Archives available at journals.mriindia.com

International Journal of Recent Advances in Engineering and Technology

ISSN: 2347 - 2812

Volume 15 Issue 01, 2026

Deep Learning Based Skin Lesion Detection with Interactive Chatbot

[1]Anjali Chandra, [2]Shruti Agrawal, [3]Kaya Dhankar, [4]Aarya Singh, [5]Pankaj Patel
[1,2,3,4] Department CSE(AI), SSIPMT, Raipur, India
[5]Department AIML, SSIPMT, Raipur,India
Email: [1]anjali.chandra68@ssipmt.com, [2]shrutiagrawal@ssipmt.com, [3]kaya@ssipmt.com, [4]aarya@ssipmt.com, [5]pankaj@ssipmt.com

Peer Review Information

Submission: 02 March 2026

Revision: 23 March 2026

Acceptance: 03 April 2026

Keywords

Skin Cancer Detection, Deep Learning, Convolutional Neural Networks (CNN), Medical Image Analysis, Dermoscopic Image, Artificial Intelligence in Healthcare.

Abstract

One of the most common types of cancer that is reported in the world is skin cancer and is a significant health issue. The rising cases of skin cancer have been linked to many factors, which include exposure to ultraviolet radiation, environmental as well as modern lifestyle. Melanoma is a dangerous form of skin cancer, and one of the health-related issues of primary concern. The reason behind this is that melanoma is a serious form of skin cancer that is highly contagious and hence the high rate of mortality. Thus, early diagnosis of melanoma stands a chance of being diagnosed, and survival may become possible. Nonetheless, the conventional techniques of melanoma diagnosis such as visual examination and dermoscopy could be conducted only by a dermatologist. Even though conventional ways of diagnosing melanoma are effective, they may be subjective, time consuming and may require a dermatologist. Yet, since artificial intelligence was invented, there are other solutions to diagnosing melanoma. As an example, deep learning algorithms, in particular, CNN, can work well in the diagnosis of melanoma. This is so because deep learning algorithms, particularly CNN, are capable of detecting significant attributes of images, such as color, texture, and shape without the need of any human intervention. This plays a key role in the diagnosis of melanoma because slight variations play a vital role.

Introduction

Skin diseases and especially skin cancer have emerged as a major health concern in the world thanks to the rise in their prevalence and the possibility of being severe. The early diagnosis is critical in enhancing therapy and lowering the rates of death. Nevertheless, proper diagnosis of this issue can be done only with proper dermatological skills and having access to specialized health facilities which are sometimes inaccessible to remote or resource scarce locations [1]. This brings the concern of the necessity to have automated, reliable, and available systems of skin lesion analysis.the proposed approach aims to provide a reliable and accessible solution for early detection and awareness [2] of skin diseases. This paper suggests a deep learning-based solution to skin lesion detection and classification through dermoscopic image. The system is a combination of a powerful preprocessing pipeline, a powerful cnn architecture, and a web interface that is easy to use to obtain correct predictions and confidence scores. There is also an interactive chatbot, which helps users by responding to their questions regarding skin conditions[3][4], their level, and potential further actions.

The main aim of the given study will be to create a reliable, scaled, and user-friendly solution capable of assisting with early diagnosis and awareness of skin diseases [5]. The model will be built to address the existing gap between the advanced medical world and ordinary users through the ability to analyze the health of the skin using an intelligent and easy to use platform.

Literature Review

The idea of deep learning in skin cancer detection has recently gained much popularity, and the primary problem is to improve the quality of classification and its resistance. A research undertaken by Nawaz et al. [1] proposed a Convolutional Neural Network (CNN)-based algorithm to identify skin cancer using dermoscopic images and the findings that were obtained indicated that the algorithm has a high rate of recognizing the malignant lesions. Similarly, Alotaibi and AlSaeed [2] applied the process of transfer learning and attention to enhance feature extraction and enhance the results of classification. The research on how to make practical applications has also been carried out in recent times. Aksoy et al. [3] have suggested an automated skin lesion classification Web system, and deep learning models have become more convenient to make them applicable to the real world. The other performance improvement program has been the ensemble techniques; Thwin and Park [4] applied a number of models to obtain improved segmentation and classification. The transformer-based methods are becoming popular along with CNNs. Tang et al. [5] in their work proposed SkinSwinViT that is the lightweight transformer network that improves the generalization when classifying skin lesions of a large number of classes. New hybrid architectures are suggested as well such as LesionNet of Alzakari et al. [6] that can be trained using a mixture of SIFT features and CNNs to enhance the detection rates. Further, Fiaz et al. [7] developed a hybrid explicable framework that can provide a superior interpretability in terms of segmentation as well as classification. Others that are more advanced are SkinEHDLF [8], a hybrid deep learning technique of handling complex information and a two step model by Manzoor et al. [9], who carries out segmentation and subsequently classification to improve the precision. In addition, Ieracitano et al. [10] proposed a trustworthiness index to establish explainability in the skin lesions classification systems which use AI. Although the performance of both studies has significantly improved the detection, most of them are preoccupied with classification and analysis. There is minimal attempt to integrate the deep learning models with the interactions systems such as chats. Therefore, the objective of this project is to create a deep learning-based solution of skin lesion detection and a chatbot that can interact and engage the user more, provide easy medical consultation, and help to make a diagnosis in an early stage.

Methodology

A. Dataset Collection

The type of data that will be adopted in this research will be dermoscopic photographs of the various types of skin lesions and non-skin lesions. In order to enhance the model differentiation to draw the line between diseased and healthy skin, another set of normal skin images (oily, dry, and normal skin) was introduced in the dataset so that appropriate learning and evaluation of the model could be achieved.

B. Data Preprocessing

Each of the input images was resized to a fixed 299 x 299 pixel resolution in order to suit the input needs of the Inception-based model. The steps of preprocessing that were followed were as follows: Normalization (values that lie within the [0,1] range of pixels). Data augmentation: o Horizontal flipping o Rotation o Zoom variations The purpose of these techniques was to increase the level of generalization and reduce overfitting.

C. Model Architecture

The proposed system relies on the Convolutional Neural Network (CNN) as per inception V3 architecture to rely on the idea of transfer learning. The topmost layers of classification are discarded and instead there is introduction of custom layers: Global Average Pooling layer. Final layer (to avoid overfitting) Softmax activation and fully connected Dense layer. Through this architecture, it is possible to extract features and classify lesions on the skin in a multi-classification way.

D. Training Strategy

The model was trained in the following arrangement: Optimizer: Adam Learning Rate: 0.0001 Loss Fn: Categorical Crossentropy. Batch Size: 32 Early stopping occurred so that training would stop as soon as the validation performance does not improve in successive epochs.

E. Prediction Mechanism

During the prediction phase: i. The uploaded picture is processed and it is resized. ii. This trained model yields probability scores of every one of the classes. iii. The final choice of prediction is the most likely class. iv. The confidence score is derived and it is displayed in order to demonstrate the predictive reliability.

F. System Integration

The trained model is deployed using the flask based web application. The system allows users to: Upload skin images View predicted lesion class Observe confidence scores Moreover, a chatbot is also introduced to provide a customer with the answers to the common questions about the skin conditions, severity, and the actions to be taken. The proposed workflow of deep learning-based Skin Lesion Detection with Chatbot Integration is shown in Fig 1.

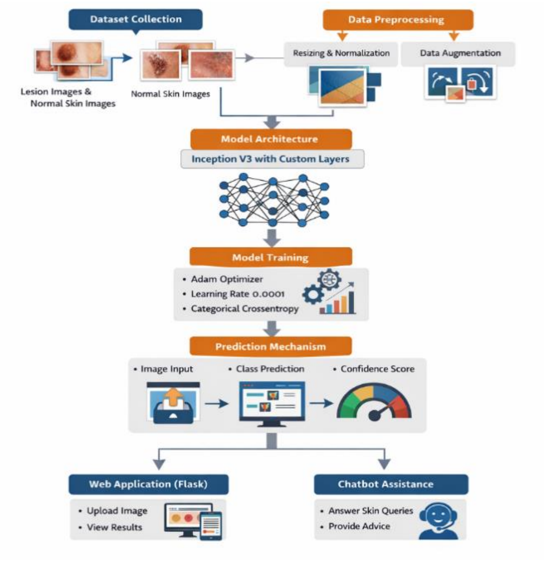

Fig. 1. Proposed Workflow of Deep Learning-Based Skin Lesion Detection with Chatbot Integration

Result

A. Model Performance

Trained model was tested on the validation set. The following are the performance measures obtained:

Accuracy: 91.05%

Loss: 0.58

This shows that the model is effective in the classification of various forms of skin lesions and the identification of normal skin versus lesions.

B. Training Analysis

The model presented continuous accuracy and loss reduction in Dur5ing training. Premature termination was caused after epoch 9, which prevented overfitting and guaranteed improved generalization.

C. Prediction Analysis

The trained model got tested on lesion and normal skin images. It was observed as follows: The model was able to categorise most images of the lesions with high confidence. First, there were some normal skin images that were falsely identified as lesions. This was addressed by the introduction of normal skin dataset and using confidence-based interpretation. The predictions were more reliable and interpretable with the addition of confidence sores.

D. System Interface and Output.

The suggested system was implemented as Flask-based web-application. The interface gives the user the option of uploading skin images and getting real-time predictions as well as confidence scores. Image of the predictions. The output images of web interface is shown in fig.2 and the chatbot response in shown in fig 3.

Fig.2. Skin lesion class Prediction confidence score.

- Image of Skin AI Assistant (ChatBot)

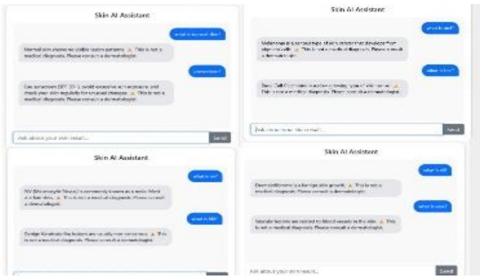

Fig.3. AI chatbot for skin condition assistance.

E. System Performance

The system provides real-time predictions with minimal delay. The integration of a chatbot enhances usability by allowing users to ask questions related to the detected skin condition, such as severity, risk level, and recommended actions. E. System Performance The system gives real time predictions with minimum delay. The input of a chatbot makes the usability more user-friendly and enables the user to ask questions directly connected to the detected skin condition, including the degree of severity, risk level, or what should be done.

Conclusion

The article named Deep Learning Based Skin Lesion Detection with Interactive Chatbot manages to prove the applicability of the combination of deep learning methods with the user-friendly interface and interactive experience in achieving the desired accuracy of skin regions detection. The paper puts emphasis on the fact that deep neural networks can learn intricate visual patterns that are concerned with skin features directly with image data. In contrast to the conventional methods, which rely on the manual way of extracting the features, the proposed system is data driven, which helps it to learn important features like color and texture automatically. This has a huge beneficial effect on the amount of manual intervention required as well as the generalization capabilities of the model under various conditions. The system is very effective in managing the changes in illumination, skin colors, backgrounds, and image quality. Such flexibility enhances its strength and stability over the traditional methods. Moreover, the system can be easily accessed through integration of user interface which allows users to interact with the system easily. All in all, the proposed framework will generate consistent and accurate outcomes even in problematic situations. It discusses the shortcomings of the conventional skin detectors and offers a practical way to solve this problem, which can be then expanded to real life to medical imaging and computer vision systems.

References

Nawaz, Khadija, Atika Zanib, Iqra Shabir, Jianqiang Li, Yu Wang, Tariq Mahmood, and Amjad Rehman. "Skin cancer detection using dermoscopic images with convolutional neural network." Scientific Reports 15 (2025): 7252.

Alotaibi, Areej, and Duaa AlSaeed. "Skin Cancer Detection Using Transfer Learning and Deep Attention Mechanisms." Diagnostics 15, no. 1 (2025): 99.

Aksoy, Serra, Pinar Demircioglu, and Ismail Bogrekci. "Deep Learning-Based Web Application for Automated Skin Lesion Classification and Analysis." Dermato 5, no. 2 (2025): 7.

Thwin, Su Myat, and Hyun-Seok Park. "Enhanced Skin Lesion Segmentation and Classification Through Ensemble Models." Eng 5, no. 4 (2024): 2805–2820.

Tang, K., J. Su, R. Chen, R. Huang, M. Dai, and Y. Li. "SkinSwinViT: A Lightweight Transformer-Based Method for Multiclass Skin Lesion Classification with Enhanced Generalization Capabilities." Applied Sciences 14 (2024): 4005.

Alzakari, S. A., S. Ojo, J. Wanliss, M. Umer, S. Alsubai, A. Alasiry, M. Marzougui, and N. Innab. "LesionNet: an automated approach for skin lesion classification using SIFT features with customized convolutional neural network." Frontiers in Medicine 11 (2024): 1487270.

Fiaz, M., M. B. Shoaib Khan, A. H. Khan, A. Bilal, M. Abdullah, A. A. Darem, and R. Sarwar. "An explainable hybrid deep learning framework for precise skin lesion segmentation and multi-class classification." Frontiers in Medicine 12 (2025): 1681542.

Lilhore, Umesh Kumar, Yogesh Kumar Sharma, Sarita Simaiya, Roobaea Alroobaea, Abdullah M. Baqasah, Majed Alsafyani, and Afnan Alhazmi. "SkinEHDLF: a hybrid deep learning approach for accurate skin cancer classification in complex systems." Scientific Reports 15 (2025): 14913.

Manzoor, Khadija, Nauman U. Gilal, Marco Agus, and Jens Schneider. "Dual-stage segmentation and classification framework for skin lesion analysis using deep neural network." Digital Health 11 (2025): 20552076251351858.

Ieracitano, Cosimo, Francesco Carlo Morabito, Amir Hussain, Muhammad Suffian, and Nadia Mammone. "TIxAI: A Trustworthiness Index for eXplainable AI in skin lesions classification." Neurocomputing 630 (2025): 129701.

He, Kaiming, Xiangyu Zhang, Shaoqing Ren, and Jian Sun. "Deep residual learning for image recognition." *CVPR* (2016).

Esteva, Andre, Brett Kuprel, Roberto A. Novoa, Justin Ko, Susan M. Swetter, Helen M. Blau, and Sebastian Thrun. "Dermatologist-level classification of skin cancer with deep neural networks." *Nature* 542, no. 7639 (2017): 115–118.

Liu, Yuan, Ayush Jain, Connie Eng, et al. "A deep learning system for differential diagnosis of skin diseases." *Nature Medicine* 26, no. 6 (2020): 900–908.

Tschandl, Philipp, Cliff Rosendahl, and Harald Kittler. "The HAM10000 dataset: A large collection of dermatoscopic images." *Scientific Data* 5 (2018): 180161.

Codella, Noel C. F., David Gutman, M. Emre Celebi, et al. "Skin lesion analysis toward melanoma detection." *IEEE ISBI Conference* (2018): 168–172.

Brinker, Titus J., Achim Hekler, Alexander H. Enk, et al. “Deep learning outperformed dermatologists in melanoma classification.” *European Journal of Cancer* 119 (2019): 11–17.

Ravi, Daniele, Charence Wong, Fani Deligianni, et al. “Deep learning for health informatics.” *IEEE Computer* 50, no. 2 (2017): 28–35.

Topol, Eric J. "High-performance medicine: the convergence of human and artificial intelligence." *Nature medicine* 25, no. 1 (2019): 44-56.

Yu, Kun-Hsing, Andrew L. Beam, and Isaac S. Kohane. "Artificial intelligence in healthcare." *Nature biomedical engineering* 2, no. 10 (2018): 719-731.

Litjens, Geert, Thijs Kooi, Babak Ehteshami Bejnordi, Arnaud Arindra Adiyoso Setio, Francesco Ciompi, Mohsen Ghafoorian, Jeroen Awm Van Der Laak, Bram Van Ginneken, and Clara I. Sánchez. "A survey on deep learning in medical image analysis." *Medical image analysis* 42 (2017): 60-88.

Ronneberger, Olaf, Philipp Fischer, and Thomas Brox. "U-net: Convolutional networks for biomedical image segmentation." In *International Conference on Medical image computing and computer-assisted intervention*, pp. 234-241. Cham: Springer international publishing, 2015.

Long, Jonathan, Evan Shelhamer, and Trevor Darrell. "Fully convolutional networks for semantic segmentation." In *Proceedings of the IEEE conference on computer vision and pattern recognition*, pp. 3431-3440. 2015.

Malik, Paras, Monika Pathania, and Vyas Kumar Rathaur. "Overview of artificial intelligence in medicine." *Journal of family medicine and primary care* 8, no. 7 (2019): 2328-2331.

Liu, Jiaying, Wenhan Yang, Xinfeng Zhang, and Zongming Guo. "Retrieval compensated group structured sparsity for image super-resolution." *IEEE Transactions on Multimedia* 19, no. 2 (2016): 302-316.

Perez, Luis, and Jason Wang. "The effectiveness of data augmentation in image classification using deep learning." *arXiv preprint arXiv:1712.04621* (2017).

Xie, Fengying, Haidi Fan, Yang Li, Zhiguo Jiang, Rusong Meng, and Alan Bovik. "Melanoma classification on dermoscopy images using a neural network ensemble model." *IEEE transactions on medical imaging* 36, no. 3 (2016): 849-858.

Yuan, Yading, Ming Chao, and Yeh-Chi Lo. "Automatic skin lesion segmentation using deep fully convolutional networks with jaccard distance." *IEEE transactions on medical imaging* 36, no. 9 (2017): 1876-1886.

Mahbod, Amirreza, Gerald Schaefer, Chunliang Wang, Rupert Ecker, and Isabella Ellinge. "Skin lesion classification using hybrid deep neural networks." In *ICASSP 2019-2019 IEEE international conference on acoustics, speech and signal processing (ICASSP)*, pp. 1229-1233. IEEE, 2019.

Winkler, Julia K., Christine Fink, Ferdinand Toberer, Alexander Enk, Teresa Deinlein, Rainer Hofmann-Wellenhof, Luc Thomas et al. "Association between surgical skin markings in dermoscopic images and diagnostic performance of a deep learning convolutional neural network for melanoma recognition." *JAMA dermatology* 155, no. 10 (2019): 1135-1141.

Han, Seung Seog, Myoung Shin Kim, Woohyung Lim, Gyeong Hun Park, Ilwoo Park, and Sung Eun Chang. "Classification of the clinical images for benign and malignant cutaneous tumors using a deep learning algorithm." *Journal of Investigative Dermatology* 138, no. 7 (2018): 1529-1538.