PRE-DETECTION OF FOOT ULCER FOR DIABETIC PATIENT USING THERMAL IMAGER

Vishnu Priya¹, D.Pamela²*, K.Geard Joe Nigel³, Prawin Angel Michael⁴
*pamela@karunya.edu
1,2 Department of Biomedical Engineering
3 Department of Robotics Engineering
4 Department of Electrical and Electronics Engineering
Karunya Institute of Technology and Sciences

Abstract

As per the statistics taken in the year 2020, a measurable audit shows that over 35% of the Indian population is influenced with foot ulcer. Foot ulcer is an issue looked by the greater part of the patient who have gone through diabetes mellitus (DM). Around 20% of the diabetes patients is influenced by foot ulcer, another 20% is affected by diabetic neuropathy, 30% patient are influenced with both the conditions. Generally the foot ulcer can be inspected with x-beams, bone output, MRI, CT, Bacterial culture of the ulcer, and even with blood tests. These methods are inspected by obtrusive method of estimations that will hurt the patient more. In order to reduce the discomfort during the interaction and furthermore for the early identification of this condition, this arrangement has been created. This pre-recognition measure is a non-intrusive method for estimation with the thermal imager. The temperature scope of ordinary foot is under 30 degree Celsius. It very well may be fluctuated (expanded) least of 2 degree Celsius for ulcerced foot. These ulcerced foot pictures has been procured with the assistance of thermal imager (AMG8833) and handled utilizing MATLAB and result is shown in a histogram. This histogram helps us to differentiate the typical and ulcerced foot. The classification is done using neural network.

Keywords : Foot Ulcer, Thermal imager, Image handling, Neural Network

1. INTRODUCTION :

The ongoing avoidance of the Diabetic Foot ulcer has been anticipated by the most recent arising innovation with the assistance of the principle of thermal imager. Thermal imager is only a thermal camera that makes a picture utilizing an IR(Infrared Radiation).

The camera advocates in catching and breaking down the information. This information
given by the imager is called as thermography. The significant source utilized in this camera is the IR radiation. The infrared energy is only one of the pieces of the electromagnetic range which incorporates radiations from the gamma beams, x-beams and bright. The pictures from the infrared camera are will in general be monochromatic in nature, the camera for the most part uses a picture sensor that doesn't recognize frequencies of infrared radiation. Foot ulcer is an open sore on the foot. A foot ulcer happens in the skin surface which can be shallow red hole. A foot ulcer likewise can be exceptionally profound. A profound foot ulcer is a pit that reaches out through the full skin thickness. People with diabetes and helpless blood flow are probably going to create foot ulcers. Individuals with these conditions, a little foot ulcer can get tainted, on the off chance that it doesn't mend as expected. Among individuals with diabetes, most extreme foot contaminations that at last require some piece of the foot or lower leg or toe to be cut off start as foot ulcer.

Foot ulcers are basic in individuals who have at least one of the accompanying medical problems: Atherosclerosis, Raynaud’s phenomenon, Peripheral neuropathy, Circulatory issues, Abnormalities in the bone or muscles of feet. The previously mentioned manifestations are usually used to analyze foot ulcer. Accordingly, in this paper efforts are made to distinguish the sickness and its manifestations of a patient before serious injury.

2. THERMAL IMAGER:

A thermographic camera is likewise called an infrared camera, that will make a picture utilizing infrared radiations, like regular camera that frames a picture utilizing noticeable visible light. Rather than the 400-700 nano meter(nm) scope of the visible light cameras, these infrared cameras are sensitive to wavelengths from around 1000 nm to around 14000 nm. The craft of catching of the information and examining the information they give is called thermography. Pictures from infrared cameras are will in general be monochromatic in light of the fact that the cameras for the most part utilize a picture sensor that doesn't recognize diverse frequency of infrared radiation.
3. AMG8833:

AMG8833 IR 8*8 Thermal Imager Array Temperature Sensor (fig:1). Module is a 8*8 exhibit of IR thermal sensor. The point associated with microcontroller or raspberry Pi, will return cluster of 64 individual infrared temperature readings more than 12 degree Celsius. AMG8833 IR 8*8 Thermal Sensor Module will gauge temperature going from 0 degree Celsius to 80 degree Celsius. It can identify human at a distance of 7 meters. This imager uses 8*8 thermal IR sensor and it offers better performance than its archetype. The sensor just backings 12c and has a configurable intrude on pin that can fire when any individual pixel goes above or beneath limits that is set by user.

Figure1 :AMG8833 THERMAL IMAGER

4. NEURAL NETWORK:

A Neural organization is a registering model, whose layers of construction takes after the arranged design of neurons in the brain, with layers of associated nodes. A neural organization can gain information, with the goal that it tends to be prepared to perceive its examples, and order information, and estimate future occasions. A neural network breaks down the given input into layers of abstraction. It can be trained over many examples to recognize patterns in images. Neural network joins a few handling layers, utilizing straightforward components working in equal and parallel by biological nervous systems. Neural network (Figure:2) consists of an information layer, one, two or more hidden layers, and a yield layer. The layers are interconnected through nodes and neurons with each layer utilizing the yield of the previous layer as its input information.
5. Methodology:

5.1 IMAGE ACQUISITION:

The procured image is then prepared utilizing MATLAB programming. A code has been created to show the temperature varieties between the ordinary and ulcered foot. As the code runs, it will identify the precise scope of the infected foot dependent on the temperature variety. This code in MATLAB additionally shows the accompanying:

- Original pseudo colour image.
- Cropped pseudo colour image.
- Cropped shading bar image.
- Indexed image (dark scale image).
• Floating point warm image.
• Histogram of the thermal image.

5.2 ORIGINAL PSEUDO COLOUR IMAGE:

This progression is for pseudo colour image handling, it can change over a greyscale image to colour. The colour tone may not be exact however very helpful for specific applications. Hence, the pseudo colour image of what we procured is shown in the yield of output.

5.3 CROPPED PSEUDO COLOUR IMAGE:

This makes an interactive crop image tool related with the figure showed in the current image. The cropped image includes all pixels in the given input image that will completely enclosed by rectangle or square. The genuine size of the yield picture doesn't compare precisely with the tallness and width of the image.

5.4 CROPPED COLOUR BAR IMAGE:

Colouring bar properties control the appearance and conduct of a colouring bar object. By changing property estimations, certain parts of the colouring bar can be adjusted. Consequently, shade of the foot image is done and shown in the output yield.

5.5 INDEXED IMAGE (GREY SCALE IMAGE):

A greyscale image is a matrix of information whose qualities are addresses the powers inside some reach. MATLAB stores a greyscale image as in an individual matrix lattice, with every component of the grid relating to single image pixel.

5.6 FLOATING POINT THERMAL IMAGE:

They offer most noteworthy exactness and dynamic range, to the detriment of generously more prominent memory prerequisite and processing time. The floating point esteems don’t really need to go exclusively somewhere in the range of 0 and 1.

5.7 HISTOGRAM OF THERMAL IMAGE:
Histogram of an image goes about as a graphical portrayal of the information, of the appropriation in a given digital image. By taking a glimpse at the histogram for a particular image, the observer can infer details about the histogram. The histogram shows the scope of range of the temperature.

Figure 3: Thermal image of ulcered foot.

Figure 4: Thermal image of normal foot.

The images of typical and ulcered foot of few subjects are taken with the thermal camera AMG8833. The photos of the temperature which is shown in the thermal camera is caught utilizing our cell phone camera for future references.
A neural network is a series of algorithms that endeavours to recognise underlying relationships in a set of data through a process that mimics, what the human brain operates. Neural network adjusts to changing every one of the information sources; so the organization produces the most ideal outcome without the need to upgrade the output measures. The hidden layers finely tune the information weights until the neural network's error gets negligible. It is speculated that secret layers extrapolate the information that have prescient force with respect to every one of the outputs. This describes highlight extraction, that will accomplish a utility like factual strategies, which in our case the temperatures of those couple of subjects of both the typical and ulcered foot is prepared utilizing this neural network.

6. PROPOSED ALGORITHM:

7. CONCLUSION:
This application is not difficult to utilize and the thermal imager AMG8833 is an easy to use gadget since this gadget can help to show the temperature straightforwardly with no contact. In light of the MATLAB and neural systems administration, the output has been obtained by our predefined specification. The targets in this venture have been effectively accomplished. The conventional method to detect the temperatures was changed over into an intelligent and in more specialized manner. This work is viewed as fruitful on the grounds that new abilities and bunches of information have been acquired through the improvement cycle. During this task improvement measure, time the board abilities were likewise acquired. In general, this framework is prepared to utilize and a ton of advantages can be acquired through the framework.

8. RESULT:

This framework is truly adaptable and cost productive which permits the client to screen and record the temperature information distantly and it will expand the precision of the observing framework in numerous ventures.

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