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[ijirset@gmail.com](mailto:ijirset@gmail.com)

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# Pressure Ulcers Classification and Detection

<sup>1</sup>Prof. Akshatha Rao, <sup>2</sup>Rithesh Kumar, <sup>3</sup>SharanyaS, <sup>4</sup>Sharanya U, <sup>5</sup>Swathi Bhat

<sup>1</sup>Professor, Dept. of ECE, SMVITM, Bantakal, Udupi Karnataka, India

<sup>2,3,4,5</sup>B.E Student, Dept. of ECE, SMVITM, Bantakal, Udupi, Karnataka, India

**ABSTRACT:** The skin injuries known as pressure ulcers are brought on by sustained pressure on the skin. Anyone can experience this, although it typically affects those who spend a lot of time in a chair, wheelchair, or bed. These wounds are frequently observed in hospitalized and bedridden patients. Therefore, it is essential to identify and classify pressure ulcers early.

**KEYWORDS:** Convolutional Neural Networks., Image Segmentation, Image Processing, Pressureinjuries, Tissue type classification

## I.INTRODUCTION

The skin that covers bony parts of the body, such as the buttocks, tailbone, hips, heels of the feet, shoulder blades, back of the head, and sides and backs of the knees, is where bedsores most frequently occur. Any region of your body can have its blood flow reduced by constant pressure. When skin rubs against clothing or bedding, friction is created. It may increase the risk of harm in people with delicate skin, especially if the skin is moist. For people to maintain good skin and stop tissue deterioration, their daily diets must contain an adequate number of calories, protein, vitamins, and minerals. Tissue injury is more likely in conditions like diabetes and vascular disease that can alter blood flow. Because of changes in skin density and vascularization, pressure ulcer risk is known to rise with ageing. In older or fragile persons, pressure injuries can be a major problem. They might be connected to the standard of care the patient gets. If you remain in bed, are unable to move, are not properly supported, are not given proper nutrition, and are not given proper skin care, pressure injuries may occur. If you have diabetes, circulatory issues, or poor nutrition, your chance of pressure injuries is increased. There are four stages to pressure injuries. Stage 1: The area is heated to the touch and appears red. The area could seem blue or purple on people with darker complexion. You might experience pain, stinging, or itching. Stage 2: The region appears more harmed and may have a blister, open sore, or scrape. The skin around the wound may be discolored, and you are in a great deal of discomfort. Stage 3: The damage beneath the skin's surface has left the area looking like a crater. Stage 4 There is a significant amount of damage and a wound that is quite huge. Affected tissues include bones, joints, muscles, and tendons. At this point, infection is a significant concern. Unusual changes in skin colour or texture are significant indicators of pressure ulcers. Swelling, pus-like drainage, a tender area, and an area of the skin that is colder or warmer to the touch than adjacent locations.

## II.PROBLEM STATEMENT

When there is no movement for a longer period of time, those who are bedridden get pressure ulcers. Patients who develop pressure ulcers experience more agony and ultimately require surgery.

## III.LITERATURE REVIEW

[1] The suggested method is built on a Convolutional Neural Network (CNN) that is optimized for segmenting the various tissue types found in pressure injuries (granulation, slough, and necrotic tissues). The CNN network receives a series of 5x5 sub-images that have had the flash light removed as a result of pre-processing. Every sub-image from the validation set will be categorized into one of the three classes by the network output. The metrics used to assess the method reveal an average precision per class of 97.31% for granulation tissue, 96.59% for necrotic tissue, and 77.90% for slough tissue, with an overall average classification accuracy of 92.01%.

[2] The Adafruit MiCS-5524 MQ2 and MQ3 electronic sensors, Arduino programming techniques, and the integration of materials (microcontroller) were employed in this work. The equipment captures a photograph of a patient who is



immobile and performs an accurate diagnosis of any pressure ulcers, both possible and actual, as well as their symptoms. Alcohol concentration in the wound will be analyzed by the MQ3 sensor using an Arduino UNO. The device must be positioned 5 cm away from the wound, according to the user. The MATLAB programmed would then read the data after it had been sent from the Arduino's USB port to the PC ports. On the other hand, the Flir One thermographic camera and a mobile device (an iOS or an Android device, depending on the model of the camera purchased) should be used by the user (medical/home care staff) to retrieve thermal data. Following that, the wounds were categorized according to their shape, color, and thickness. The end user can interact with the results as they are shown in a MATLAB GUI. This paper utilized a user interface and scored an average of 87.75 %

[3] This study combines infrared thermal imaging and convolutional neural networks to detect and avoid pressure injury while assisting nurses in keeping an eye on patients' skin conditions. The clinical nurses took infrared thermal images in the initial stage and labelled them with the normal group and the pressure injury group. The second stage involved classifying these two groups of the gathered photos using convolutional neural networks, as well as the random forest and support vector machine learning methods. The particular picture dataset, which included 82 infrared thermal images taken a day before to pressure injury, was used to evaluate the classification algorithm, which had been trained on 164 photos. The infrared thermal pictures' texture features were extracted using a grey level co-occurrence matrix, and we used the Chi square test and Pearson's correlation coefficient to pick the features. The suggested convolutional neural networks model had a 95.2% classification accuracy.

[4] The objective of this study is to create a system for the automatic interpretation of color to aid in the care of PU patients. Red, Yellow, and Black, or RYB, is a color-based classification method for open wounds. It classifies the wound by looking at its variations in red, yellow, or black. Weka (Waikato Environment for Knowledge Analysis) software was employed in this work to mine PU pictures. The following information will be gathered using a PU evaluation form: the total number of ulcers, their color, thickness, size, location, look, odor, and level of pain. The PU will be photographed so that the PU's skin tone can be evaluated. Images must be divided in order to highlight lesions and healthy skin. The k-means algorithm can be used to accomplish this after limiting the number of segments to 2. For classification and decision tree creation, filter J48 will be employed. The precision score makes it possible to assess classification critically.

#### IV.SYSTEM ARCHITECTURE

The objective of this work is to create an automatic segmentation technique for PU RGB-colored images. In addition to the backdrop, the suggested system extracts three different ulcer tissues: granulation (red), necrotic eschar (black), and slough (yellow). The core concept of the suggested system rests on translating multiple models of the original PU pictures into numerous modalities. A multi-pathway CNN network is used in the proposed method to combine five different models and give an accurate tissue segmentation result.

The user is given a list of options to pick from at the outset of the programmed, each of which represents a wound-related symptom. The next step is to construct a dictionary called dict, where each of the options (a to g) is represented by a key and a value that indicates how severe the symptom is. The number of symptoms the user wants to submit is requested from them. To cycle through the number of times the user wants to input symptoms, a loop is employed. The user is prompted to enter a choice (from a to g) throughout each iteration of the loop. The programme then determines the value that corresponds to the option entered in the dictionary and adds it to determine the value of the overall sum. After processing all of the inputs, the programme produces the final score based on the severity of the chosen symptoms. If the total score is greater than or equal to 60, the ulcer wound will be printed; otherwise, it will be printed as not an ulcer wound, and the programme will end. If the wound is an ulcer, the input image is used to segment three different types of wound tissues (necrosis, fibrin, and granulation).

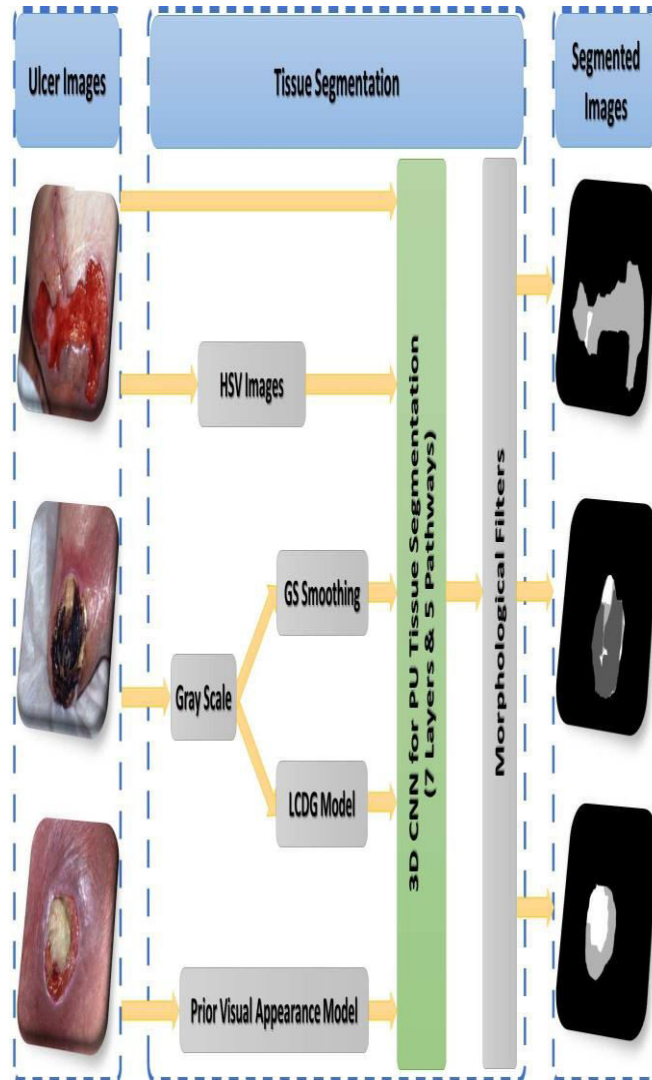


Fig: System Architecture

### V.ALGORITHM

At the start of the programme, the user is offered a list of options to choose from, each of which stands for a symptom associated to a wound. The next stage is to build a dictionary known as dict, where each of the choices (a to g) is represented by a key and a value that denotes how severe the symptom is. The user is asked to report however many symptoms they choose. A loop is used to repeatedly input symptoms as many times as the user desires. In each iteration of the loop, the user is asked to enter a selection ranging from a to g.

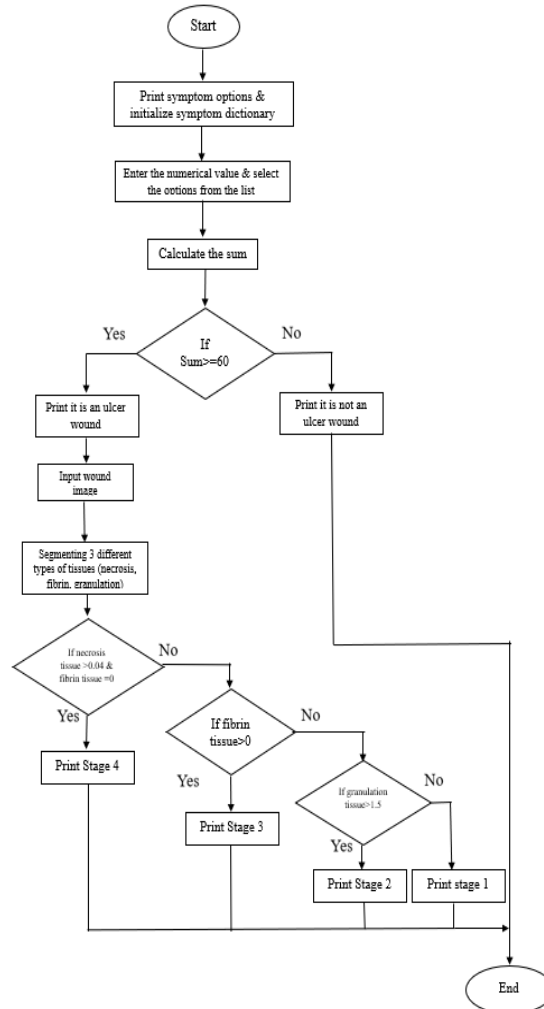


Fig 2 Algorithm for ulcer detection

## VI. TECHNOLOGY USED

### Image Segmentation

Image segmentation is the process of dividing an image into multiple segments, or regions, in order to simplify or change the representation of an image into something more meaningful and easier to analyze. Image segmentation is often used in computer vision applications such as object recognition, image editing, and medical image analysis.

### Jupyter Notebook

Jupyter Notebook is an open-source web application that allows you to create and share documents that contain live code, equations, visualizations, and narrative text. It supports many programming languages, including Python, R, and Julia, among others. The notebooks are interactive and can be used for data cleaning and transformation, numerical simulation, statistical modeling, machine learning, and much more. Jupyter Notebook can be installed locally on your computer or used through cloud-based platforms such as Google Colab or Microsoft Azure. To get started with Jupyter Notebook, you can download it from the official website or use it through one of the cloud-based platforms. Once installed, you can create a new notebook and start experimenting with code and text.



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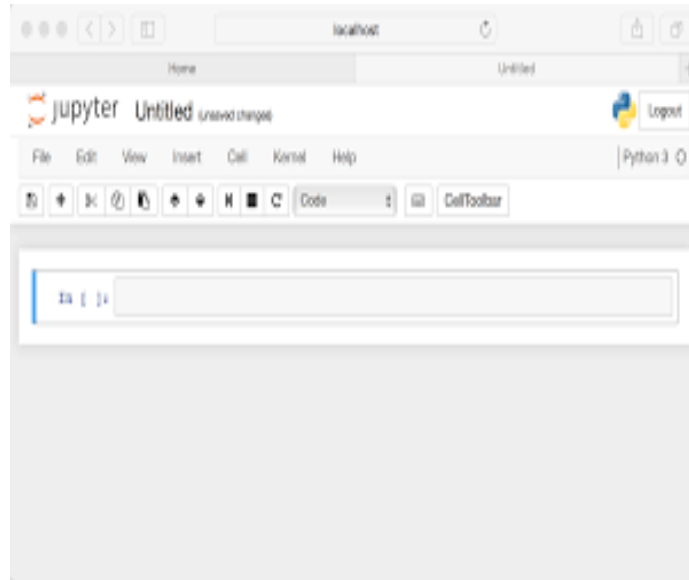
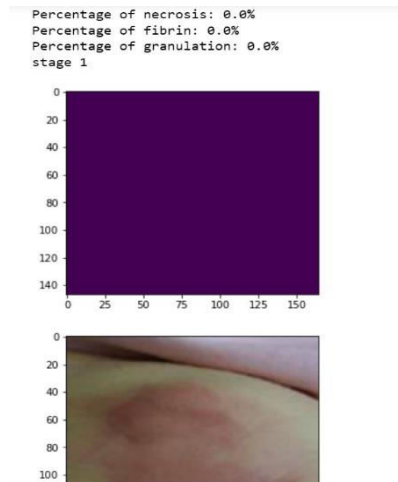


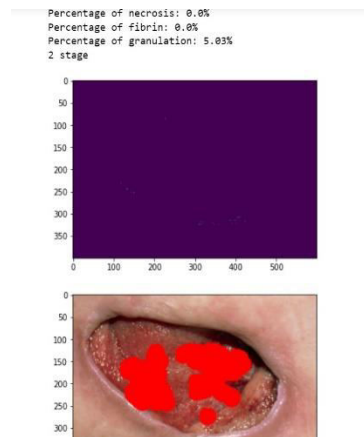
Fig: Jupyter notebook

### VII IMPLEMENTATION AND RESULTS

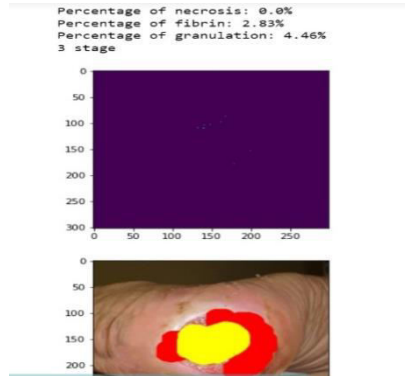
#### Stage 1



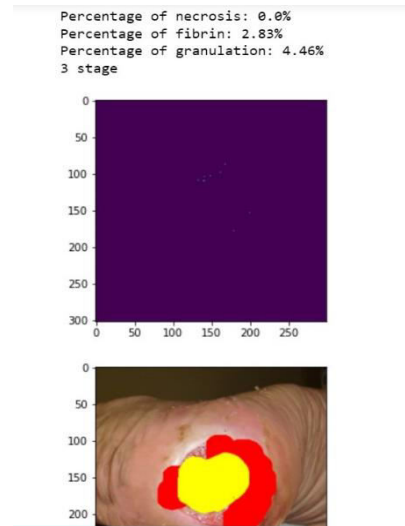
#### Stage 2



### Stage 3



### Stage 4



## VIII.CONCLUSION

In summary, the programme described is made to ask users to choose symptoms connected to a wound, calculate a score based on the seriousness of the symptoms, and label the wound as an ulcer if the sum of the scores is greater than a certain level. The programme may take a photograph of the wound and segment the tissue to classify it into one of four stages if the wound is determined to be an ulcer. The program's functionality and accuracy may vary depending on a number of variables, including the image's quality and the user's selection of the type and severity of the wound's symptoms. Therefore, it is crucial to make sure the programme is carefully designed and tested to provide accurate results.

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