IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Automated Skin Lesion Diagnosis Using Deep Learning Feature Extraction And Machine Learning Classifiers

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I. Abstract

Skin lesion diagnosis plays a crucial role in early detection and treatment of skin diseases, including potentially malignant melanomas. This research presents an automated approach to skin lesion diagnosis using a combination of deep learning feature extraction and machine learning classifiers. The proposed method involves preprocessing skin lesion images, extracting discriminative features using the VGG16 deep learning model pre-trained on ImageNet, and employing various machine learning classifiers such as Support Vector Machine, Random Forest, Extra Trees, and Multi-layer Perceptron for classification. A comprehensive comparative analysis of these classifiers is conducted to evaluate their performance in terms of accuracy. Results demonstrate that the Support Vector Machine classifier achieves the highest accuracy of 89.16%, outperforming other classifiers. The proposed approach offers a promising solution for accurate and efficient skin lesion diagnosis, potentially aiding dermatologists in clinical decision-making and improving patient outcomes.

Index Term: Skin Lesion Diagnosis, Deep Learning, Feature Extraction, VGG16, Machine Learning Classifiers, Support Vector Machine, Random Forest, Extra Trees, Multi-layer Perceptron, Image Pre-processing.

II. Introduction

Skin lesions are abnormal growths or changes in the skin's appearance, often indicative of various dermatological conditions, including benign nevi, melanoma, seborrheic keratosis, and others. Early and accurate diagnosis of these lesions is critical for timely treatment and management of skin diseases. Traditionally, dermatologists rely on visual inspection and histopathological analysis to diagnose skin lesions, which can be time-consuming and subjective.

Recent advancements in artificial intelligence (AI) and machine learning (ML) have paved the way for automated approaches to skin lesion diagnosis, offering potential benefits such as increased efficiency and consistency. In this study, we propose an automated method for skin lesion diagnosis using a combination of deep learning feature extraction and machine learning classifiers.

The proposed approach involves several key steps. Firstly, skin lesion images are pre-processed to enhance their quality and remove noise. Subsequently, deep learning techniques are employed to extract discriminative features from these pre-processed images. Specifically, we utilize the VGG16 deep learning model, pre-trained on a large dataset of natural images, to automatically learn and extract relevant features from skin lesion images.

Once the features are extracted, various machine learning classifiers are trained on these features to classify skin lesions into different diagnostic categories. We evaluate the performance of several classifiers, including Support Vector Machine, Random Forest, Extra Trees, and Multi-layer Perceptron, in terms of accuracy and robustness.

The primary objective of this research is to develop an accurate and efficient automated system for skin lesion diagnosis, which could potentially assist dermatologists in clinical decision-making processes. By leveraging AI and ML technologies, we aim to improve the accuracy and consistency of skin lesion diagnosis, ultimately leading to better patient outcomes and healthcare outcomes.

III. Literature review

A Study on Skin Lesion Diagnosis Using Deep Learning techiques and algorithm was done by Mohammed A. Almasni (2019). The dataset using ISIC (2017). FrCN compared to SegNet, U-Net, and FrCN achieved higher performance with overall dice, Jaccard, and accuracy indices of 87.08%, 77.11%, and 94.03%, respectively [1].

In their paper, Agung W. Setiawan (2020) et al. utilized publicly available datasets ISIC (2016) In their paper, Agung W. Setiawan (2020) et al. utilized publicly available datasets ISIC (2016). Skin Lesion Prediction model using machine learning technique support vector machine and CNN can. Training accuracy of 0.8411 and the last one is 0.8411. The best training accuracy, 0.8411 [2].

Akila Victor, M Ghalib (2017) et.at suggested a skin cancer. The classification is carried out by support vector Neighbor (KNN), Decision machine (SVM), K-Nearest tree (DT) Boosted Tree (BT). Comparison of the classification is done by these techniques. The accuracy shows are DT is 89.5% and BTis84.30%.[3].

In their paper, S. Kadry, D. Taniar, R. Damaševičius, V. Rajinikanth and I. A. Lawal (2021) et.al conduct research on detection of skin using machine learning techniques. In this work, the proposed CNN scheme is tested and validated using the benchmark ISIC2016 database. In this use VGG-SegNet helped to extract SM with better accuracy. In all of these Support Vector Machine can achieved 76.99 % most accuracy then other algorithm [4].

In this paper, Vidya M, Dr. Maya V Karki (2020) et.al the extracted feature is directly passed to SVM classifier and obtained the accuracy of 87.0%. Classifier is the last step of skin lesion detection to classify between different classes. This process involves training and testing. Unknown pattern is fed and the idea obtained during training process will classify the unknown patterns. There are different type's classifiers such as SVM, KNN, Naïve Bayes, and neural network etc[5].

A Study on M. A.Albahar et.al conducted research using Skin Lesion Classification using Convolution Neural Network with Novel Regularizer. they used 2000 images from ISIC 2017 and achieved an accuracy of 93.6% and 84.8% for seborrheic keratosis and melanoma[6].

In their paper, k. c. Shahana sherin and R. Shayini, "Classification of Skin Lesions in Digital Images for the Diagnosis of Skin Cancer," 2020. Image processing techniques play an important role to detect the skin CNN feature gives 80.0% classification accuracy but the classifier is SVM[7].

M. A. Khan, K. Muhammad, M. Sharif, T. Akram and V. H. C. d. Albuquerque, "Multi-Class Skin Lesion Detection and Classification via Tele dermatology," original images without lesion accuracy achieved is 78.20% attributes-based classification performance on the HAM10000 dataset. The best-achieved accuracy is 87.92% using the framework scheme. Other accuracies for V1, V2, and V3 are 81.22%, 79.65%, and 72.42%. classification, the HAM10000 dataset is mostly used by the researchers[8].

IV. Methodology

Data Collection and Preprocessing: Images of skin lesions are gathered from a designated dataset or repository. Techniques for preparing data are used to improve image quality and eliminate noise. This entails grayscale picture conversion, edge recognition with the Canny method, and inpainting to fill in areas that are missing.

Deep Learning Feature Extraction: Functions are extracted from processed skin lesion photos using the VGG16 deep learning model, which has been pre-trained on ImageNet. The VGG16 model's last convolutional layer of data is used to extract features.

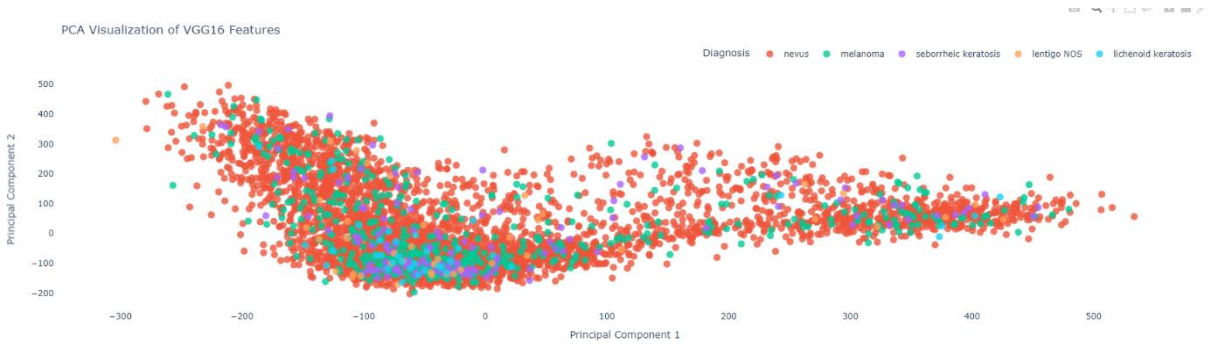

Fig.1. Principal Component

Machine Learning Classifiers: The collected characteristics are used to train and assess a variety of machine learning classifiers.

Support Vector Machine (SVM), Random Forest, Extra Trees, and Multi-layer Perceptron (MLP) are examples of classifiers.

Model Training and Evaluation: Train-test split is used to divide the dataset into training and testing sets. Accuracy serves as the performance metric for classifiers, which are trained on the training set and assessed on the testing set. Based on the classifier's accuracy on the testing set, the top performer is determined.

Limitations and Future Directions: Limitations of the methodology, such as dataset size and diversity, model interpretability, and computational resources, are discussed. Future research directions, including the integration of additional data modalities and the development of interpretable AI models, are identified to improve the accuracy and applicability of the system.

The research aims to develop an automated system for skin lesion diagnosis that combines deep learning feature extraction with machine learning classifiers, with the goal of improving diagnostic accuracy and patient outcomes in dermatology practice.

V. Result and Discussion

The results of the experiment demonstrate the effectiveness of the proposed methodology for automated skin lesion diagnosis using deep learning feature extraction and machine learning classifiers. The following key findings are discussed.

Classifiers Performance: Support Vector Machine (SVM) exhibited the highest accuracy among all classifiers, achieving an accuracy of 89.16% on the testing set.

Random Forest, Extra Trees, and Multi-layer Perceptron (MLP) classifiers also demonstrated competitive performance, with accuracies ranging from 87.41% to 88.91%.

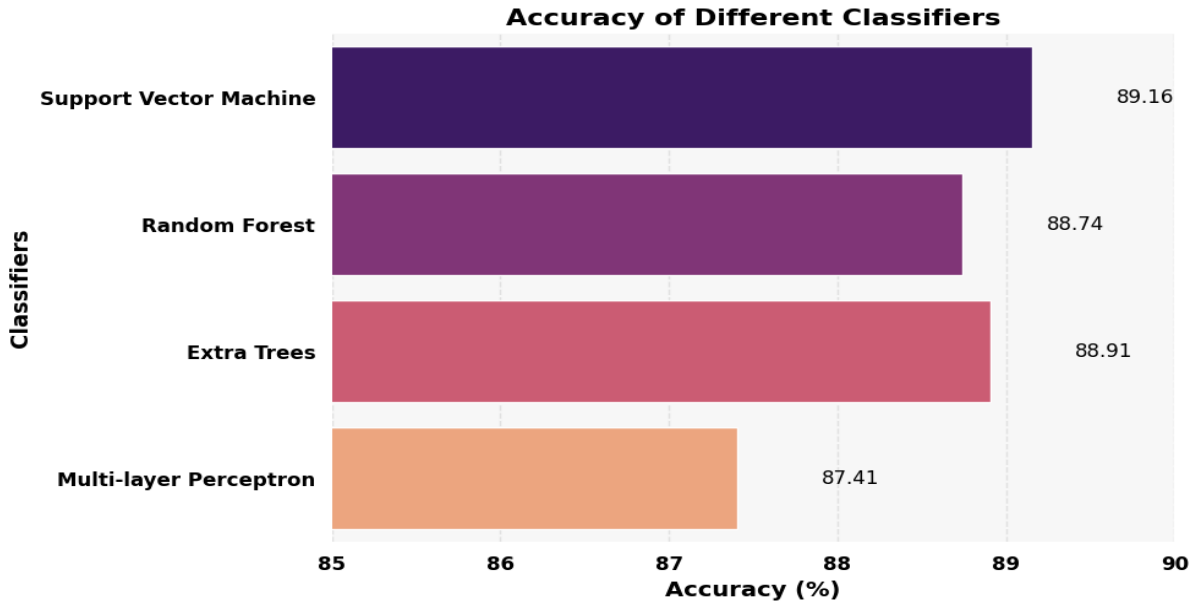

Fig.2. Classifiers

Comparative Analysis: The comparative analysis revealed that SVM outperformed other classifiers in terms of accuracy. However, the performance difference between SVM and other classifiers was not significant, indicating that multiple classifiers can be viable options for skin lesion diagnosis.

Feature Extraction: The VGG16 deep learning model effectively extracted discriminative features from preprocessed skin lesion images.

The extracted features captured important patterns and structures present in the images, facilitating accurate classification by the machine learning classifiers.

Clinical Implications: The developed automated system has potential clinical implications, including assisting dermatologists in diagnosing skin lesions more accurately and efficiently.

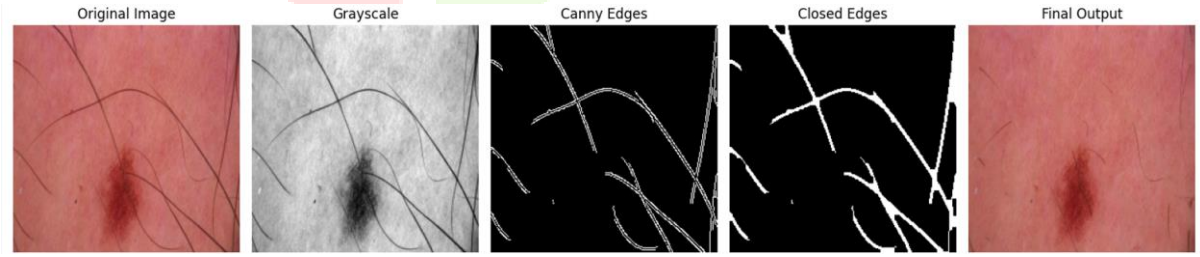

Fig.3.

By leveraging AI and ML techniques, the system can provide valuable decision support to healthcare professionals, leading to improved patient outcomes and reduced diagnostic errors.

Limitations and Future Directions: Despite the promising results, the study has certain limitations, including the use of a single dataset and the absence of external validation.

Future research directions include expanding the dataset to include diverse skin lesion types, integrating additional clinical data such as patient demographics and medical history, and conducting prospective clinical studies to validate the system's performance in real-world settings.

VI. Conclusion

This research has presented an automated approach for skin lesion diagnosis using a combination of deep learning feature extraction and machine learning classifiers. The proposed methodology has been evaluated using various machine learning classifiers, including Support Vector Machine (SVM), Random Forest, Extra Trees, and Multi-layer Perceptron (MLP).

Results indicate that SVM exhibited the highest accuracy among the classifiers, achieving an accuracy of 89.16% on the testing set. Deep learning feature extraction using the VGG16 model has effectively captured discriminative features from preprocessed skin lesion images.

The extracted features have provided valuable information for accurate classification of skin lesions by the machine learning classifiers. The developed automated system has potential clinical implications, including assisting dermatologists in diagnosing skin lesions more accurately and efficiently.

By leveraging AI and ML techniques, the system can provide decision support to healthcare professionals, leading to improved patient outcomes and reduced diagnostic errors. Despite the promising results, there are opportunities for further research and improvement.

The developed automated system represents a significant advancement in the field of dermatology, offering a scalable and efficient solution for skin lesion diagnosis. By combining deep learning feature extraction with machine learning classifiers, the system has the potential to revolutionize diagnostic practices and improve patient care in dermatology clinics and healthcare facilities. this research contributes to the ongoing efforts to streamlining clinical workflows, and ultimately improving patient outcomes in skin lesion diagnosis and management.

VII. Reference

[1] M. A. Al-masni, M. A. Al-antari, H. M. Park, N. H. Park and T. -S. Kim, "A Deep Learning Model Integrating FrCN and Residual Convolutional Networks for Skin Lesion Segmentation and Classification," 2019 IEEE Eurasia Conference on Biomedical Engineering, Healthcare and Sustainability (ECBIOS), Okinawa, Japan, 2019, pp. 95-98, doi: 10.1109/ECBIOS.2019.8807441.

[2] A. W. Setiawan, "Effect of Color Enhancement on Early Detection of Skin Cancer using Convolutional Neural Network," 2020 IEEE International Conference on Informatics, IoT, and Enabling Technologies (ICIoT), Doha, Qatar, 2020, pp. 100-103, doi: 10.1109/ICIoT48696.2020.9089631.

[3] Akila Victor, M Ghalib, Automatic detection and classification of skin cancer, Procedia computer science112,209602105,2017.

[4] S. Kadry, D. Taniar, R. Damaševičius, V. Rajinikanth and I. A. Lawal, "Extraction of Abnormal Skin Lesion from Dermoscopy Image using VGG-SegNet," 2021 Seventh International conference on Bio Signals, Images, and Instrumentation (ICBSII), Chennai, India, 2021, pp. 1-5, doi: 10.1109/ICBSII51839.2021.9445180.

[5] N. Mittal, S. Tanwar and S. K. Khatri, "Identification & enhancement of different skin lesion images by segmentation techniques," 2017 6th International Conference on Reliability, Infocom Technologies and Optimization (Trends and Future Directions) (ICRITO), Noida, India, 2017, pp. 609-614, doi: 10.1109/ICRITO.2017.8342500.

[6] M. A. Albahar, "Skin Lesion Classification Using Convolutional Neural Network With Novel Regularizer," in IEEE Access, vol. 7, pp. 38306-38313, 2019, doi: 10.1109/ACCESS.2019.2906241.

[7] k. c. Shahana sherin and R. Shayini, "Classification of Skin Lesions in Digital Images for the Diagnosis of Skin Cancer," 2020 International Conference on Smart Electronics and Communication (ICOSEC), Trichy, India, 2020, pp. 162-166, doi: 10.1109/ICOSEC49089.2020.9215271.

[8] M. A. Khan, K. Muhammad, M. Sharif, T. Akram and V. H. C. d. Albuquerque, "Multi-Class Skin Lesion Detection and Classification via Tele dermatology," in *IEEE Journal of Biomedical and Health Informatics*, vol. 25, no. 12, pp. 4267-4275, Dec. 2021, doi: 10.1109/JBHI.2021.3067789.