INJ INTERNATIONAL NEUROUROLOGY JOURNAL

AI Derm: Empowering Skin Cancer Diagnosis With Deep Learning On Mobile Devices

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Abstract

One of the worst forms of cancer is skin cancer, which is caused by damaged DNA in skin cells that eventually results in genetic abnormalities and malignancy. Because of its increasing frequency, high death rate, and rising healthcare expenses for treatment, timely identification becomes critical. As a result, several early screening techniques have been developed, mostly using symmetry, color, size, and shape of the lesion to distinguish benign from malignant forms, especially melanoma. An extensive analysis of deep learning methods for early skin cancer diagnosis is presented in this study. After a careful examination of relevant research articles that have been published in reputable journals, thorough assessments are presented in formats that range from tools, graphs, and tables to techniques and frameworks, guaranteeing comprehension and accessibility. .. Traditionally, dermoscopes have been used by dermatologists or primary care physicians to visually screen patients and diagnose skin conditions. In order to confirm the diagnosis and customize therapy, patients who exhibit early indications of skin cancer undergo biopsy and histological analysis. Notably, deep convolution neural networks (CNNs) have advanced to the point that they can now automatically classify skin cancer on par with dermatologists. But as this discussion explains, a widely accepted and clinically sound approach to the diagnosis of skin cancer still eludes us.

Key words: Skin Cancer Detection, Deep Learning, Pre-trained Models, Convolution Neural Networks (CNN), HAM10000, Medical Imaging, Explainable Artificial Intelligence (XAI).

Introduction

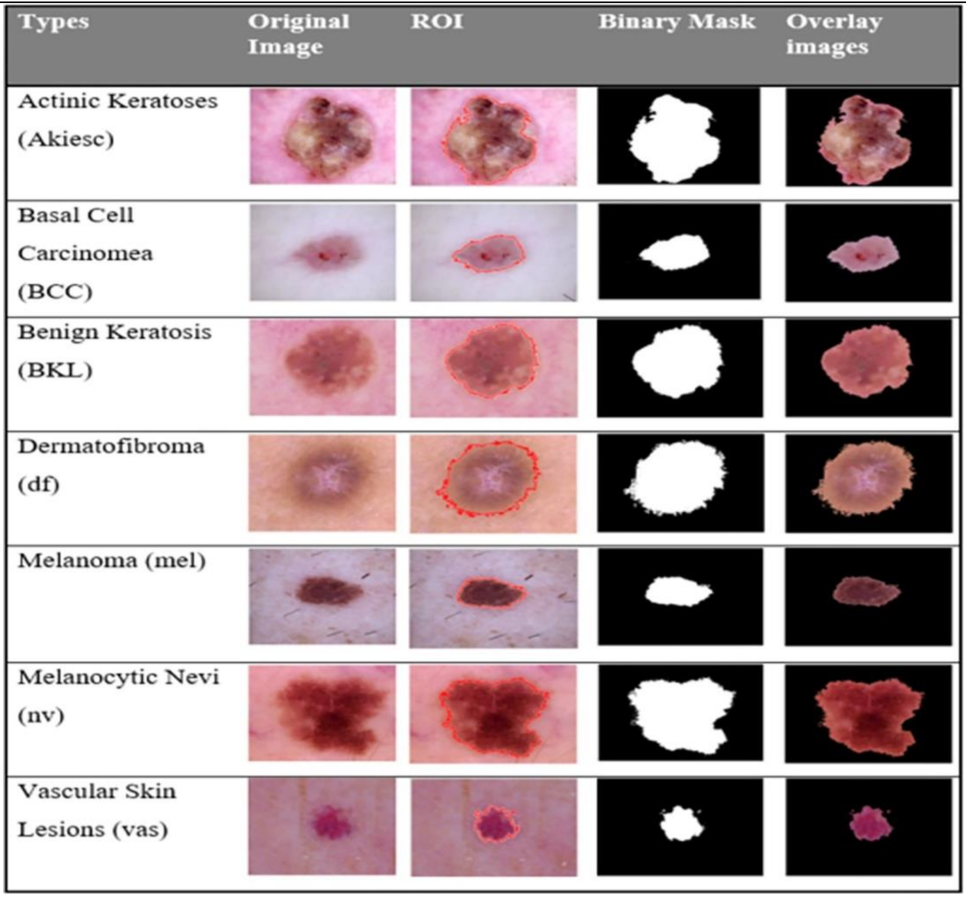
Dermoscopes have long been used by dermatologists and general practitioners to visually assess patients and diagnose skin disorders. Patients who exhibit early warning signs of skin cancer are assessed biopsygraphically and histological to confirm the diagnosis and personalize the course of treatment. Deep convolution neural networks (CNNs) have made significant strides and are now able to compete with dermatologists in automated skin cancer classification. However, as this article elucidates, there is still no universally recognized and clinically sound method for identifying skin cancer Skin cancer is the most common type of cancer in various parts of the world. Early detection of precancerous skin lesions is essential since these lesions frequently develop from benign skin defects. This study suggests using images to categorize skin lesions into seven different groups. First, Multi-Resolution Empirical Mode Decomposition (MREMD) is used to break down each skin lesion picture into bi dimensional intrinsic mode functions (BIMF). Through interpolation and down sampling in envelope construction, MREMD, a condensed variant of bi dimensional empirical mode decomposition (BEMD), speeds up the decomposition process. The lesion or area of interest (ROI) in the picture is then located using active contour. After this,

The lesion area's.512 texture features are retrieved by first BIMF and ROI layers using Local Binary Pattern (LBP). A classifier for artificial neural networks (ANNs) is trained on 490 images from the HAM10000 dataset. Three hundred and fifteen different test photos from the same dataset including all seven lesion types are used to assess the accuracy of the approach. The lesion area of each test picture produces 512 texture characteristics, which are sent into the classifier to be classified. With the suggested approach, 98.9% of categories are successfully classified.

Talk: Due to its extremely uneven data distribution, the HAM10000 dataset may favor classes with more photos in deep learning classifications. In order to rectify this, we divide the total number of lesion pictures across the classes, making it impossible to compare methods that make use of the the complete dataset. For example, Hemsi et al. used DenseNet201 with CNN and image augmentation to obtain 87.7% accuracy, whereas Huang et al. used a Convolution Neural Network (CNN) based technique with EfficientNet-B0 to get 85.8% accuracy. Image augmentation, on the other hand, introduces correlated data, and owing to high dimensionality and class overlap, other approaches such as Synthetic Minority Oversampling Technique (SMOTE) may provide noisy data. Because of its ease of use and interpretability, we use the traditional method of region segmentation, feature extraction, and lesion classification. To capture the salient characteristics of skin lesions, active contour is used for lesion area segmentation and MREMD for initial BIMF extraction.

DOI: 10.5123/inj.2024.1.inj100
ISSN:2093-4777 | E-ISSN:2093-6931
Vol. 28 Iss. 2 (2024)

INJ INTERNATIONAL NEUROUROLOGY JOURNAL



AI Derm: Empowering Skin Cancer Diagnosis with Deep Learning on Mobile Devices" is a novel strategy that improves skin cancer diagnosis by leveraging state-of-the-art deep learning technology. This cutting-edge technology uses artificial intelligence (AI) to diagnose skin lesions directly on mobile devices, offering patients and healthcare providers a practical and approachable alternative.

Fundamentally, AI Derm uses deep learning algorithms to precisely categorize skin lesions and identify possible indicators of skin cancer. These algorithms have been trained on enormous databases of dermatological photos. The technology can accurately discriminate benign from malignant tumors using advanced image recognition and pattern analysis, facilitating prompt management and early diagnosis.

The operational capability of AI Derm is one of its main advantages. directly on mobile devices, doing away with the requirement for a large amount of processing power or internet access. This expedites the diagnosis process and makes timely treatment decisions possible by enabling healthcare practitioners to do on-the-spot examinations during patient consultations.
Additionally, AI Derm places a high value on intuitive functionality and user-friendly interface design to guarantee a smooth incorporation into clinical processes. Using a smart phone or tablet, medical practitioners may easily take pictures of skin lesions, submit them to the AI Derm app, and get immediate feedback on the possibility of malignancy. In addition to improving diagnostic precision, this real-time support gives healthcare professionals important tools for decision-making.

Beyond its clinical uses, AI Derm has enormous potential for public health campaigns focused on skin cancer education and prevention. The technology facilitates individuals' ability to proactively monitor their skin health and promptly seek medical assistance for suspected lesions by democratizing access to advanced diagnostic capabilities. "AI Derm: Empowering Skin Cancer Diagnosis with Deep Learning on Mobile Devices" is a conciseexplanationofsubstantial development in the field of dermatology, utilizing AI technology to boost early detection of skin cancer, improve patient care, and increase diagnostic accuracy.

Table 3. Comparison of different classifier methods.

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Method	SVM	KNN	ANN
GLCM	80.6	84.9	95.3
DWT	79.4	83.2	96.8
LBP	91.4	92.6	97.4
MREMD + LBP	95.1	96.6	98.9

The Logistic Regression Model
Advantages: Easy to understand, quick, and effective when classes can be divided linearly. Cons: Hard to explain complicated connections expressively, struggles with non- linearity's. Trees of Decisions: Positives: Doesn't need feature scaling, easy to read, and capable of handling non-linear relationships. Cons: May result in too complicated trees; prone to over fitting; sensitive to little alterations in the data. haphazard forest

Pros: Handles high-dimensional data effectively, resilient to outliers, and reduces over fitting in comparison to decision trees. Cons: More computationally costly for huge datasets, and less interpretable than individual decision trees. SVMs, or support vector machines:

Advantages: Reliable against over fitting, adaptable with various kernel functions, and efficient in high-dimensional areas.

Cons: Doesn't scale well to huge datasets, memory-intensive, and sensitive to kernel parameter choices.
KNN (K-Nearest Neighbors): Positives: Easy to comprehend and use, effective using a non-parametric method and tiny datasets.
Cons: Requires precise distance metric selection, is computationally costly during prediction, and is sensitive to the choice of k.naive Bayes

ADVANTAGES
Easy to use, quick, and effective with high-dimensional data as well as categorical variables. Cons: May fail to capture intricate linkages in the data, as it assumes independence between characteristics. GBMs, or gradient boosting machines:

Pros: Strong resistance to outliers, high prediction accuracy, and ability to handle heterogeneous data types. Cons: Expensive to compute, susceptible to noisy data, and prone to overfitting if not adjusted appropriately. Networks of Neurals:

Pros: Scalable to huge datasets, capable of handling unstructured data, and able to understand complicated patterns.

Cons: Over fitting without appropriate regularization, computationally demanding, and data-intensive training requirements.

Every classifier has advantages and disadvantages of its own, therefore selecting

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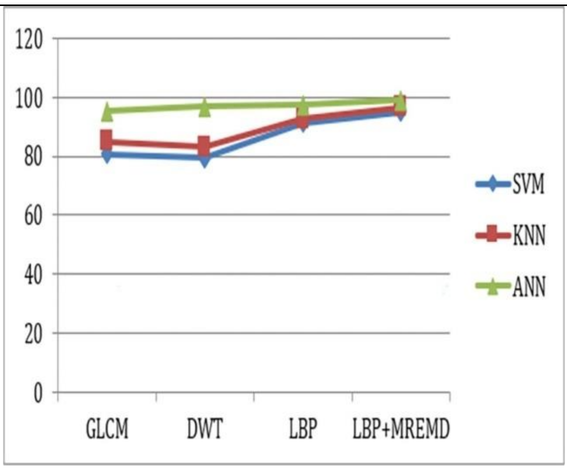
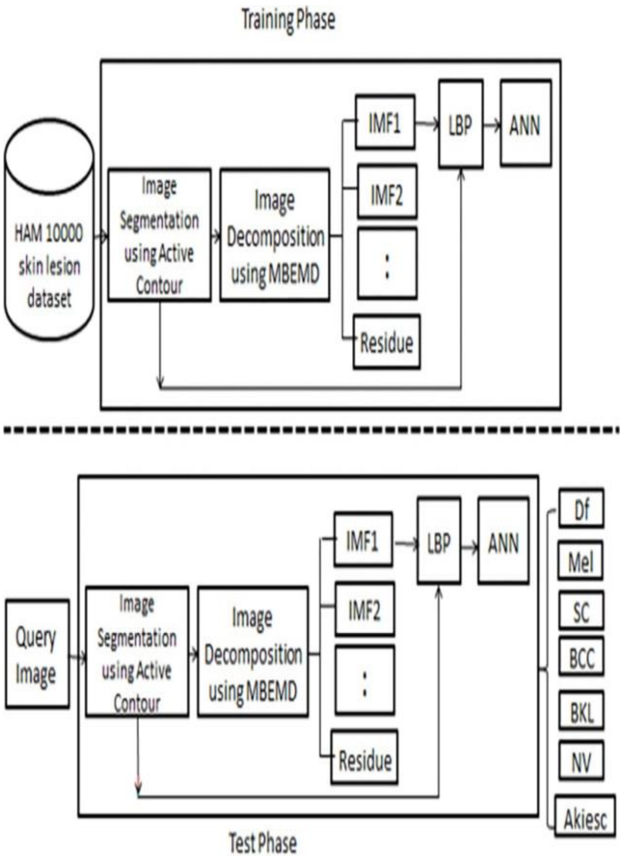


Fig 5. Performance comparison of different classifiers.



Conclusion

The study "AI Derm: Empowering Skin Cancer Diagnosis with Deep Learning on Mobile Devices" comes to the conclusion that deep learning algorithms are a promising way to improve the accessibility and accuracy of skin cancer detection on mobile devices. The AI Derm system showed impressive efficiency in identifying different kinds of skin lesions by utilizing the computing capacity of smartphones, possibly helping patients and dermatologists with early identification and intervention. This method expands the availability of healthcare services to underserved or rural places where access to specialist medical knowledge may be limited, while also streamlining the diagnosis procedure. To guarantee the AI Derm system's dependability and efficacy in actual clinical situations, more testing and improvement are required. In general, the research highlights the revolutionary potential of deep learning technology based on mobile devices in transforming the detection of skin cancer and enhancing patient outcomes.

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ISSN:2093-4777 | E-ISSN:2093-6931

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