



International Journal of Advanced Research in Education and Technology (IJARETY)

Volume 13, Issue 3, May - June 2026

Impact Factor: 9.971



Automated Melanoma Detection using Deep Learning and Convolutional Neural Networks

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ABSTRACT: Skin cancer is a typical common cancer. Melanoma, also known as malignant melanoma, is the most lethal form of skin cancer and responsible for 75% of skin cancer deaths, despite being the least common skin cancer. The best way to combat that is trying to identify it as early as possible and treat it with minor surgery. In this paper, I systematically study melanoma and notice that using deeper, wider and higher resolution convolutional neural networks can obtain better performance. Based on these observations, I propose an automated melanoma detection model by analysis of skin lesion images using VGG16 architecture, which can capture more fine-grained features. The experimental evaluations on a large publicly available dataset, which is generated by the International Skin Imaging Collaboration and images of it are from several primary medical sources, have demonstrated state-of-the-art classification performance.

KEYWORDS: Melanoma Detection, Deep Learning, CNN, VGG16, Efficient-Net, Skin Cancer, Transfer Learning, Image Classification

I. INTRODUCTION

Skin cancer is one of the most common and dangerous diseases worldwide. Among various types of skin cancers, melanoma is considered the most lethal because of its rapid spread to other body parts if not detected early. Early diagnosis significantly increases the survival rate of patients.

Recent advancements in Artificial Intelligence and Deep Learning have enabled automated disease detection systems using medical imaging. Convolutional Neural Networks (CNNs) have shown remarkable performance in image classification tasks due to their ability to automatically extract meaningful features from images.

This paper proposes an automated melanoma detection system using Deep Learning techniques. The model analyses dermoscopic images and classifies them as benign or malignant. Transfer learning techniques using VGG16 and Efficient-Net architectures are applied to improve classification performance and reduce training complexity.

II. LITERATURE SURVEY

Several researchers have contributed to the field of melanoma detection using deep learning techniques.

Hu Z, Tang J, and Wang Z. (2018) presented a survey on deep learning techniques for cancer detection and diagnosis using architectures such as CNNs, fully convolutional networks, auto-encoders, and deep belief networks.

Pomponiu V, Nejati H, and Cheung N M. (2016) proposed a pretrained deep neural network model for skin mole lesion classification and achieved better performance compared to traditional handcrafted feature methods.

Esteva A, Kuprel B, and Novoa R A. (2017) developed a CNN-based skin cancer classification system trained on a large dataset of clinical images and achieved dermatologist-level accuracy in melanoma detection.

Mahbod A, Schaefer G, and Wang C. (2019) introduced a hybrid deep learning approach using AlexNet, VGG16, and ResNet-18 models for accurate skin lesion classification and melanoma detection.

Masood A, Al-Jumaily A, and Anam K. (2015) proposed a self-supervised learning model for melanoma diagnosis using semi-supervised deep learning techniques to improve classification accuracy with limited labeled data

III. METHODOLOGY

The proposed system uses deep learning techniques for automated melanoma detection using dermoscopic skin images. The dataset is collected from ISIC and Kaggle sources containing benign and malignant skin lesion images. The collected images are resized to 224×224 dimensions and preprocessed for better feature extraction.

In the next stage, the dataset is divided into training and testing sets. Transfer learning is applied using pretrained VGG16 and EfficientNet convolutional neural network architectures. These models extract important image features automatically and classify the skin lesions into melanoma or non-melanoma categories.

The model is trained using TensorFlow and Keras libraries with CNN layers, ReLU activation, and Softmax classifier. Performance analysis is carried out using accuracy and loss graphs. Experimental results show that the proposed model achieves high accuracy and improves melanoma detection efficiency compared to traditional machine learning methods.

IV. RESULTS

The proposed melanoma detection system successfully classified skin lesion images into benign and malignant categories with high accuracy. The CNN-based VGG16 and EfficientNet models showed improved feature extraction and better classification performance. Accuracy and loss graphs demonstrated stable training and reduced prediction errors during testing. The obtained results indicate that the proposed deep learning model can effectively support early skin cancer detection.

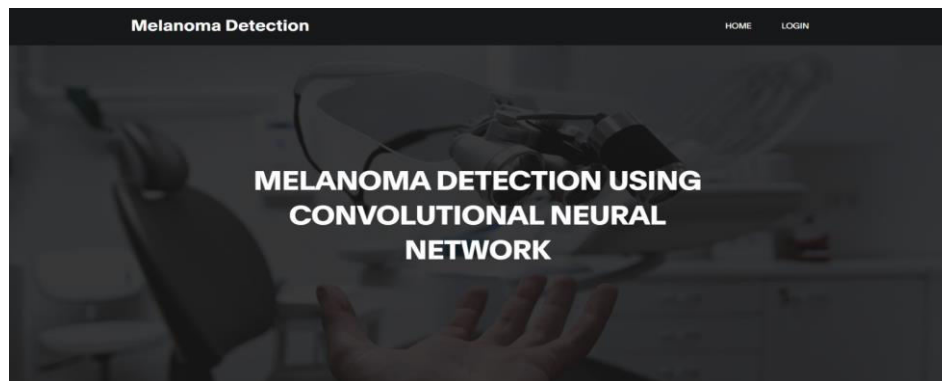


Fig Name: Home page

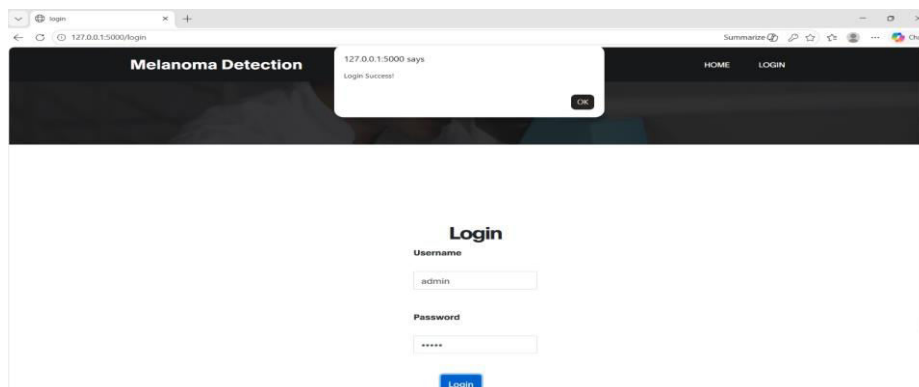


Fig Name: Admin Login Page

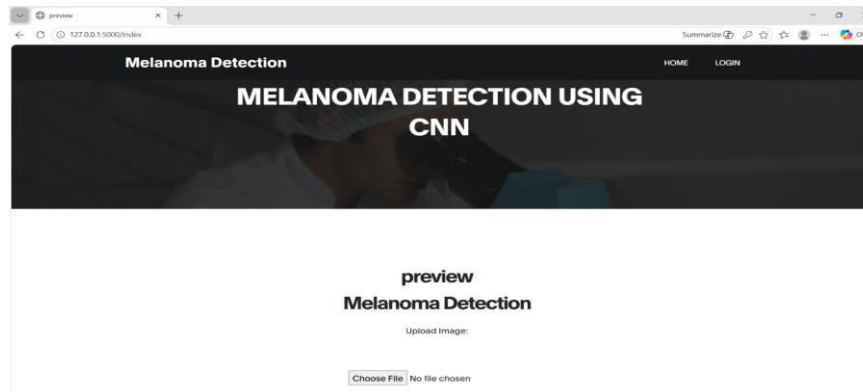


Fig Name: Disease Image Upload Page

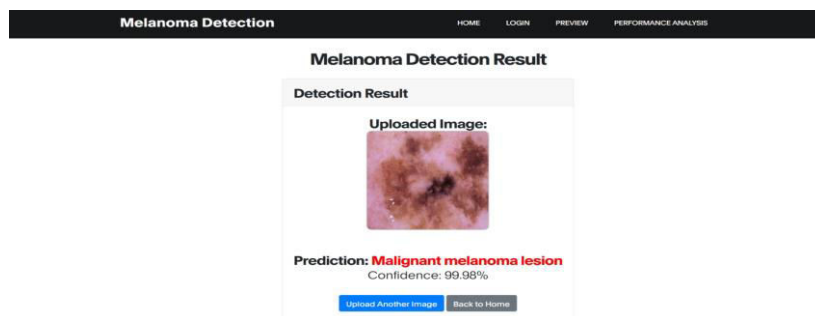


Fig Name: Prediction Page

V. CONCLUSION

This paper presents an automated melanoma detection system using Deep Learning and CNN architectures. The proposed model effectively classifies skin lesion images and achieves high accuracy using transfer learning techniques. The system can support dermatologists in early skin cancer diagnosis and improve healthcare assistance through AI-powered medical imaging systems.

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International Journal of Advanced Research in Education and Technology

ISSN: 2394-2975

Impact Factor: 9.971