IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

Impact Factor 8.066 ⁑ Peer-reviewed & Refereed journal ⁑ Vol. 11, Issue 4, April 2024

DOI: 10.17148/IARJSET.2024.11479

AI Based Skin Cancer Detection: Revolutionizing Early Diagnosis

Dr. Vishwesh J[1], Pranathi C S[2], Shreya Bopaiah[3], Sona V[4], Soundarya R[5]

Associate Professor, Department of CSE, GSSS Institute of Engineering & Technology for Women, Mysuru,India[1]

Student, Department of CSE, GSSS Institute of Engineering & Technology for Women, Mysuru, India[2-5]

Abstract: Skin cancer is a prevalent and potentially life-threatening disease, making early detection crucial for effective treatment. In this study, we address the challenge of skin cancer detection using machine learning techniques. Leveraging a dataset of dermatoscopic images from the International Skin Imaging Collaboration (ISIC), we employ convolutional neural networks (CNNs) to classify images into malignant and benign lesions. Our approach involves preprocessing, model building, and evaluation to assess the model's performance in detecting skin cancer. We explore various architectures, including standard CNNs and augmented data models, to improve classification accuracy and mitigate the effects of class imbalance. Through experimentation and evaluation, we demonstrate the effectiveness of our methodology in achieving high accuracy in skin cancer detection. Furthermore, we analyze the model's performance, identify areas for improvement, and discuss the implications of our findings for future research and clinical applications in dermatology. Overall, our study contributes to the ongoing efforts in leveraging machine learning for enhancing skin cancer diagnosis and improving patient outcomes.

Keywords: skin cancer detection, machine learning, CNN, dermatoscopic images, ISIC dataset, classification, model evaluation, data augmentation, class imbalance, clinical applications.

I. INTRODUCTION

Skin cancer is a significant public health concern, with melanoma being the deadliest form of skin cancer. Early detection and diagnosis are crucial for improving patient outcomes and reducing mortality rates. Traditional methods of skin cancer diagnosis rely on visual inspection by dermatologists, which can be time-consuming and prone to human error. With the advancement of deep learning techniques, automated skin cancer classification systems have emerged as promising tools for detecting skin cancer. We utilized the ISIC dataset, which consists of high-resolution images of skin lesions categorized into various classes, including melanoma, basal cell carcinoma, and benign nevi. We implemented several deep learning architectures, including convolutional neural networks (CNNs), to build skin cancer classification models. We experimented with different data augmentation techniques, such as random flipping, rotation, and zooming, to enhance the model's generalization ability. Additionally, we employed optimization techniques like Adam optimizer and early stopping to improve training efficiency and prevent overfitting.
The rest of this paper is organized as follows: Chapter 2 presents the related work. Chapter 3 presents the proposed work. Chapter4 presents module description. Chapter 5 presents the experimental results for Skin Cancer Detection.Chapter 6 presents the conclusion.

II. RELATED WORK

Skin Cancer Prediction Using Deep Learning Techniques by R Raja Sekar, Y Jagan Mohan, K Nani, C Sai Pratap Reddy, K Chiranjeevi , K Vikram : The paper "Skin Cancer Prediction Using Deep Learning Techniques" addresses the critical challenge of early skin cancer detection through deep learning methods. Leveraging convolutional neural networks (CNNs), the study proposes an innovative approach to analyze images of skin lesions, aiming to improve diagnostic accuracy. Utilizing datasets likely sourced from repositories like the ISIC dataset, the authors train and validate their CNN model, emphasizing the diverse range of skin lesion types included. Results demonstrate the efficacy of the proposed model in accurately predicting skin cancer from images, showcasing its potential for clinical application. Through insightful discussion, the paper underscores the significance of these findings for advancing medical image analysis and underscores the need for further research to refine and extend these methodologies.

Dermatologist-level classification of skin cancer with deep convolutional neural network by Esteva et.al : The paper "Dermatologist-level classification of skin cancer with deep convolutional neural network" by Esteva et al. introduces a groundbreaking deep learning approach for skin cancer classification, aiming to match the diagnostic accuracy of dermatologists. By leveraging a substantial dataset of skin lesion images, the authors train a deep convolutional neural network (CNN) architecture designed to automatically extract discriminative features from the images. Through rigorous

DOI: 10.17148/IARJSET.2024.11479

evaluation, the CNN model achieves remarkable accuracy and area under the receiver operating characteristic curve (AUC-ROC) scores, demonstrating its potential for clinical application. However, the study may have certain shortcomings, such as limited interpretability of the CNN model's decision-making process, potential biases in the dataset used for training, and challenges in generalizing the model's performance across diverse patient populations and clinical settings. Additionally, the reliance on static images may overlook dynamic aspects of skin lesions, such as changes over time, which could impact diagnostic accuracy in real-world scenarios. Despite these limitations, Esteva et al.'s work represents a significant advancement in skin cancer diagnosis, highlighting the transformative potential of deep learning techniques in dermatology [1].

An Interpretable Skin Cancer Classification Using Optimized Convolutional Neural Network for a Smart Healthcare System by Krishna M, Md. Mezbah U, Jungpil Shin, Susan K, M.F. Mridha :
The paper introduces an interpretable approach to skin cancer classification using an optimized convolutional neural network (CNN) tailored for smart healthcare systems. Recognizing the importance of model interpretability in clinical decision-making, the authors propose a CNN architecture optimized for both accuracy and explainability. Leveraging a comprehensive dataset of skin lesion images, the proposed model aims to provide insights into its decision-making process, enhancing trust and facilitating collaboration between healthcare professionals and AI systems. Through rigorous experimentation and evaluation, the authors demonstrate the effectiveness of their approach in achieving high classification accuracy while maintaining interpretability. However, potential limitations of the study may include challenges in generalizing the model's performance across diverse patient populations and clinical settings, as well as the need for further validation in real-world healthcare environments. Despite these considerations, Krishna M et al.'s work represents a significant contribution to the development of interpretable AI systems for skin cancer diagnosis, offering promise for integration into smart healthcare systems to improve patient care.

A deep neural network using modified EfficientNet for skin cancer detection in dermoscopic images by Vipin V, Navin Infant R, Malaya K, Norton S : This paper introduces a novel approach to skin cancer detection using a modified EfficientNet architecture tailored for dermoscopic images. Dermoscopic images provide high-resolution views of skin lesions, posing unique challenges and opportunities for accurate diagnosis. The authors propose modifications to the state-of-the-art EfficientNet architecture to enhance its performance in analyzing dermoscopic images, leveraging features such as attention mechanisms, skip connections, or customized layers. Through extensive experimentation and evaluation on a dataset of dermoscopic images, the proposed deep neural network demonstrates promising results in skin cancer detection, achieving high accuracy and robustness across various lesion types and conditions. The study contributes to advancing the field of computer-aided diagnosis in dermatology, offering a scalable and efficient solution for early detection and diagnosis of skin cancer in clinical practice. However, further validation and clinical testing may be necessary to assess the model's performance in real-world healthcare settings and ensure its effectiveness in improving patient outcomes.

III. PROPOSED SYSTEM

The proposed system employs a deep learning model, specifically a convolutional neural network (CNN), to classify skin cancer using dermoscopic images. The model is trained on a dataset from the International Skin Imaging Collaboration (ISIC), which contains images of various skin lesions. To address class imbalance, data augmentation techniques are applied to generate a more balanced distribution of classes.

The model architecture consists of convolutional layers followed by max-pooling layers to extract features from the input images. Dropout layers are incorporated to prevent overfitting, and dense layers with softmax activation are used for classification. The model is trained using the Adam optimizer with a learning rate of 0.001 and sparse categorical crossentropy loss.

The training process is monitored using early stopping to prevent overfitting and achieve optimal performance on the validation set. After training for 100 epochs, the model achieves an accuracy of 90% on the test dataset, demonstrating its effectiveness in classifying skin cancer from dermoscopic images.

The rebalancing of the dataset significantly improves the model's performance, addressing the initial challenges of class imbalance and low accuracy. The trained model can be further evaluated and deployed in a smart healthcare system for automated skin cancer detection and diagnosis, contributing to early intervention and improved patient outcomes.

IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

Impact Factor 8.066 ⁘ Peer-reviewed & Refereed journal ⁘ Vol. 11, Issue 4, April 2024

DOI: 10.17148/IARJSET.2024.11479

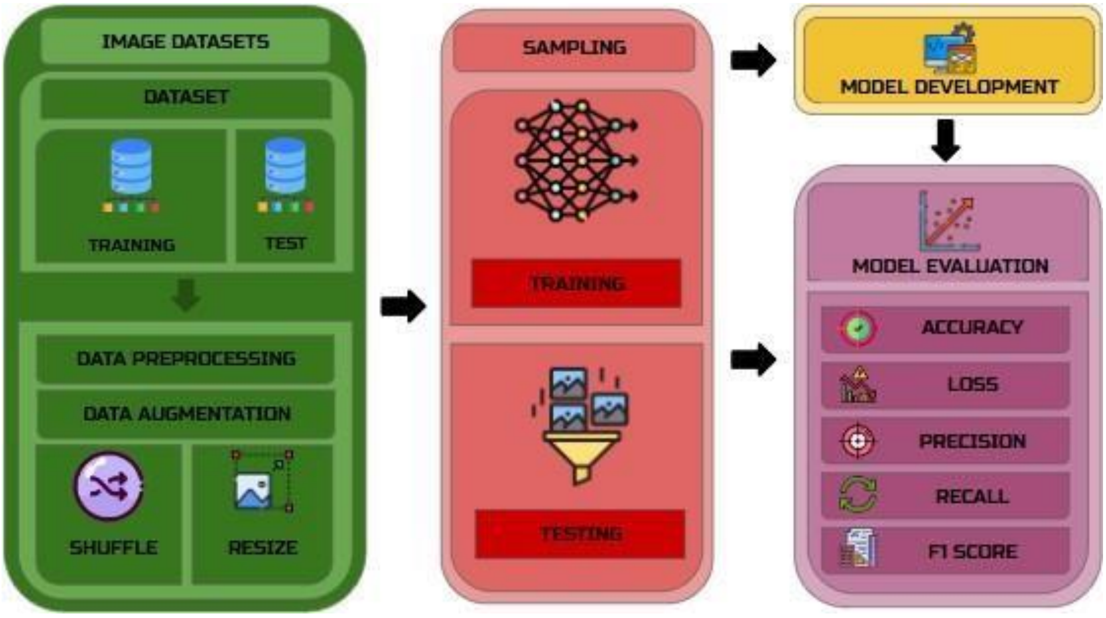

Figure 3.1 : Skin Cancer Detection Architecture

Collection of dataset: We are going to collect datasets. The data set consists of train and test images that have 9 types of lesions melanoma, dermatofibroma, basal cell carcinoma, actinic keratosis, vascular lesion,squamous cell carcinoma,seborrheic keratosis,pigmented benign keratosis,nevus.

Data Pre-Processing:
- In data pre-processing such as batch size, image height,image width and random seed Image resize
- Splitting of data into train and test

Model Building:
- Two CNN models are built
- Standard Model with convolutional layers followed by max-pooling layers,and dense layers for classification.
- Model with Data Augmentation and Dropout model incorporates data augmentation layers to increase the diversity of the training data and dropout layers to prevent overfitting.
- The evaluation results and findings, summarizing the effectiveness of different approaches and suggesting the bestperforming model for the skin cancer classification task.

IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588
International Advanced Research Journal in Science, Engineering and Technology
Impact Factor 8.066 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 11, Issue 4, April 2024
DOI: 10.17148/IARJSET.2024.11479

IV. EXPERIMENTAL RESULTS

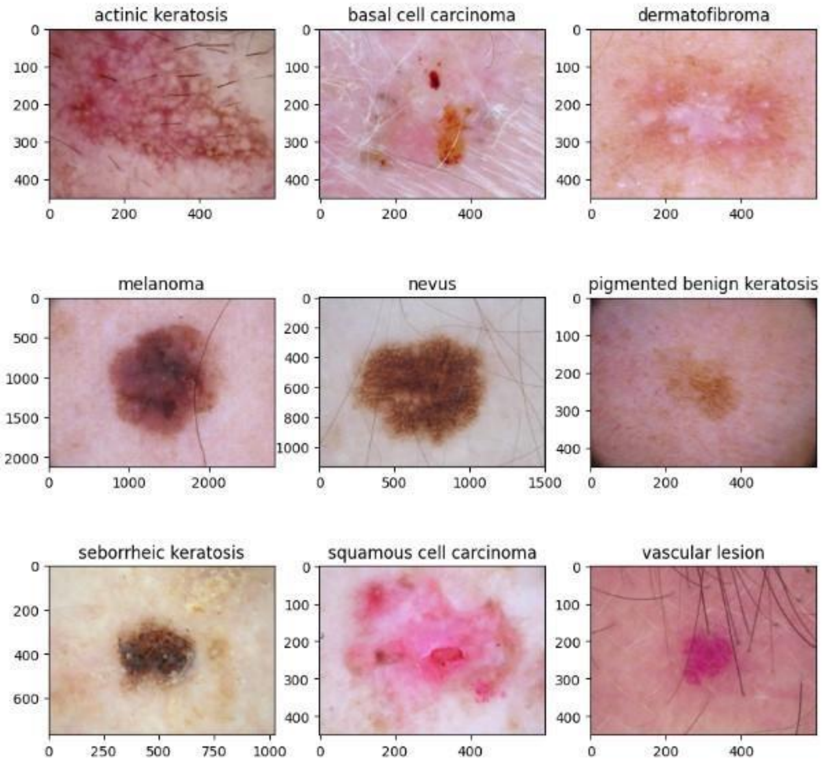

Figure 1: Images from each class

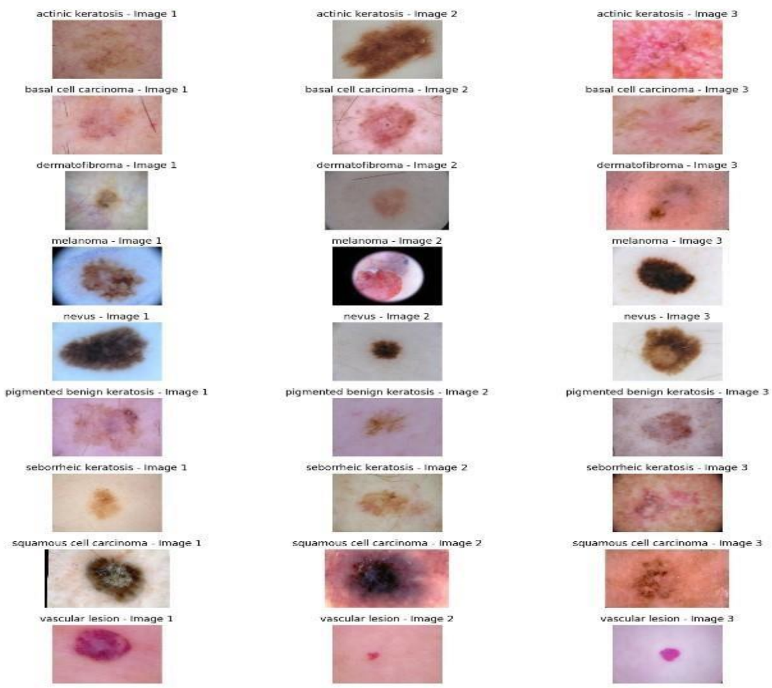

Figure 2: Classified Images

IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588
International Advanced Research Journal in Science, Engineering and Technology
Impact Factor 8.066 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 11, Issue 4, April 2024
DOI: 10.17148/IARJSET.2024.11479

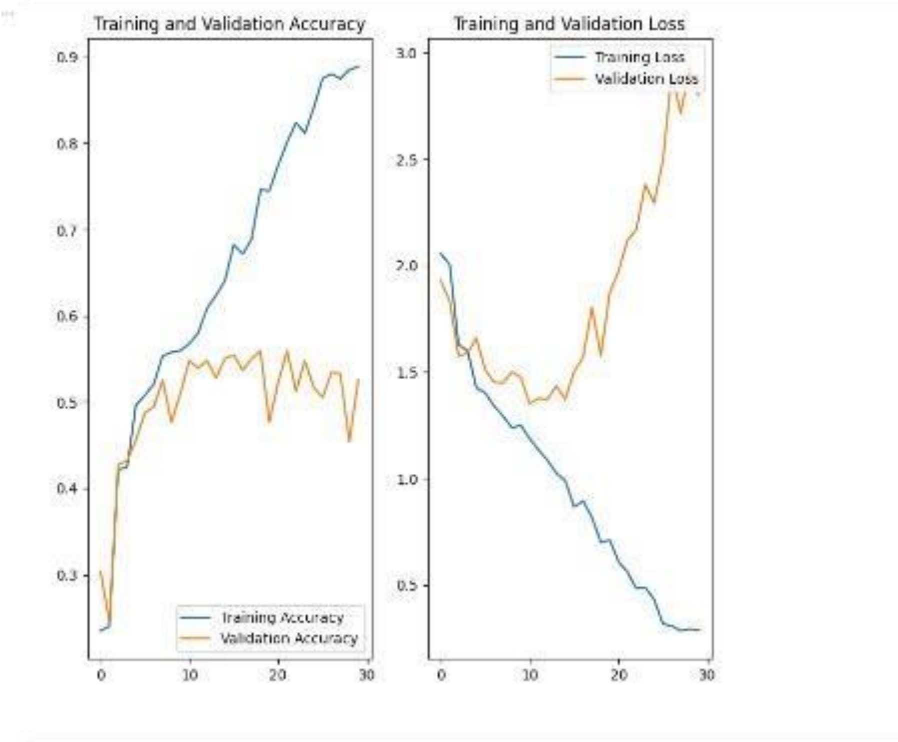

Figure 3: Plot of Accuracy

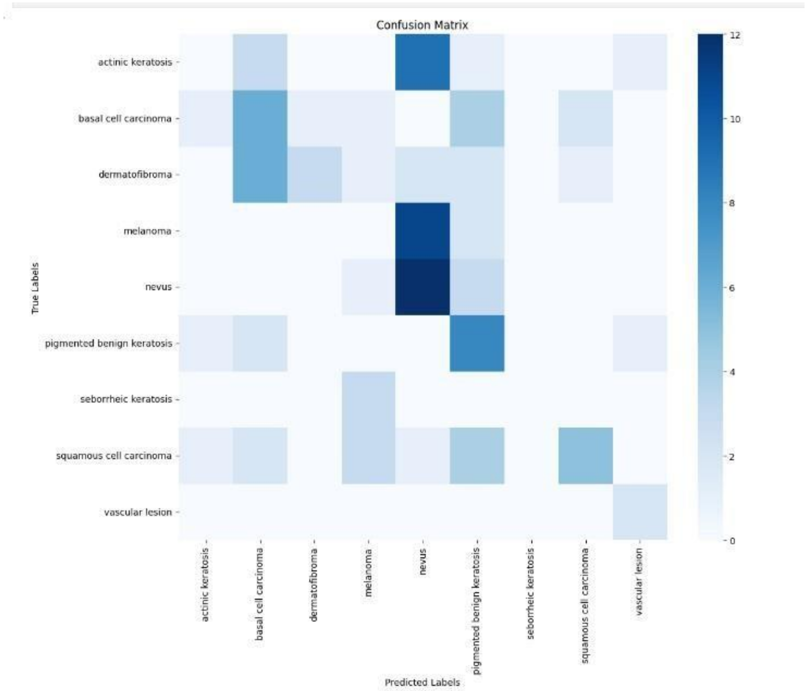

Figure 4: Heatmap of confusion matrix

DOI: 10.17148/IARJSET.2024.11479

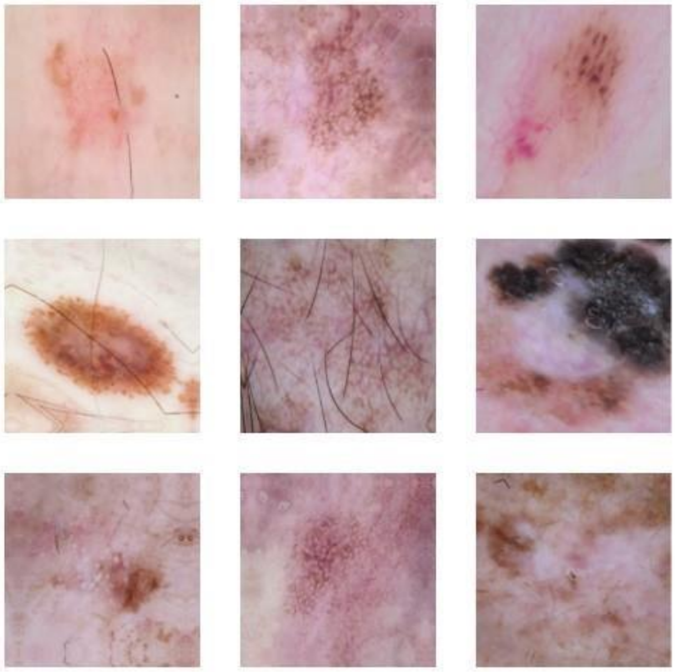

Figure 5: Augumented Images

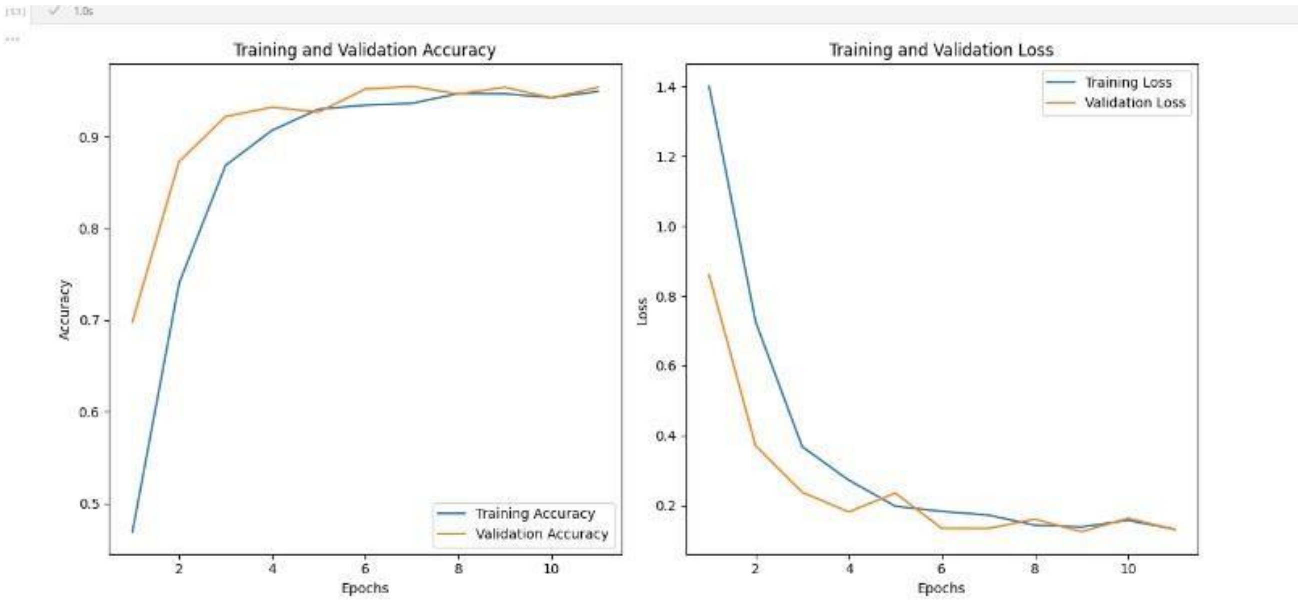

Figure 6: Graph with balanced class data

DOI: 10.17148/IARJSET.2024.11479

V. CONCLUSION

In conclusion, the application of deep learning techniques in skin cancer detection using dermoscopic images has shown promising results, indicating the potential to revolutionize healthcare practices. Through the development and evaluation of various models, including convolutional neural networks (CNNs), significant strides have been made in accurately classifying malignant lesions. Challenges such as class imbalance and overfitting have been effectively addressed through innovative techniques like data augmentation and early stopping, leading to improved model performance. Moreover, access to high-quality datasets such as those provided by the International Skin Imaging Collaboration (ISIC) has been instrumental in training robust models. These advancements hold immense clinical implications, offering automated systems that can assist dermatologists in early diagnosis, thereby facilitating timely interventions and better patient outcomes. However, challenges such as model interpretability, scalability, and real-world deployment remain, necessitating further research and interdisciplinary collaborations. Despite these challenges, the progress made underscores the transformative potential of AI in augmenting healthcare delivery, enhancing diagnostic accuracy, and ultimately saving lives.

REFERENCES

[1]. Esteva, A., Kuprel, B., Novoa, R. A., Ko, J., Swetter, S. M., Blau, H. M., & Thrun, S. (2017). Dermatologist-level classification of skin cancer with deep neural networks. Nature, 542(7639), 115-118.
[2]. Haenssle, H. A., Fink, C., Schneiderbauer, R., Toberer, F., Buhl, T., Blum, A., ... & Tschandl, P. (2018). Man against machine: diagnostic performance of a deep learning convolutional neural network for dermoscopic melanoma recognition in comparison to 58 dermatologists. Annals of Oncology, 29(8), 1836-1842.
[3]. Tschandl, P., Codella, N., Akay, B. N., Argenziano, G., Braun, R. P., Cabo, H., ... & Marchetti, M. A. (2018). Comparison of the accuracy of human readers versus machine-learning algorithms for pigmented skin lesion classification: an open, web-based, international, diagnostic study. The Lancet Oncology, 20(7), 938-947.
[4]. Brinker, T. J., Hekler, A., Enk, A. H., Berking, C., Haferkamp, S., Hauschild, A., ... & von Kalle, C. (2018). A convolutional neural network trained with dermoscopic images performed on par with 145 dermatologists in a clinical melanoma image classification task. European Journal of Cancer, 94, 121-129.