation

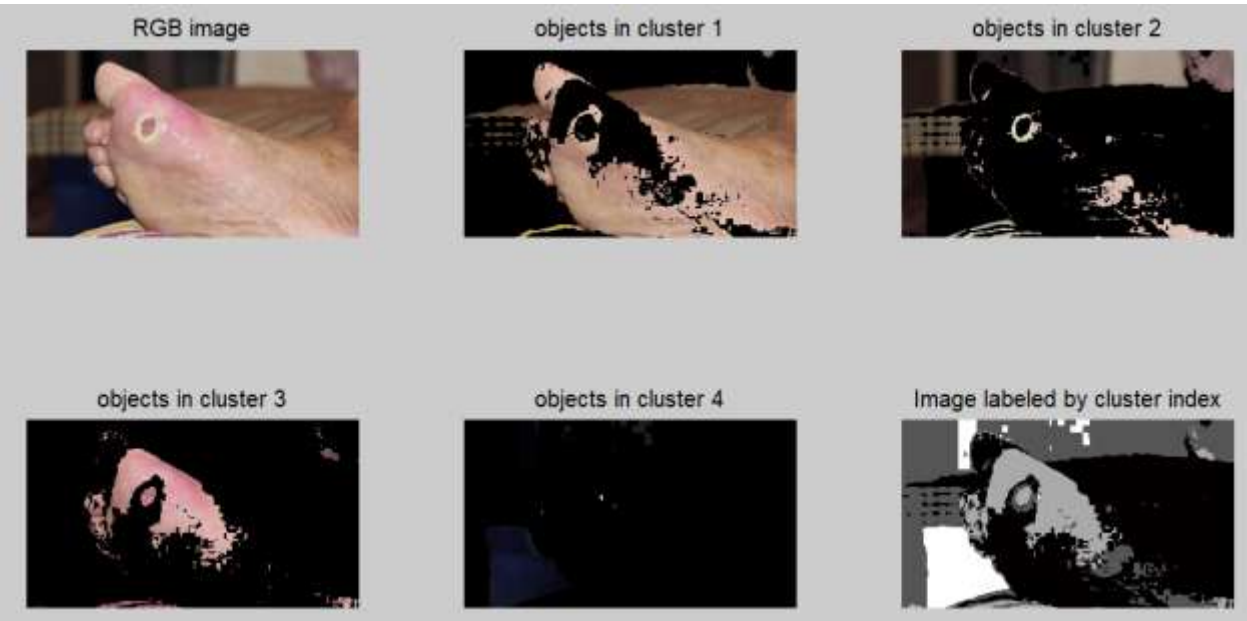

Fig 4.5: Cluster representation of RGB Image

Fig 4.6: Hue, Saturation and Intensity results of Infected Image

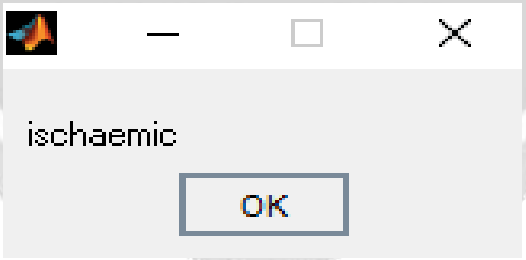

Fig 4.6: Diabetic foot Ulcer Infection type "ischaemic" Result in Dialog Box

5. CONCLUSION

In this paper, respectively, the applications of K-means clustering and Neural Networks (NNs) have been formulated for clustering and classification of Infections that effect on Diabetic Foot Ulcer foot. Recognizing the Infection is mainly the purpose of the proposed approach. Thus, the proposed Algorithm was tested on five Infections which influence on the Diabetic Foot Ulcers; they are: Early scorch, Cottony mold, ashen mold, late scorch, tiny whiteness. The experimental results indicate that the proposed approach is a valuable approach, which can significantly support an accurate detection of Diabetic foot Ulcer Infections in a little computational effort. An extension of this work will focus on developing hybrid algorithms such as genetic algorithms and NNs in order to increase the recognition rate of the final classification process underscoring the advantages of hybrid algorithms; also, we will dedicate our future works on automatically estimating the severity of the detected Infection.

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