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Skin Disease Detection Using Convolutional Neural Network

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ABSTRACT :

Skin illnesses are one of the most frequent diseases in humans, and their prevalence is on the rise. As a result, early diagnosis is critical. Even expert doctors are unable to categorise skin disorders and their causes, necessitating the use of computer-based skin disease detection to make recommendations to non-specialized users. It is well known that detecting and treating skin diseases early can reduce patient mortality and morbidity. Digital dermoscopy is commonly regarded as one of the most cost-effective methods for diagnosing and classifying skin conditions. As a result, image processing techniques can be used to identify skin cancer. It is a non-invasive way to use image processing for diagnostic purposes. It can be utilized in the medical field to provide quantitative information about a lesion. It's nothing more than an early warning system to help you avoid issues later on in your treatment. The discovery of a lesion at an early stage is a critical and fundamental step. This must be accomplished without the use of any type of injection that penetrates the body. Investigate digital photographs of skin lesions as a simple method. Feature extraction is a critical tool for evaluating and examining an image effectively. To begin, numerous pictures were segmented and their properties were extracted. The suggested approach employs the most fundamental segmentation technique. It does not require human interaction, and no parameter changes are required for different skin lesions. We can look at color-based features, shape-based features, and texture-based features in this study. And also implement deep learning algorithm named as Convolutional neural network algorithm to classify the skin diseases with severity levels with precaution details.

Keywords – photographs , non-invasive

I.INTRODUCTION :

Skin cancers have posed a significant health threat for many years, primarily due to the large number of different types of cancers that make diagnosis challenging. Detecting these cancers often requires laboratory testing, which can be time-consuming and inaccessible for many individuals. To address this, we propose an automated skin cancer classification system that helps individuals identify the type of pigmented lesion on their skin. The goal of this project is to enable people to detect early signs of skin cancer, allowing them to seek appropriate medical attention sooner and assist doctors in making faster and more accurate diagnoses. The most dangerous form of skin cancer is melanoma, which originates from melanocytic cells. Our proposed system is optimized to run efficiently on resource-constrained smartphones, making it highly accessible. The system localizes skin lesions by combining skin detection with hierarchical segmentation using two fast segmentation methods. Early detection of melanoma increases the chances of successful treatment and cure, which is why it is essential to have non-invasive, efficient methods for identifying skin cancer. Unlike traditional methods of detecting skin cancer, which are painful, invasive, and time-consuming, this system works with images of the skin, making it non-invasive. The detection process involves image processing techniques, starting with pre-processing and followed by image segmentation. The affected areas are then isolated from healthy skin using segmentation, which reduces the complexity of the classification process. After segmentation, key features of malignant and benign melanoma lesions are extracted, enabling the system to classify the lesion as either cancerous or non-cancerous. In our approach, we use 2D wavelet transforms for feature extraction, which allows us to extract important characteristics of the skin lesions. These features are then fed into an Artificial Neural Network (ANN) classifier, which makes the final classification. The classification system helps determine whether the skin lesion is benign or malignant, offering an important tool for early detection and timely treatment. The work presented here emphasizes the use of mobile image analysis for the detection of malignant melanoma (MM), a type of skin cancer that arises from pigment-producing cells in the skin. MM is one of the most dangerous types of skin cancer, and its early detection is crucial for improving survival rates. The system aims to provide a cost-effective and accessible method for detecting melanoma at an early stage, using mobile imaging technology, which is convenient and practical for everyday use. Dermoscopy, or epiluminescence microscopy, is a non-invasive skin imaging technique that enhances the visibility of subsurface structures, making it easier to detect melanoma compared to conventional clinical images. This method increases the effectiveness of clinical diagnostic tools by providing new morphological criteria that can distinguish melanoma from other skin lesions. Early detection of melanoma allows for quicker treatment, which significantly improves the chances of a successful cure. Cancerous lesions can either be benign or malignant, with malignant lesions being more aggressive and capable of invading surrounding tissues. Early diagnosis and treatment are critical for improving survival rates, especially for melanoma. The system proposed in this project aims to improve early detection by using deep learning techniques to identify malignant lesions accurately, even in the early stages, when they are smaller and easier to remove. As the demand for dermatological consultations continues to grow globally, the need for automated systems that can assist in the diagnosis of skin cancers becomes more urgent. Melanoma, in particular, poses a significant challenge, as it can appear in many different forms, making it difficult to differentiate from benign lesions. AI-based systems can help reduce the diagnostic burden on healthcare professionals and improve early

detection, ultimately saving lives and reducing healthcare costs. The main objective of this project is to develop a deep learning-based system for the classification of skin cancer, with an emphasis on improving accuracy in detecting and diagnosing skin lesions. The system will also be capable of segmenting the skin lesions from dermoscopic images, extracting relevant features, and classifying them into different categories of skin cancer, including melanoma. By automating the process, the system can assist in making timely and accurate diagnoses, which is crucial for effective treatment. This project aims to make significant strides in the identification and recognition of skin cancers using deep learning algorithms. The use of pre-processing techniques, feature extraction algorithms, and accurate classification models will enhance the effectiveness of the system, providing valuable diagnostic information to users and healthcare professionals alike. This approach offers a practical solution to the growing challenge of skin cancer detection, making it easier to detect and treat skin cancers early, ultimately improving patient outcomes.

II.RELATED WORKS :

Skin cancer has become increasingly dangerous due to its rapid global growth in recent years, prompting the need for automated diagnostic systems. Many methods utilizing machine learning and ensemble learning have been developed to help dermatologists in diagnosing skin lesions early. The primary goal is to use a classifier to distinguish between various types of skin cancer. This work proposes an improved ensemble learning strategy for classifying skin cancer by extracting effective features like shape, color, texture, and skeletal information from skin lesion images. The results of the experiments suggest a promising outcome, with computer-aided diagnosis (CAD) systems aiding dermatologists in providing accurate diagnoses. The rapid rise in cases of malignant melanoma, the deadliest form of skin cancer, has prompted the development of machine learning techniques for skin cancer detection. The difficulty in distinguishing skin cancer from other skin conditions, such as moles and scars, calls for enhanced lesion detection methodologies. This study proposes an approach using feature extraction techniques based on the ABCD rule, GLCM, and HOG to improve accuracy. With SVM, KNN, and Naive Bayes classifiers, the proposed system achieved high classification accuracy and sensitivity, showing great promise in early detection and classification of skin lesions. Skin cancer, particularly melanoma, spreads rapidly and is among the most serious cancers. Early diagnosis is crucial, and machine learning techniques have proven effective in providing accurate predictions. This study proposes using pixel mean values and standard deviations for image contrast enhancement, followed by segmentation with OTSU thresholding. Features such as GLCM for texture identification and HOG for object detection are extracted. Synthetic Minority Over-sampling Technique (SMOTE) is applied to address class imbalance, and feature selection is done using a wrapper method before classification with SVM and Random Forest. This approach achieved high classification accuracy, particularly with Random Forest. Melanoma, the most dangerous form of skin cancer, is often detected through biopsies, a time-consuming and uncomfortable process. This study suggests a computer-aided detection method using image processing and Support Vector Machine (SVM) algorithms to improve melanoma diagnosis. The proposed system utilizes pre-processing, segmentation, and feature extraction techniques, including GLCM, color, and shape. Combining these features and applying them to the SVM classifier yielded an impressive classification accuracy of 83%, demonstrating the potential of machine learning in melanoma detection. With the rise in skin cancer cases globally, early detection of malignant melanoma is critical for improving survival rates. This study explores the use of machine learning techniques to detect and classify skin cancer from dermoscopic images. The process involves pre-processing to remove hair and noise, segmentation using k-means clustering, and feature extraction using ABCD and GLCM methods. The ISIC 2019 Challenge dataset is employed for classification, and results demonstrate high accuracy in identifying various types of skin cancer, emphasizing the importance of machine learning in skin cancer diagnosis. Skin cancer is one of the deadliest cancers, with melanoma being a major threat. Early detection is key to treatment, and this study explores the use of machine learning techniques to diagnose and classify skin cancer. By analyzing dermoscopic images, the study applies pre-processing techniques such as the Dull Razor method to enhance image quality. K-means clustering is used for segmentation, and features like ABCD and GLCM are extracted. The MSVM classifier was used for final classification, achieving high accuracy in detecting different skin cancer types. Skin cancer is a serious threat, and early diagnosis is essential for effective treatment. This study uses machine learning techniques to detect and classify various skin cancers, such as melanoma, basal cell carcinoma, and squamous cell carcinoma. Dermoscopic images are processed and features such as color, texture, and shape are extracted for classification. The study focuses on combining machine learning methods with image processing to accurately identify and categorize skin cancer, offering promising results for early detection. Melanoma, a lethal form of skin cancer, has seen significant increases in incidence globally. Early detection can significantly improve survival rates, and this study proposes a hybrid approach combining traditional machine learning classifiers and convolutional neural networks (CNNs) for melanoma detection. By using a combination of features describing skin lesion borders, texture, and color, the study achieves improved accuracy through majority voting. The hybrid model offers a promising solution for early melanoma detection, which is crucial for reducing mortality rates associated with this aggressive cancer. Deep learning models, particularly Convolutional Neural Networks (CNNs), have become a powerful tool for skin cancer detection. With millions of new skin cancer cases diagnosed every year, CNNs can provide an automated and accurate method for classifying skin cancer. The goal of this project is to develop a CNN model capable of classifying different types of skin cancer, which could assist in early detection and improve patient outcomes. CNNs have shown to provide the most accurate results in visual imaging tasks, making them highly suitable for skin cancer diagnosis. Melanoma is the deadliest form of skin cancer, and early detection significantly improves survival chances. This study explores the use of deep learning techniques, specifically modified VGG16 and InceptionV3 models, to classify melanoma. Compared to other state-of-the-art methods, the proposed approach using modified VGG16 achieved an accuracy of 73.33%. These findings contribute to the development of more effective models for melanoma classification, offering a potential improvement in early diagnosis and treatment of skin cancer.

III.PROPOSED SYSTEM :

We proposed a CNN-based framework for Skin cancer Analysis towards Melanoma Detection We made detailed analysis of the proposed deep learning frameworks in several aspects, e.g. the performances of networks with different depths; the influences caused by adding different components. This work provides useful guidelines for the design of deep learning network in related medical research. In this work, CNN is used as a deep learning framework for the automated detection of malignant melanoma. CNN networks benefit from a range of convolves filters. They will examine different structures in

the input images. Thus, when using CNN, the input is the image itself and also the network automatically extracts the suitable aspects of the image. Our CNN model consists of multiple layers

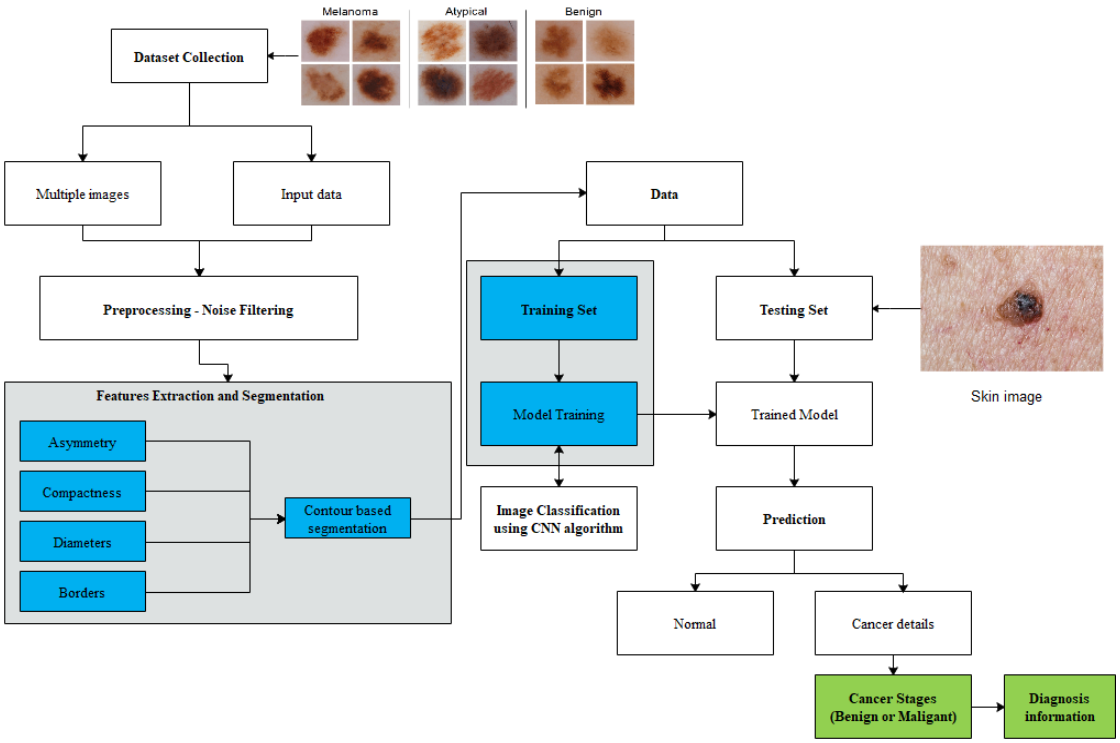

Figure 1: System Architecture of proposed system

IV. MODULES :

Preprocessing in image analysis is crucial to enhance the quality of the data for further processing. The first step involves selecting the image and resizing it to a uniform size (256x256). A key technique used during preprocessing is median filtering, which helps reduce noise, particularly "salt and pepper" noise. This is achieved by sliding a window across the image and replacing each pixel with the median of its neighboring pixels, which preserves edges and eliminates random noise. This step ensures the images are of higher quality before proceeding to more complex analyses, such as feature extraction. Feature extraction simplifies the image data into distinctive features that can be used for classification. In melanoma detection, color histograms and texture features are the primary attributes extracted. The HSV (Hue, Saturation, and Value) color space is used to capture color distribution, which helps in distinguishing skin lesions despite lighting variations. Texture features like homogeneity are also extracted to measure the uniformity of pixel distribution, which is important for distinguishing malignant from benign lesions. These features allow the image to be represented in a more manageable form for classification. Segmentation isolates the skin lesion from the surrounding tissue, focusing the analysis on the area of interest. The Snake Model, a deformable spline, is used to segment the lesion. It works by minimizing an energy function that combines internal forces (which maintain the smoothness of the spline) and external forces (which pull the spline towards the object boundary). This method is particularly effective for capturing the irregular boundaries of melanoma lesions, which can be difficult to detect using traditional methods. The classification process uses the extracted features to categorize the skin lesions as malignant or benign. A Convolutional Neural Network (CNN) is employed for this task, as it excels in image classification. The CNN consists of convolutional layers that apply filters to detect patterns in the image, followed by max-pooling layers that reduce the data dimensions while retaining important features. The network learns from a large set of labeled images, enabling it to distinguish between different types of lesions. This structure allows the CNN to capture complex patterns, improving classification accuracy. The integrated system enhances melanoma detection by combining preprocessing, feature extraction, segmentation, and classification techniques. Median filtering reduces noise, HSV color and texture features enable robust feature extraction, the Snake Model ensures precise segmentation, and the CNN provides accurate classification. This approach improves boundary detection and overall accuracy, providing valuable diagnostic support for dermatologists in the early detection of melanoma.

V.RESULTS AND DISCUSSION :

The system was seen to predict the said diseases with an accuracy of around 94% - 95%. The model loss can be seen decreasing abruptly at first and then gradually towards the end. Accordingly, the accuracy rises abruptly and consolidates towards the end. The epoch was set to 50 after carefully testing for different epoch values.

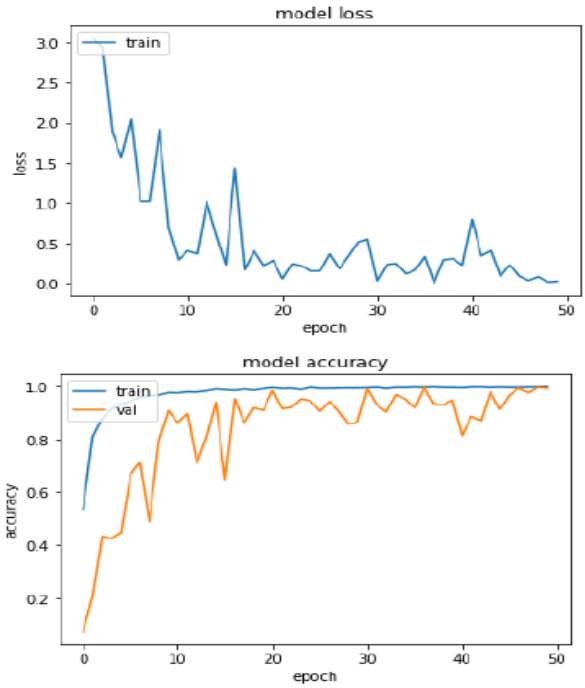

Fig 7.1: Training loss and accuracy

VI.CONCLUSION :

In conclusion, the integrated system effectively enhances melanoma detection through advanced preprocessing, feature extraction, segmentation, and classification techniques. By utilizing median filtering, HSV color and texture features, the Snake Model, and CNN, it improves accuracy and boundary detection. This approach offers a promising tool for early and precise diagnosis of melanoma.

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