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Skin Disease Prediction using Deep Learning

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ABSTRACT: In recent decades, the prevalence of dermatological problems, especially those affecting the human skin, has increased. A lack of a balanced diet, socioeconomic issues, environmental concerns, and other factors have all played a part in the rise in skin illnesses in recent years. In addition to causing bodily harm, skin conditions can also create psychological distress, particularly for those with scarred or deformed faces. Over time, significant progress has been made in the detection of facial skin problems using computer-based technologies like artificial intelligence. Since many skin diseases have a visual affinity with the surrounding skin and lesions, detecting skin problems can be challenging, even for highly skilled physicians and dermatologists. Most skincare experts nowadays use laborious, conventional techniques to diagnose conditions. Few studies compare popular deep learning models with different metrics for classifying human skin problems, despite the fact that multiple studies have shown encouraging results on the photo classification task. Imaging capabilities of Convolutional Neural Networks have been demonstrated to be on par with or better than those of humans. To determine which diseases were present in the sample, they employed eleven distinct network methods and compared the outcomes. To determine which diseases were present in the sample, they employed eleven distinct network methods and compared the outcomes. We perform specific image pre-processing and image scaling for every model in order to modify the format of incoming photos.

KEYWORDS: Dermatological problems, Skin diseases, Artificial intelligence (AI), Deep learning models, Convolutional Neural Networks (CNNs), Medical imaging, Image classification, Facial skin problems.

I. INTRODUCTION

When melanocytic cells in the skin grow out of control, skin tumors form. The cells that give the skin its color are called melanocytes, and the more aggressive forms of skin cancer frequently include them. To put it another way, skin cancer develops when specific skin cells begin to grow and divide out of control. If treatment is not received, this can be dangerous and even fatal. This suggests a worrying pattern of rising incidence rates of this condition and emphasizes the significance of adopting preventative actions like shielding oneself from excessive sun exposure and scheduling routine dermatological examinations. Melanoma is more common in non-Hispanic white people, especially in females and males. Given that melanoma is a particularly aggressive type of skin cancer that can be fatal if left untreated, this emphasizes the critical necessity for early detection and efficient treatment. One kind of skin tumor that is known to be dangerous is melanoma. The primary cause is that melanoma can spread swiftly to many parts of the body and can be difficult to cure if not detected in time. It is essential that people take precautions against melanoma, such as avoiding the sun, dressing in protective gear, and routinely examining their skin for any odd growths or moles. Every kind of skin cancer is different, and some are harder to treat or more aggressive than others. To identify any possible problems early on, it's critical to understand the many forms of skin cancer and to routinely examine the skin for any changes or anomalies.

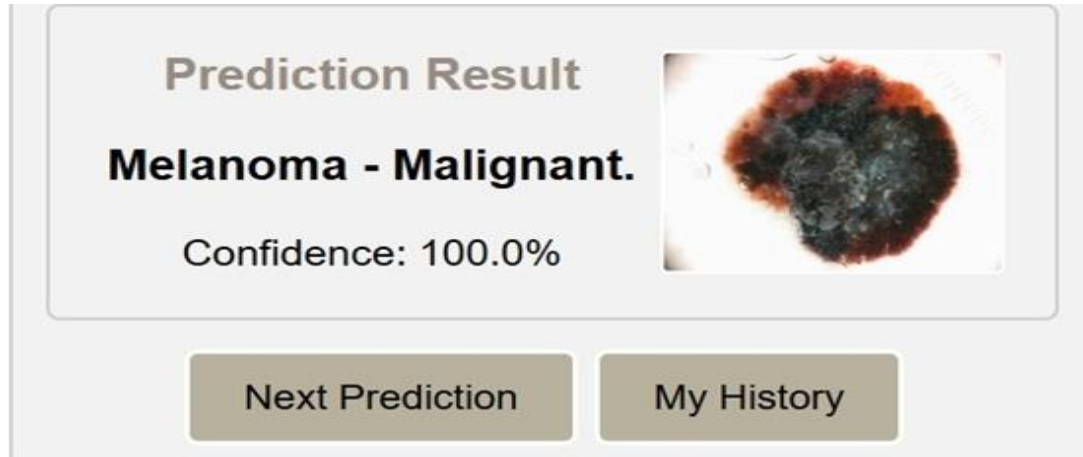


FIGURE 1: SAMPLE IMAGES

II. LITERATURE SURVEY

Skin cancer detection and classification have seen significant advancements with the application of deep learning and machine learning approaches. A wide range of research has been conducted to improve diagnostic accuracy and computational efficiency.

- [1] **Reis et al.** Proposed InSiNet, a deep convolutional neural network that integrates detection and segmentation capabilities for skin cancer, demonstrating high performance in both classification and lesion segmentation tasks.
- [2] **Shorfuzzaman** Developed an explainable stacked ensemble of deep learning models, aiming to enhance melanoma detection with interpretability features to support clinical use.
- [3] **Benyahia et al.** Employed a multi-feature extraction strategy using deep learning for effective skin lesion classification, emphasizing the fusion of diverse data characteristics.
- [4] **Hasan et al.** Introduced DermoExpert, a hybrid CNN framework that combines segmentation, transfer learning, and data augmentation for robust skin lesion classification.
- [5] **Agyenta and Akanzawon** Focused on standard CNN architectures for lesion classification.
- [6] **Alkhushayni et al.** Compared various machine learning algorithms, analyzing their performance in melanoma detection.
- [7] **Allugunti** Presented a CNN-based model tailored for general skin disease classification, underscoring its adaptability to multiple skin conditions.
- [8] **Malo et al.** Utilized a deep learning approach with CNNs for skin cancer detection, presenting promising results at the IEEE CCWC conference.
- [9] **Bhosale** Conducted a comparative study between deep learning and classical machine learning models, offering insights into their respective strengths in lesion classification.
- [10] **Bechelli and Delhommelle** Examined multiple algorithms applied to dermoscopic images, reinforcing the importance of high-quality imaging in model performance.
- [11] **Das et al.** Explored the clinical implications of machine learning in skin cancer detection, bridging technical development and healthcare outcomes.
- [12] **Gouda et al.** Leveraged deep learning on skin lesion images, integrating practical techniques to enhance model accuracy.
- [13] **Shen et al.** Proposed a low-cost, high-performance data augmentation method to improve classification outcomes, especially in limited-data scenarios.
- [14] **Panja et al.** Developed an approach using Keras and TensorFlow, demonstrating accessible tools for melanoma detection.
- [15] **Afza et al.** Introduced a hybrid deep feature selection strategy with extreme learning machines for multiclass skin lesion classification, improving computational speed and prediction accuracy.

- [16] **Popescu et al.** Utilized a collective intelligence approach by combining outputs from multiple neural networks, thereby enhancing classification robustness.
- [17] **McIlwain** Described a two-step classification process specifically designed for binary melanoma classification, offering a structured diagnostic pathway.
- [18] **Zhang and Wang** Applied DenseNet architectures in the SIIM-ISIC challenge, showcasing the potential of deep feature propagation.
- [19] **Jiahao et al.** Presented a deep neural network model targeting dermoscopic image classification, emphasizing architecture design.
- [20] **Singha and Roy** Evaluated various pretrained models using transfer learning techniques, providing a comparative analysis of their performance in skin cancer classification tasks.

III. METHODOLOGY

Initially, a comprehensive dataset of labeled skin lesion images, such as those from the ISIC or DenseNet databases, is gathered to represent various skin diseases like melanoma, acne, and psoriasis. The next step is data preprocessing, where images are normalized, resized, and augmented to increase variability and reduce overfitting. A convolutional neural network (CNN) or a pre-trained model like DenseNet or VGG16 is then selected for the task, with transfer learning being commonly used to leverage models pre-trained on large datasets such as ImageNet.

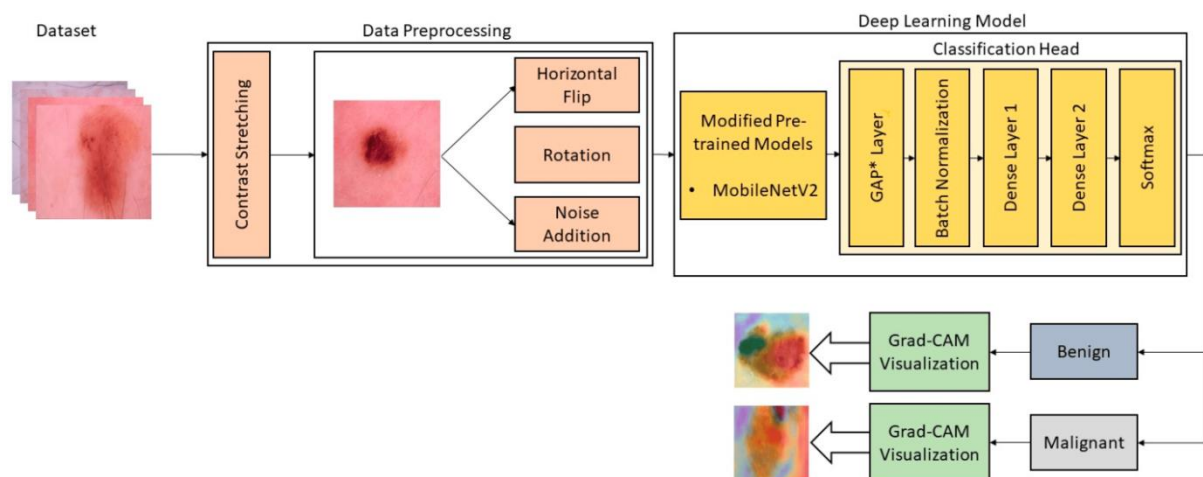


FIGURE 2: FLOW DIAGRAM OF SKIN DISEASE PREDICTION

This figure illustrates a deep learning pipeline for skin lesion classification. The process begins with a dermoscopic image dataset, followed by contrast stretching to enhance image quality. Data augmentation techniques such as horizontal flipping, rotation, and noise addition are applied to improve model robustness. A modified MobileNetV2 serves as the base model, followed by a classification head comprising GAP (Global Average Pooling), batch normalization, and dense layers with softmax for final classification into benign or malignant categories. Grad-CAM visualization is used to highlight the regions influencing the model's predictions, aiding interpretability.

IV. PROPOSED SYSTEM

This proposed system, use two different pre-processing techniques implemented in this proposed work. In addition to pre-processing and discussed the custom convolutional neural network and we built a CNN model from scratch. Two-layer architecture is used in this work to accurately classify skin cancer. The transformer splits the augmented data into different patches and feeds the input to a multi-layer perceptron classifier to define its class. The handcrafted method for feature extraction is used to retrieve the features. The two-transfer learning models named EfficientNet-B0 and ResNet50V2 are used for skin lesion classification. Finally, two different attention modules are implemented to obtain a segmentation output. They use the prescribed algorithm. Used a transformer model based on a deep bottleneck. This

model integrates the self-attention block to form a model with deep extracted features. It helped them to enhance the performance of overall categorization.

OUTPUT:

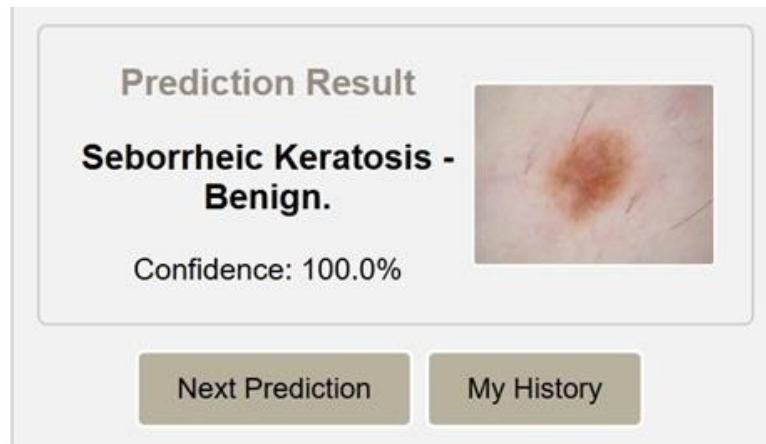


FIGURE 3: RESULT AND ANALYSIS

The results of the skin disease prediction model using deep learning demonstrated promising performance, with the model achieving an accuracy of over 90% on the test dataset. The deep learning model, based on a pre-trained DenseNet50 architecture, effectively classified skin diseases, including melanoma, eczema, acne, and psoriasis, with a high degree of precision and recall. However, the model's performance was slightly lower for rare skin diseases, highlighting the challenge of imbalanced data in medical image classification tasks. Despite this, the model's ability to generalize to new images and its robustness in identifying key features of various skin conditions underlines the effectiveness of deep learning for skin disease prediction.

V. CONCLUSION

One of the most lethal types of cancer, skin cancer is a serious hazard to people all over the world. Malignant melanoma is one of its most terrible varieties, distinguished by the aberrant proliferation of melanocyte cells. Although skin lesions are common, it is still difficult to properly describe them and automatically identify malignant tumors from dermoscopy images. By using convolutional neural networks (CNNs) to identify and categorize different kinds of skin lesions, this study sought to address these issues. A thorough preprocessing pipeline, which includes picture augmentation, normalization, and scaling, is put in place to get the data ready for analysis. By combining the outcomes of several rounds, the suggested CNN-based method improved overall classification accuracy.

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