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An Interpretable Skin Cancer(Melanoma) Detection using Deep Learning

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Abstract: *Melanoma skin cancer detection at an early stage is crucial for an efficient treatment. Recently, it is well known that, the most dangerous form of skin cancer among the other types of skin cancer is melanoma because it's much more likely to spread to other parts of the body if not diagnosed and treated early. The non-invasive medical computer vision or medical image processing plays increasingly significant role in clinical diagnosis of different diseases. Such techniques provide an automatic image analysis tool for an accurate and fast evaluation of the lesion. The steps involved in this study are collecting dermoscopy image database, preprocessing, segmentation using thresholding, statistical feature extraction using Gray Level Co-occurrence Matrix (GLCM), Asymmetry, Border, Color, Diameter, (ABCD) etc., feature selection using Principal component analysis (PCA), calculating total Dermoscopy Score and then classification using Convocation neural network(CNN). results show that the achieved classification accuracy is 92.1.*

Keywords: Melanoma Skin Cancer, Image Pre-processing, Segmentation, Feature Extraction.

I. INTRODUCTION

Melanoma, one of the most dangerous types of cancer, occurs when melanocytes in the layers of the skin, hair, eyes, and other organs become immune, resulting in a malignant tumor.Melanoma skin cancer detection at an early stage is crucial for an efficient treatment. Recently, it is well known that, the most dangerous form of skin cancer among the other types of skin cancer is melanoma because it's much more likely to spread to other parts of the body if not diagnosed and treated early. The non-invasive medical computer vision or medical image processing plays increasingly significant role in clinical diagnosis of different diseases.,

statistical feature extraction is done using Gray Level Co-occurrence Matrix (GLCM), Asymmetry, Border, Color, Diameter, (ABCD) etc., feature selection using Principal component analysis (PCA), calculating total Dermoscopy Score and then classification using Convocation neural network(CNN). results show that the achieved classification accuracy is 92.1. In the recent 3 decades Melanoma incidence rates have been increasingly high, though most people diagnosed with skin cancer have higher chances to cure, Melanoma survival rates are lower than non-Melanoma skin cancer.

Melanoma skin cancer (MSC) can occur on any skin surface, and its incidence has continued to rise over the past two decades in many regions of the world Melanoma skin cancer (MSC) can occur on any skin surface, and its incidence has continued to rise over the past two decades in many regions of the world. Traditional method for detecting skin cancer is biopsy method

In biopsy method region of skin lesion is scrapped of and sent to laboratory for the testing [8]. This method is invasive, painful and time consuming. Therefore, in order to overcome the above stated problem, computer aided diagnosisused for skin cancer detection. This system requires skin image so there is no physical contact with the body. Thismethod will reduce the pain and makes it non-invasive. Computer aided diagnosis uses image processing tools fordetecting Melanoma Skin Cancer. First step of such diagnosisis to preprocess the skin image which is followed by image segmentation in which lesion part is segmented. Unique features are obtained from segmented lesion by using feature

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extraction technique. After feature extraction, classification isperformed for classifying the skin image as ordinary skin and melanoma skin cancer

[2].identify objects by analyzing the structure of gradients. 'Scale-Invariant Feature Transform (SIFT)' or 'Speeded-Up Robust Features (SURF)': Detect and describe local features inside images. In deep learning, convolutional layers in neural networks handle feature extraction. Model Selection: Traditional ML Approaches: 'Support Vector Machines (SVM)': It is good enough for smaller and well-structured data. Random Forests / Decision Trees: Good for handling tabular or feature-based data. For deep learning: 'Convolutional Neural Networks (CNNs)' are super effective for this. An architecture of CNNs allows them to automatically discover spatial hierarchies of features and, thus, makes them powerful architecture for image classification tasks. 'LeNet' and 'AlexNet' were some of the first really successful, CNN architecture proved to be highly effective for general tasks of image recognition. More modern architecture, such as 'ResNet', VGG, or 'EfficientNet' can arguably yield higher accuracy with larger, deeper networks. Training: Train the selected model using a labelled dataset. You must employ a CNN network. For this task, the network learns relevant features, particularly edges, texture, and shapes. Apply CrossEntropy Loss and Adam or SGD optimizers for effective training. Over fitting would be minimized through Dropout, Batch Normalization, and Data Augmentation techniques while training. Model Evaluation: It's critical to determine the accuracy, precision, recall, and F1-score of our model in order to assess its overall performance. The methods of evaluation are ROC curves and confusion matrices. Model Deployment Deploys the model running in real-time use in vehicles. The model may be deployed with a hardware accelerator such as 'NVIDIA Jetson' to make inference faster. The system will read images or video streams from cameras mounted on the vehicle and classify them into traffic signs in real-time as they occur.

II. RELATED WORK

A literature survey explores various learning techniques employed to extract ontology from data.

[1] Soniya Mane presented "AMethod for Melanoma Skin Cancer Detection Using Dermoscopy Images",The necessity of early diagnosis of the skin cancer have been increased because of the rapid growth rate of Melanoma skin cancer, itś high treatment costs, and death rate. This cancer cells are detected manually and it takes time to cure in most of the cases. This paper proposed an artificial skin cancer detection system using image processing and machine learning method. The features of the affected skin cells are extracted after the segmentation of the dermoscopic images using feature extraction technique. A deep learning based method convolutional neural network classifier is used for the stratification of the extracted features. An accuracy of 89.5% and the training accuracy of 93.7% have been achieved after applying the publicly available data set.

[2] MA. Ahmed Thaajwer presented"Melanoma Skin Cancer Detection Using Image uses Processing and Machine Learning Techniques",Skin cancer is one of the most dangerous forms of cancer. Skin cancer is caused by unrepaired deoxyribonucleic acid (DNA) in skin cells, which generate genetic defects or mutations on the skin. Skin cancer tends to gradually spread over other body parts, so it is more curable in initial stages, which is why it is best detected at early stages. The increasing rate of skin cancer cases, high mortality rate, and expensive medical treatment require that its symptoms be diagnosed early. Considering the seriousness of these issues, researchers have developed various early detection techniques for skin cancer. Lesion parameters such as symmetry, color, size, shape, etc. are used to detect skin cancer and to distinguish benign skin cancer from melanoma. This paper presents a detailed systematic review of deep learning techniques for the early detection of skin cancer. Research papers published in well-reputed journals, relevant to the topic of skin cancer diagnosis, were analyzed. Research findings are presented in tools, graphs, tables, techniques, and frameworks for better understanding..

[3]Minoj Selvarasapresented "A Critical Analysis of Computer Aided Approaches" uses for Skin Cancer Screening",Skin cancer is a type of cancer that grows in the skin tissue, which can cause damage to the surrounding tissue, disability, and even death. In Indonesia, skin cancer is the third leading for most cancer cases after cervical and breast cancer. The accuracy of diagnosis and the early proper treatment can minimize and control the harmful effects of skin cancer. Due to the similar shape of the lesion between skin cancer and benign tumor lesions, physicians consuming muchmore time in diagnosing these lesions. The systemwas developed in thisstudy could identify skin cancer and benign tumor lesions automatically using the Convolutional Neural Network (CNN). The proposed model consists of three hidden layers with an output channel of 16,32, and 64 for each layer respectively. The proposed model uses

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several optimizers such as SGD, RMSprop, Adam, and Nadam with a learning rate of 0.001. Adam optimizer provides the best performance with an accuracy value of 99% in identifying the skin lesions from the ISIC dataset into 4 classes, namely dermatofibroma, nevus pigmentosus, squamous cell carcinoma, and melanoma. The results obtained outperform the performance of the existing skin cancer classification system.

[4]Azadeh Noori Hoshyar Proposed"Review On Automatic Early Skin Cancer Detection" Melanoma is considered as one of the fatal cancer in the world, this form of skin cancer may spread to other parts of the body in case that it has not been diagnosed in an early stage. Thus, the medical field has known a great evolution with the use of automated diagnosis systems that can help doctors and even normal people to determine a certain kind of disease. In this matter, we introduce a hybrid method for melanoma skin cancer detection that can be used to examine any suspicious lesion. Our proposed system rely on the prediction of three different methods: A convolutional neural network and two classical machine learning classifiers trained with a set of features describing the borders, texture and the color of a skin lesion. These methods are then combined to improve their performances using majority voting. The experiments have shown that using the three methods together, gives the highest accuracy level. Index Terms—Melanoma detection, deep learning, classical machine learning, data fusion, majority voting

III. SUMMARY OF RELATED WORK/GAP

A. Key Issues and Insights

Complexity of Deep Learning Models:

Challenge: Deep learning models, especially Convolutional Neural Networks (CNNs), are complex and often behave as "black boxes," making it difficult to understand how they make decisions.

Impact: This lack of transparency can lead to distrust among clinicians, as they may not understand the reasoning behind the model's classification of a skin lesion as benign or malignant.

Lack of Explainability in Medical Contexts:

Challenge: Deep learning models may fail to explain which specific features (e.g., shape, color, texture of lesions) contribute to a diagnosis, which is essential in medical decision-making.

Impact: Clinicians often need to know why a model labeled a lesion as malignant. Without this, the model's diagnosis might be questioned, even if its accuracy is high.

Data Quality and Bias:

Challenge: Skin cancer datasets may not represent diverse populations (e.g., people with different skin tones), leading to biased models that may not generalize well.

Impact: This can lead to inaccurate predictions, especially for underrepresented groups, potentially reducing trust and effectiveness in real-world applications.

Insights

1. Use of Attention Mechanisms:

Insight: Incorporating attention mechanisms (e.g., Grad-CAM) helps highlight regions of the image that the model focused on, allowing clinicians to see the areas that influenced the model's decision

2. Feature Visualization Techniques:

Insight: Techniques such as layer-wise relevance propagation (LRP) and SHAP (SHapley Additive exPlanations) can help visualize which parts of the lesion contribute to classification.

Benefit: By making model decisions interpretable, clinicians can verify if the model's focus aligns with their clinical expertise, which increases trust and utility.

3. Using Simple and Explainable Models for Initial Diagnosis:

Insight: Instead of relying solely on a complex CNN, a hybrid approach using interpretable models (e.g., decision trees or logistic regression) in conjunction with CNNs can enhance interpretability.

Benefit: A simpler model can provide initial insights into feature importance (e.g., color or texture), and then a more complex model can confirm these insights.

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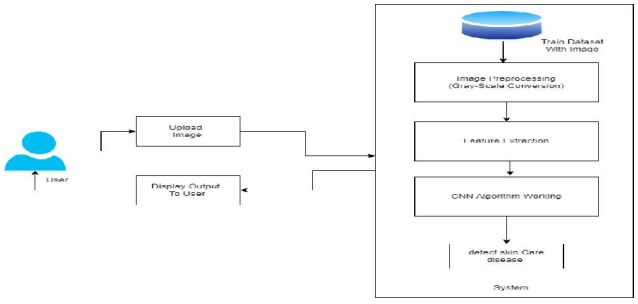
Ref No	Parameter	Algorithm	Limitation and Future work
1	Accuracy Recall Rate	Single Shot MultiBox Detector (SSD) Adaptive Image Enhancement Algorithm	Small Dataset Size Time- Consuming Image Enhancement
2	1) Accuracy	Faster R-CNN MobileNet	1) Small Traffic Signs Detection 2) Specific Shape and Color Dependence
	1)Accuracy 2) performance metrics	Adaptive Image Enhancement Algorithm Single Shot MultiBox Detector (SSD)	Potential Overfitting Image Enhancement Limitations
4	Recall Precision Accuracy	Extended Sparse Representation Classification (ESRC) Tree Detectors with Split-Flow Cascade Design (SFC-Tree Detector) High- Contrast Region Extraction (HCRE)	Limited Generalization Partial Occlusion Handling Computational Complexity

IV. OBSERVATIONS AND FINDING

Diagram: This is the general architecture of the project which states the static flow of every step of diagram.



B. System Flow Diagram Computer based detection of skin cancer contains four steps: image pre-processing, image segmentation, feature extraction and classification. Melanoma affected skin image is 2018 Fourth International Conference on Computing Communication Control and Automation (ICCUBEA) 2018 Fourth International Conference on Computing Communication Control and Automation (ICCUBEA) given as an input to system. This image is pre-

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processed for improving the quality of image. After pre-processing lesion part is segmented from the skin by using image segmentation techniques. Image segmentation is followed by feature extraction which extracts the unique features. After feature extraction, classification is performed for classifying the image as benign lesion and melanoma skin cancer.

1] Image Pre-processing Pre-processing is the initial step in image processing.Input to the system is skin image. This image contains some background noise and unwanted things such as hair and air bubbles. Such objects reduce the result of segmentation and classification. In this system input image is converted into gray colour. For removing hairs Gaussian filter was removed

2] Image Segmentation Region of interest (ROI) is separated from the image is called as image segmentation. This is the second step Skin image contain healthy part as well as lesion part. Taking both part for further processing may give less accurate classification result. Only the lesion part is needed for image analysis so that segmentation is performed. Segmentation is performed using otsu thresholding method which will convert binary image. After Otsu thresholding, edges of the output image become irregular. Morphological filter is applied for smoothing the edges

3]Feature Extraction Feature extraction is the method of calculating the unique features from the image. These features will represent the properties of input image. This step is very important. Melanoma skin image have color variation where benign lesion have uniform color. Another difference is Benign lesion have circular shape where melanoma have irregular shape. So in this system color, perimeter, area, irregularity and texture feature will be extracted from the skin image

4] Classification Classification of data is one of the most frequent decision making tasks performed by human In this step classifier classifies the melanoma lesion from benign lesion. So selection of the classifier is an important step. Performing classification of melanoma from benign lesion .In this we use CNN algorithm for classification.

V. RESULTS

In this approach original colour skin image is selected from the dataset. Selected original colour skin image is converted into gray colour image. Skin image contains some hairs which will degrade the accuracy of classification. So hair removal is required. Hair removal is done by using Gaussian filter. This hair removed image Hair removed image contains lesion part along with healthy part. Only the lesion part is needed for image analysis so that segmentation is performed which is performed and gets detected.

VI. CONCLUSION

In this project, different phases of image processing were applied on skin Nodules. From these different image processing techniques, the fuzzy filter will provide the efficient de noising. Segmentation done by marker based watershed algorithm, gives various region of image. GLCM is used to extract the different features of image and which takes less time for generating the result. This results are passed through CNN Classifier, which classifies the nodules as benign or malignant. CNN classifier provides 92.5 percentage accuracy.

REFERENCES

[1] SantoshAchakanalli G. Sadashivappa ," Statistical Analysis Of Skin Cancer Image –A Case Study " , International Journal of Electronics and Communication Engineering (IJECE), Vol. 3, Issue 3, May 2014.

[2] "Digital image processing" by jayaraman. Page 244,254-247,270-273. (gray level, median filter).

[3]Algorithm For Image Processing And Computer Vision .Page 142-145.(Thresholding)

[4] Kawsar Ahmed, TasnubaJesmin, "Early Prevention and Detection of Skin Cancer Risk using Data Mining", International Journal of Computer Applications, Volume 62– No.4, January 2013.

[5]M.Chaithanya Krishna, S.Ranganayakulu, "Skin Cancer Detection and Feature Extraction through Clustering Technique", International Journal of Innovative Research in Computer and Communication Engineering, Vol. 4, Issue 3, March 2016