# SKIN CANCER DETECTION USING DEEP LEARNING

[1]Pasupuleti Divya Naga Lakshmi, [2]K. Sarada
[1]M. Tech Student, Department of CSE, Prakasam Engineering College (Autonomous), Kandukur, India
[2]Associate Professor, Department of CSE, Prakasam Engineering College (Autonomous), Kandukur, India

***ABSTRACT-*** ***Skin cancer is one of the most common and potentially life-threatening diseases, and early detection plays a significant role in improving treatment outcomes. Conventional diagnostic approaches primarily depend on visual examination by dermatologists, which may be time-consuming and subject to variations in clinical expertise. This paper presents a deep learning-based skin cancer detection framework using Dense Convolutional Network (DenseNet) and VGG-19 Convolutional Neural Network (CNN) architectures. The proposed system analyzes skin lesion images and classifies them into five categories: melanoma, basal cell carcinoma, squamous cell carcinoma, Merkel cell carcinoma, and healthy skin. The framework utilizes transfer learning to improve feature extraction and classification performance. DenseNet enables effective feature reuse through dense connectivity, whereas VGG-19 extracts hierarchical visual representations from lesion images. The system evaluates model performance using accuracy, precision, recall, sensitivity, and specificity. The combined application of these architectures aims to improve classification reliability and support early identification of suspicious skin lesions. The framework is intended to assist healthcare professionals in preliminary skin cancer screening and clinical decision-making.***

***KEYWORDS: -*** ***Skin Cancer Detection, Deep Learning, DenseNet, VGG-19, Convolutional Neural Network, Medical Image Classification, Transfer Learning.***

## INTRODUCTION

Skin cancer is a major healthcare concern affecting individuals worldwide. It develops due to abnormal growth of skin cells and may become life-threatening when not identified at an early stage. Melanoma, basal cell carcinoma, squamous cell carcinoma, and Merkel cell carcinoma are important types of skin cancer that require accurate identification and timely treatment.

Traditional skin cancer diagnosis generally depends on clinical examination and dermatological expertise. However, manual examination can be time-consuming and may result in inconsistent interpretations due to variations in lesion appearance, color, texture, and shape. The increasing number of skin cancer cases creates a need for automated and reliable diagnostic assistance systems. Recent developments in Artificial Intelligence (AI) and deep learning have introduced effective approaches for medical image classification. Convolutional Neural Networks (CNNs) are particularly useful because they automatically extract relevant features from images without requiring extensive handcrafted feature engineering.

This work utilizes DenseNet and VGG-19 architectures to classify different categories of skin lesions. DenseNet improves information flow and feature reuse through dense connections between layers, while VGG-19 captures detailed hierarchical image patterns through its deep convolutional structure.

ISSN: 3049-0952
www.jsetms.com

The proposed framework uses transfer learning and model evaluation techniques to improve classification reliability. It aims to provide an automated image-based screening approach that assists healthcare professionals in identifying potentially abnormal skin lesions.

## RELATED WORK

Previous research on skin cancer detection has explored traditional machine learning techniques and advanced deep learning architectures. Traditional approaches generally depend on manually extracted image features, followed by classification using algorithms such as Support Vector Machines and Random Forests.

With the development of deep learning, CNN-based approaches have become widely used for medical image analysis. Researchers have investigated architectures such as VGG, ResNet, and DenseNet for identifying different skin lesion categories.

Transfer learning has also been explored to improve classification performance by utilizing pretrained neural network models. These approaches reduce the requirement for training complex architectures entirely from scratch. DenseNet is particularly useful for feature reuse and improved gradient propagation, whereas VGG-19 provides hierarchical feature extraction through multiple convolutional layers. Although existing approaches demonstrate the potential of deep learning, challenges remain in handling variations in skin lesion images, dataset diversity, computational requirements, and classification reliability.

The proposed project explores DenseNet and VGG-19 architectures for multiclass skin cancer classification and comparative performance evaluation.

## LITERATURE SURVEY

The development of automated skin cancer detection has gained significant attention through machine learning and deep learning techniques. Existing studies have explored CNN-based approaches for analyzing dermoscopic images and identifying different skin lesion categories. Wu et al. [1] reviewed deep learning techniques for skin cancer classification and highlighted their importance in medical image analysis. Dildar et al. [2] discussed various deep learning methods for improving skin cancer detection. Naqvi et al. [3] reviewed recent advancements in deep learning-based skin cancer diagnosis. Gururaj et al. [4] investigated deep learning approaches for automated skin cancer classification. Mahbod et al. [5] explored hybrid deep neural networks for skin lesion classification. Ashraf et al. [6] demonstrated the application of transfer learning for skin cancer detection. Existing research indicates that CNN architectures can automatically extract important image features and improve classification capabilities. However, challenges such as image quality variations, dataset imbalance, and classification reliability remain. Therefore, this project utilizes DenseNet and VGG-19 architectures for multiclass skin cancer detection and comparative performance evaluation.

## EXISTING METHOD

Existing skin cancer detection methods mainly involve manual examination by dermatologists and traditional machine learning techniques. These approaches analyze skin lesion images to identify abnormalities and determine whether a lesion is benign or malignant.

Traditional machine learning algorithms, such as Support Vector Machines (SVM) and Random Forests, generally depend on

ISSN: 3049-0952
www.jsetms.com

handcrafted features extracted from images. Their classification performance depends on the quality of the selected features.

Deep learning approaches use CNN architectures to automatically extract visual features, including color, texture, shape, and structural patterns. However, these models may require large labeled datasets and significant computational resources.

## PROPOSED METHOD

The proposed method focuses on developing an efficient skin cancer detection system using advanced deep learning techniques, particularly DenseNet and VGG-19. Initially, dermoscopic skin images are collected and preprocessed through resizing, normalization, noise removal, and image enhancement to improve image quality. Data augmentation techniques such as rotation, flipping, and scaling are applied to increase dataset diversity and improve model performance. The preprocessed images are then passed to DenseNet and VGG-19 models for automatic feature extraction and classification. DenseNet improves feature reuse and gradient propagation through its dense connectivity, while VGG-19 extracts detailed visual features such as lesion color, texture, shape, and structure. Transfer learning using pretrained weights helps reduce training time and improve learning efficiency. Both models are trained to classify images into five categories: melanoma, basal cell carcinoma, squamous cell carcinoma, Merkel cell carcinoma, and healthy skin. Their performance is evaluated using accuracy, precision, recall, and F1-score. Model score fusion combines the strengths of both architectures to improve prediction reliability. Finally, the system predicts the category of a given skin image and displays the result, helping support early detection and clinical decision-making.

## SYSTEM ARCHITECTURE

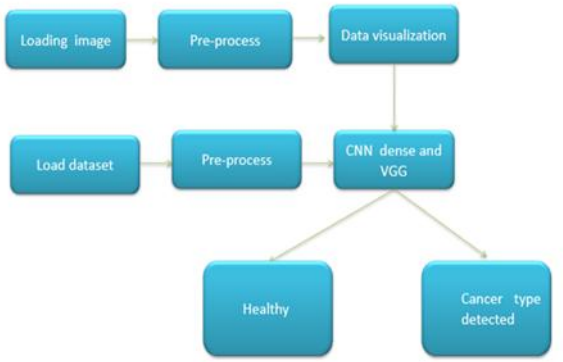


**Figure 1: System Architecture of the Proposed Skin Cancer Detection Model**

## METHODOLOGY DESCRIPTION

Data Collection Module: The data collection module is the first stage of the proposed skin cancer detection system. In this module, dermoscopic skin images are collected from labeled datasets for training and testing the deep learning models. The dataset contains five categories: melanoma, basal cell carcinoma, squamous cell carcinoma, Merkel cell carcinoma, and healthy skin. Each image is organized according to its respective category to ensure proper classification. The collected images provide the necessary input for training DenseNet and VGG-19 models to identify different skin lesion patterns. A diverse set of images helps the system learn important visual features and improve its ability to classify new skin images accurately.

## RESULTS AND DISCUSSION

The proposed skin cancer detection system uses advanced deep learning models, DenseNet and VGG-19, to classify dermoscopic images into five categories: melanoma, basal cell carcinoma, squamous cell carcinoma, Merkel cell carcinoma, and healthy skin. The system processes the input images through preprocessing techniques such as resizing, normalization, and noise removal to improve image quality.

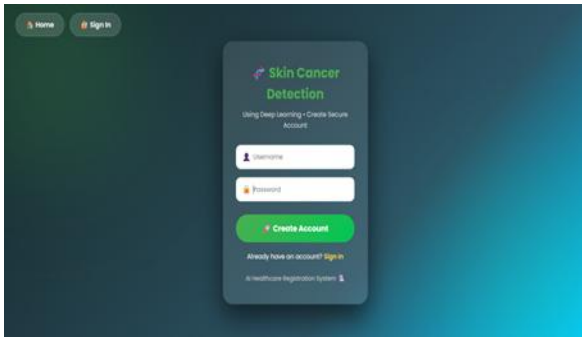


**Figure 2: User Registration Page.**

The registration page allows new users to create an account by entering their username and password to access the skin cancer detection system.

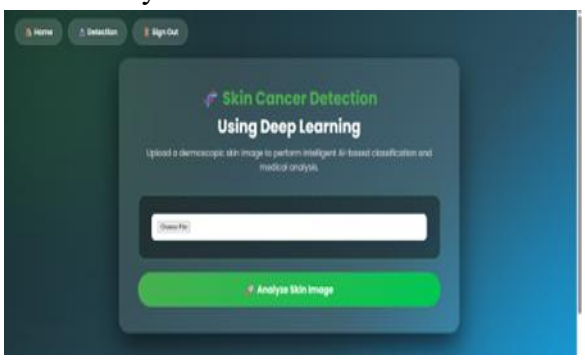


**Figure 3: Home Page of Skin Cancer Detection System.**

The interface displays the Skin Cancer Detection system with options to upload a dermoscopic image and analyze it using deep learning models

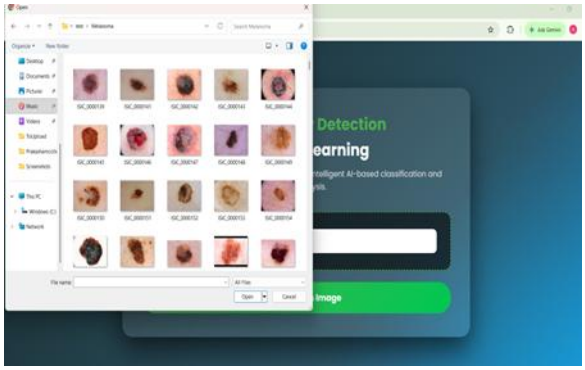

**Figure 4: Uploading Skin Images for Detection.**

The user selects a skin lesion image from the dataset using the file upload option. The selected image is uploaded to the system for skin cancer detection using deep learning models.

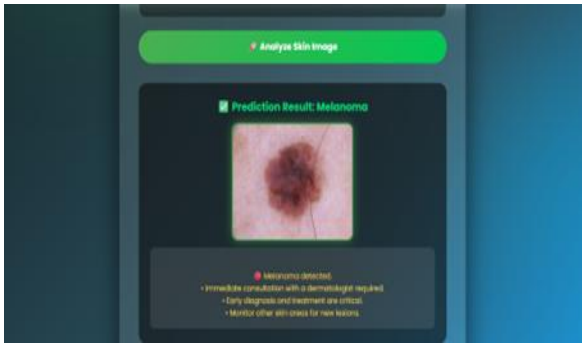


**Figure 5: User Interface for Skin Cancer Detection Using Deep Learning.**

The system allows users to upload a skin image, analyze it using DenseNet and VGG-19, and view the predicted result.

extract important features from the images and generate classification results. The performance is evaluated using metrics such as accuracy, precision, recall, F1-score, and confusion matrix analysis. Testing results described in the project indicate that the system can identify different skin cancer categories and distinguish healthy skin from cancerous lesions. The testing process also evaluates image preprocessing, data augmentation, prediction speed, and system stability. Overall, the results demonstrate the potential of DenseNet and VGG-19 for automated skin cancer classification and show how the system can support early detection and assist healthcare professionals in preliminary assessment.

## CONCLUSION

This project demonstrates the effectiveness of deep learning techniques for automated skin cancer detection and classification. The proposed system uses advanced CNN architectures, DenseNet and VGG-19, to analyze dermoscopic images and identify five categories: melanoma, basal cell carcinoma, squamous cell carcinoma, Merkel cell carcinoma, and healthy skin. The models automatically extract important features from images and reduce the dependency on manual feature extraction. Transfer learning helps improve the learning process, while data

ISSN: 3049-0952
www.jsetms.com

augmentation supports better model generalization. The system provides a reliable approach for distinguishing between different skin cancer types and healthy skin. Overall, this project highlights the potential of deep learning in improving skin cancer classification, supporting early detection, and assisting healthcare professionals in clinical decision-making. The system is designed as a supportive tool and does not replace professional medical diagnosis.

## FUTURE SCOPE

The proposed skin cancer detection system can be further improved by incorporating larger and more diverse skin image datasets to enhance classification accuracy and generalization. Advanced deep learning architectures and hybrid models can be explored to improve feature extraction and prediction performance. Attention mechanisms can be introduced to help the system focus on important regions of skin lesions. Future development can include real-time image acquisition and faster prediction capabilities. The system can also be extended to identify additional skin diseases and integrate clinical information for better analysis. Ensemble learning techniques can be further explored to combine predictions from multiple models and improve reliability. Additionally, the system can be developed as a user-friendly web or mobile application to make it more accessible. These improvements can help create a more efficient skin cancer classification system that supports healthcare professionals in early detection and decision-making.

## REFERENCES

1. A. Esteva, B. Kuprel, R. A. Novoa, J. Ko, S. M. Swetter, H. M. Blau, and S. Thrun, “Dermatologist-Level Classification of Skin Cancer with Deep Neural Networks,” Nature, vol. 542, pp. 115–118, 2017. DOI: 10.1038/nature21056.

2. M. Dildar et al., “Skin Cancer Detection: A Review Using Deep Learning Techniques,” International Journal of Environmental Research and Public Health, vol. 18, no. 10, p. 5479, 2021. DOI: 10.3390/ijerph18105479.

3. M. Naqvi, S. Q. Gilani, T. Syed, O. Marques, and H.-C. Kim, “Skin Cancer Detection Using Deep Learning—A Review,” Diagnostics, vol. 13, no. 11, p. 1911, 2023. DOI: 10.3390/diagnostics13111911.

4. Y. Wu, B. Chen, A. Zeng, D. Pan, R. Wang, and S. Zhao, “Skin Cancer Classification With Deep Learning: A Systematic Review,” Frontiers in Oncology, vol. 12, 2022. DOI: 10.3389/fonc.2022.893972.

5. P. Tschandl, C. Rosendahl, and H. Kittler, “The HAM10000 Dataset, a Large Collection of Multi-Source Dermatoscopic Images of Common Pigmented Skin Lesions,” Scientific Data, vol. 5, p. 180161, 2018. DOI: 10.1038/sdata.2018.161.

6. N. C. F. Codella et al., “Skin Lesion Analysis Toward Melanoma Detection: A Challenge at the 2017 International Symposium on Biomedical Imaging,” 2017. arXiv:1710.05006.

7. N. C. F. Codella et al., “Skin Lesion Analysis Toward Melanoma Detection 2018: A Challenge Hosted by the International Skin Imaging Collaboration (ISIC),” 2018. arXiv:1902.03368.

8. K. Simonyan and A. Zisserman, “Very Deep Convolutional Networks for Large-Scale Image Recognition,” in International Conference on Learning Representations (ICLR), 2015.

9. G. Huang, Z. Liu, L. van der Maaten, and K. Q. Weinberger, “Densely Connected Conolutional Networks,” in Proceedings of

the IEEE Conference on Computer Vision and Pattern Recognition (CVPR), 2017, pp. 4700–4708. DOI: 10.1109/CVPR.2017.243.
10. A. Krizhevsky, I. Sutskever, and G. E. Hinton, "ImageNet Classification with Deep Convolutional Neural Networks," in Advances in Neural Information Processing Systems, 2012.
11. K. He, X. Zhang, S. Ren, and J. Sun, "Deep Residual Learning for Image Recognition," in Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition (CVPR), 2016, pp. 770–778.
12. O. Russakovsky et al., "ImageNet Large Scale Visual Recognition Challenge," International Journal of Computer Vision, vol. 115, pp. 211–252, 2015.
13. A. Mahbod, G. Schaefer, C. Wang, R. Ecker, and I. Ellinger, "Skin Lesion Classification Using Hybrid Deep Neural Networks," in IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), 2019, pp. 1229–1233. DOI: 10.1109/ICASSP.2019.8683352.
14. T. J. Brinker et al., "Deep Neural Networks Are Superior to Dermatologists in Melanoma Image Classification," European Journal of Cancer, vol. 119, pp. 11–17, 2019. DOI: 10.1016/j.ejca.2019.05.023.
15. T. J. Brinker et al., "Deep Learning Outperformed 136 of 157 Dermatologists in a Head-to-Head Dermoscopic Melanoma Image Classification Task," European Journal of Cancer, vol. 113, pp. 47–54, 2019. DOI: 10.1016/j.ejca.2019.04.001.