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Skin Cancer Image Segmentation using Convolutional Neural Network with Tensorflow

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***Abstract*— Skin cancer is one of the most common cancers worldwide, and its occurrence is increasing rapidly due to excessive exposure to ultraviolet (UV) radiation, environmental changes, and unhealthy lifestyles. Early detection is very important because it improves treatment success and survival rates. Traditional diagnosis methods such as dermoscopy and biopsy are costly, time-consuming, and require expert doctors. To overcome these challenges, this project proposes a web-based skin cancer detection system using deep learning techniques. The system is developed using Flask as the backend framework and uses a Convolutional Neural Network (CNN) for image classification. TensorFlow and Keras are used to train the model with dermoscopic skin images. Users can register, log in, and upload skin images through a simple interface. The uploaded image is preprocessed and analysed by the CNN model to predict the type of skin cancer in real time. The system also provides basic treatment suggestions to create awareness among users. MySQL is used to securely store user and login details. An admin module is included to manage user information efficiently. Additionally, a chatbot feature is integrated to answer user queries instantly. The proposed system provides a fast, reliable, and accessible method for preliminary skin cancer screening. Although it does not replace professional medical diagnosis, it acts as a supportive tool for early detection and awareness. By combining artificial intelligence with web technologies, the system improves accuracy, efficiency, and accessibility in skin cancer detection.**

Keywords— Skin Cancer Detection, Convolutional Neural Network (CNN), Image Classification, Deep Learning, Flask Web Application, Medical Image Analysis

I. INTRODUCTION

I.1 Background of Skin Cancer Detection

Skin cancer is one of the most common types of cancer affecting people worldwide, primarily caused by prolonged exposure to ultraviolet (UV) radiation from the sun. It leads to the abnormal growth of skin cells and can become life-threatening if not detected at an early stage. Common types of skin cancer include basal cell carcinoma, squamous cell carcinoma, and melanoma. Early diagnosis plays a vital role in improving survival rates and reducing treatment complexity. However, in many cases, early detection is difficult due to lack of awareness and limited access to dermatological expertise[1].

1.2 Limitations of Traditional Diagnosis Methods

Traditional methods for detecting skin cancer involve physical examination, dermoscopic analysis, and biopsy procedures performed by dermatologists. These methods are often time-consuming, expensive, and require expert knowledge. In addition, manual diagnosis may lead to human errors and inconsistencies, especially when dealing with large numbers of patients. The increasing demand for faster and more accurate diagnosis highlights the need for automated systems that can assist medical professionals[2].

1.3 Role of Machine Learning in Skin Cancer Detection

Machine learning and deep learning techniques have emerged as powerful tools in medical image analysis. In particular, Convolutional Neural Networks (CNNs) are widely used for image classification tasks due to their ability to automatically extract features from images. These models can analyze skin lesion images and classify them into different categories of skin cancer with high accuracy. By leveraging large datasets, machine learning models can identify patterns that are not easily visible to the human eye[3].

1.4 Challenges in Skin Cancer Prediction

Despite the advantages of machine learning, several challenges exist in skin cancer prediction. Variations in image quality, lighting conditions, and skin tone can affect model performance. Additionally, medical datasets may contain imbalanced data, where some cancer types have fewer samples than others. This can

lead to biased predictions and reduced accuracy. Ensuring proper preprocessing and model training is essential to overcome these challenges.

1.5 Proposed Deep Learning-Based System

To address these challenges, this project proposes a web-based skin cancer prediction system using a deep learning model. The system allows users to upload skin images, which are then processed and analyzed by a trained CNN model. The model predicts the type of skin cancer and provides corresponding treatment suggestions. The system is developed using Flask for backend processing and integrates a database for user management, making it a complete and user-friendly application.

1.6 Objectives and Contributions

The main objective of this project is to develop an efficient and accurate system for skin cancer detection using machine learning techniques. The proposed system aims to provide quick predictions, improve early diagnosis, and reduce dependency on manual methods. It contributes to the healthcare domain by combining image processing, deep learning, and web technologies to create an intelligent diagnostic support system. The system can be used as a preliminary screening tool to assist both patients and medical professionals.

1.7 Scope of the System

The scope of the proposed skin cancer prediction system is to provide an efficient and accessible tool for the early detection of various types of skin cancer using image-based analysis. The system is designed to assist users in identifying potential skin diseases by allowing them to upload images through a web-based interface. It processes the input image using a trained deep learning model and provides instant predictions along with basic treatment suggestions.

I. LITERATURE REVIEW

Skin cancer detection has gained significant attention in recent years due to the increasing number of cases worldwide and the need for early diagnosis. Traditional diagnostic methods rely on visual inspection and dermoscopic analysis performed by dermatologists. Although these methods are widely used, they are often time-consuming and depend heavily on the expertise of medical professionals. As a result, researchers have explored automated approaches using machine learning and deep learning techniques to improve the accuracy and efficiency of skin cancer detection. Recent advancements in machine learning have enabled the development of intelligent systems capable of analyzing medical images and classifying skin lesions. Supervised learning algorithms such as Support Vector Machines (SVM), Decision Trees, and Random Forest have been applied to classify skin cancer based on extracted features from images. Among these, Random Forest has shown good performance due to its robustness and ability to handle complex datasets. However, these traditional machine learning methods often require manual feature extraction, which can limit their effectiveness[4].

Deep learning approaches, particularly Convolutional Neural Networks (CNNs), have significantly improved the performance of skin cancer classification systems. CNN models automatically extract relevant features from images and learn complex patterns, making them highly suitable for medical image analysis. Various studies have demonstrated that CNN-based models achieve higher accuracy compared to traditional machine learning techniques. Pre-trained models and transfer learning methods have also been used to enhance performance, especially when large datasets are not available.

Despite these advancements, several challenges remain in the field of skin cancer detection. One of the major issues is the variability in skin lesion images, including differences in size, color, texture, and lighting conditions. Additionally, datasets used for training models may be imbalanced, leading to biased predictions. Noise and irrelevant features in the data can further affect model performance. Researchers have addressed these challenges using preprocessing techniques such as image normalization, data augmentation, and feature selection to improve model accuracy. Several studies have also focused on integrating machine learning models with web-based and mobile applications to make skin cancer detection more accessible. These systems allow users to upload images and receive instant predictions, providing a convenient solution for preliminary screening. However, limitations such as computational complexity, requirement of high-quality images, and lack of interpretability still exist. This project builds upon existing research by developing a web-based skin cancer prediction system using deep learning techniques. Unlike traditional methods, the proposed system focuses on automated image classification and real-time prediction through a user-friendly interface. By integrating machine learning with web technologies, the system aims to provide an efficient and accessible solution for early skin cancer detection and contribute to advancements in healthcare applications.

3. METHODOLOGY

The proposed skin cancer prediction system is designed using a structured approach that integrates deep learning, image processing, and web-based technologies to provide accurate and efficient disease classification. The system processes skin images uploaded by users, analyzes them using a trained Convolutional Neural Network (CNN) model, and generates predictions along with treatment recommendations. The methodology consists of multiple stages, each contributing to the overall performance and reliability of the system[5].

3.1 Data Collection

The first step in the methodology involves collecting a dataset of skin lesion images representing different types of skin cancer. The dataset includes images of various categories such as Basal Cell Carcinoma, Squamous Cell Carcinoma, Merkel Cell Carcinoma, and other related diseases. These images are obtained from standard medical datasets and online repositories to ensure diversity and quality. Each image is labeled according to its respective class, enabling supervised learning during model training[6].

3.2 Data Preprocessing

Raw medical images often contain noise, inconsistencies, and variations in size and resolution. Therefore, preprocessing is performed to improve the quality of the input data. All images are resized to a fixed dimension (e.g., 200×200 pixels) to match the input size required by the CNN model. Image normalization is applied to scale pixel values, ensuring uniformity across the dataset. In addition, unnecessary background information is reduced to focus on the region of interest. These preprocessing steps help improve model accuracy and training efficiency[7].

3.3 Model Development using CNN

A Convolutional Neural Network (CNN) is used for the classification of skin cancer images due to its ability to automatically extract spatial features from images. The CNN model consists of multiple layers such as convolutional layers, pooling layers, and fully connected layers.

- The **convolutional layers** extract important features such as edges, textures, and patterns from the input images.
- The **pooling layers** reduce the dimensionality of feature maps, improving computational efficiency.
- The **fully connected layers** perform classification based on the extracted features. The model is trained using labelled data, where it learns to differentiate between various skin cancer types.

The trained model is saved as a .h5 file and later loaded into the system for real-time prediction.

3.4 Image Prediction Process

Once the model is trained, it is integrated into the web application. When a user uploads an image, the system reads the image using OpenCV and preprocesses it to match the required input format. The processed image is then passed to the trained CNN model, which predicts the probability of each class. Based on the highest probability, the system identifies the corresponding type of skin cancer and displays the result to the user[8].

3.5 Treatment Recommendation

After classification, the system provides basic treatment suggestions corresponding to the predicted disease. These recommendations are predefined in the system and include options such as medication, therapy, or surgical procedures. This feature helps users gain awareness about possible treatments, although it is not intended to replace professional medical advice[9].

3.6 System Implementation

The entire system is implemented as a web application using the Flask framework in Python. The frontend is developed using HTML and CSS to provide a simple and user-friendly interface. The backend handles user requests, processes images, and interacts with the trained model.

The system also includes:

- User module (registration and login)
- Admin module (view user details)
- Database integration using MySQL

Additionally, a chatbot is integrated using Chatter Bot to provide basic interaction and information to users.

3.7 Workflow of the System

The workflow of the system follows a sequential process starting from user interaction to result generation. Initially, the user logs into the system and uploads a skin image. The uploaded image undergoes preprocessing and is passed to the trained CNN model. The model analyses the image and predicts the type of skin cancer. The result, along with treatment suggestions, is then displayed on the user interface. This workflow ensures smooth and efficient operation of the system[10].

3.8 Performance Evaluation

The performance of the model is evaluated based on its ability to correctly classify different types of skin cancer. The model is tested using sample images, and its accuracy is analysed. The results indicate that the CNN model provides reliable predictions when trained with properly pre-processed data. The system demonstrates good performance in identifying various skin diseases, making it suitable for preliminary diagnosis.

3.9 Machine Learning Techniques

The proposed system uses advanced machine learning and deep learning techniques for accurate skin cancer detection. The primary technique used is the Convolutional Neural Network (CNN), which is highly effective for image classification tasks. CNN automatically extracts important features such as edges, textures, and patterns from skin images without the need for manual feature extraction. In addition to CNN, image preprocessing techniques are applied using OpenCV, including image resizing, normalization, and noise reduction to improve data quality and model performance. The model is developed and trained using TensorFlow and Keras, which provide efficient tools for building and deploying deep learning models. The system follows a supervised learning approach, where the model is trained on labelled skin image datasets to classify different types of skin cancer. The prediction is based on probability scores, and the class with the highest probability is selected as the final output. These techniques together ensure accurate, fast, and reliable skin cancer prediction[7].

II. RESULTS

The implementation of the proposed skin cancer prediction system is carried out using a combination of deep learning, image processing, and web technologies. The system is developed as a web-based application that allows users to interact easily and obtain real-time predictions. The implementation focuses on integrating the trained CNN model with a user-friendly interface to ensure efficient and accurate performance.

4.1 System Implementation

The proposed skin cancer prediction system is implemented using Python with the Flask framework to develop a web-based application. The system provides an interactive interface where users can register, log in, and upload skin images for analysis. The frontend is designed using HTML and CSS to ensure simplicity and ease of use, while the backend handles all processing tasks incluing image handling, model prediction, and database interaction. The overall implementation ensures smooth communication between the user interface and the underlying deep learning model.

4.2 Model Integration

The trained Convolutional Neural Network (CNN) model is integrated into the application by loading the saved .h5 file using TensorFlow and keras. During execution, when a user uploads an image, it is first processed and then passed to the model for prediction. The model analyses the image and produces output values corresponding to different classes. Based on these outputs, the system determines the predicted skin cancer type. This integration enables real-time prediction within the web application.

4.3 Image Processing

Image processing is carried out using OpenCV to ensure that all input images are in a suitable format for the CNN model. The uploaded images are resized to a fixed dimension and normalized to maintain consistency. This step helps in improving the clarity of important features and reduces variations in the dataset. Proper preprocessing plays a significant role in enhancing the accuracy of the model and ensures reliable predictions.

4.4 Database Implementation

The system uses MySQL as the database for storing user information such as registration details and login credentials. efficient storage and retrieval of data. It supports user authentication and ensures that only authorized users can access the system. The admin module is also implemented to monitor and manage user data effectively.

4.5 Performance Analysis

The performance of the system is evaluated based on its prediction accuracy and efficiency. The CNN model demonstrates good performance when tested with sample images.The preprocessing techniques and model training contribute to improved accuracy. The system is capable of handling real-time inputs and generating reliable results.

4.6 Role of Algorithms in the System

The combination of CNN, image preprocessing, and deep learning frameworks forms a powerful system for skin cancer detection. Each component contributes to improving accuracy, efficiency, and user experience.

- OpenCV → Input processing
- CNN → Core classification engine
- TensorFlow/keras → Model execution
- Flask → Web integration

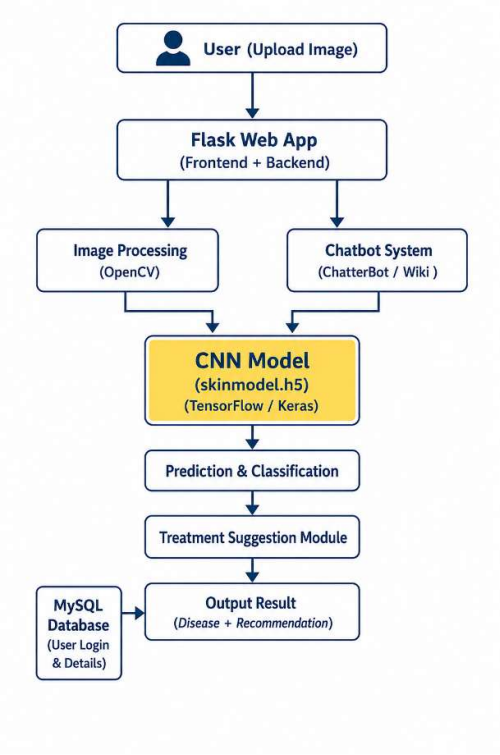

Figure 1 : Overview of proposed research work

4.6 Output Screenshots

The system interface includes different modules such as user login, registration, and prediction page. The prediction page allows users to upload an image and view results instantly.

The output displays:

- Predicted skin cancer type
- Suggested treatment
- User-friendly interface

III. CONCLUSION

The proposed Skin Cancer Prediction System effectively demonstrates the application of deep learning techniques in the domain of medical image analysis. By utilizing a Convolutional Neural Network (CNN), the system is capable of accurately analysing skin images and classifying them into different types of skin cancer. The use of image preprocessing techniques through OpenCV ensures that the input data is standardized and of high quality, which significantly contributes to improved prediction accuracy and consistency. The system is implemented as a web-based application using the Flask framework, providing a simple and user-friendly interface for users to interact with the system. Users can easily upload images and obtain real-time predictions, making the system

both accessible and efficient. The integration of a MySQL database enables secure storage and management of user information, while the inclusion of a chatbot module enhances user experience by providing additional support and information. The results obtained from the system indicate that it performs reliably in classifying skin cancer images and delivering fast responses. The combination of deep learning and web technologies ensures that the system operates smoothly and efficiently in real-time scenarios. This makes the application suitable for preliminary screening and awareness, especially in situations where immediate medical consultation may not be available. Furthermore, the project highlights the importance of integrating artificial intelligence in healthcare to improve diagnostic processes. It demonstrates how advanced technologies can reduce manual effort, minimize errors, and provide quick insights into medical conditions. Although the system is not intended to replace professional medical diagnosis, it serves as a valuable support tool for early detection and decision-making. In conclusion, the developed system provides an effective, scalable, and user-friendly solution for skin cancer prediction. It lays a strong foundation for future improvements and real-world implementation, contributing to the advancement of intelligent healthcare systems and promoting early diagnosis for better treatment outcomes.

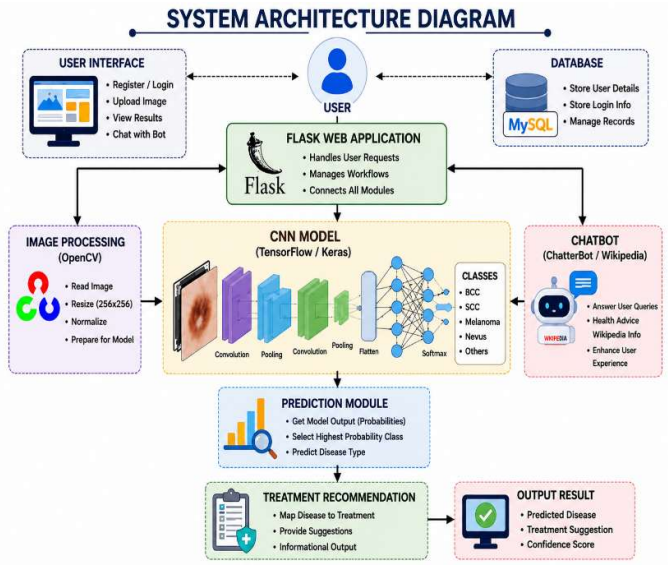

Figure 2 : System Architecture Diagram

IV. FUTURE SCOPE

The proposed Skin Cancer Prediction System provides a strong foundation for further enhancements and advancements in the field of intelligent healthcare applications.

6.1 Dataset Enhancement

- The accuracy and reliability of the proposed system can be significantly improved by expanding the dataset used for training the model.
- At present, the system is trained with a limited number of skin images, which may restrict its ability to generalize effectively across different real-world conditions.
- By incorporating a larger dataset that includes images of various skin tones, lighting conditions, and stages of skin diseases, the model can learn more diverse features.
- This enhancement will enable the system to perform better in identifying complex patterns and provide more accurate predictions in practical applications.

6.2 Advanced Deep Learning Techniques

- The current system uses a Convolutional Neural Network for classification; however, its performance can be further enhanced by adopting advanced deep learning techniques.
- Methods such as transfer learning can be applied to leverage pre-trained models, which helps in improving accuracy and reducing training time.
- Additionally, implementing more advanced architectures can allow the system to capture deeper and more complex features from images.
- These improvements will make the model more efficient and capable of handling challenging classification tasks.

6.3 Mobile Application Development

- In order to increase accessibility and user convenience, the system can be developed into a mobile application.
- A mobile-based platform will allow users to capture images directly from their smartphones and receive instant predictions.
- This will make the system more practical and user-friendly, especially for individuals in remote or rural areas where access to medical facilities is limited.
- The portability of a mobile application can greatly enhance the reach and usability of the system.

6.4 Data Security and Privacy

- As the system involves handling sensitive user information, ensuring strong data security and privacy measures is essential.
- Future improvements can include the implementation of secure authentication methods, encrypted data storage, and safe data transmission protocols.
- These measures will protect user data from unauthorized access and build trust among users.
- Maintaining privacy is particularly important in healthcare applications, where confidentiality plays a critical role.

6.5 Mask R-CNN Based Segmentation

In future, the system can be enhanced by incorporating Mask R-CNN (Region-Based Convolutional Neural Network) to improve the accuracy of skin cancer detection. Unlike traditional CNN models that classify the entire image, Mask R-CNN enables precise segmentation of the affected skin region, allowing the system to focus only on the lesion area.

- This helps in extracting more relevant features and reduces the impact of background noise.
- By identifying the exact boundaries of the infected region, the model can provide more accurate and reliable predictions.
- Additionally, this approach can offer visual representation of the detected area, making the results more interpretable for users and medical professionals.
- Integrating Mask R-CNN will significantly enhance the performance, precision, and practical usability of the system in real-world healthcare applications.

REFERENCES

[1] H. Benbrahim, H. Hachimi, and A. Amine, "Deep convolutional neural network with tensorflow and keras to classify skin cancer images," *Scalable Computing: Practice and Experience,* vol. 21, no. 3, pp. 379-390, 2020.

[2] A. Panja, J. J. Christy, and Q. M. Abdul, "An approach to skin cancer detection using Keras and Tensorflow," in *Journal of Physics: Conference Series*, 2021, vol. 1911, no. 1: IOP Publishing, p. 012032.

[3] J. O. Emuoyibofarhe, D. Ajisafe, R. S. Babatunde, and M. Christoph, "Early Skin Cancer Detection Using Deep Convolutional Neural Networks on Mobile Smartphone," *International Journal of Information Engineering & Electronic Business,* vol. 12, no. 2, 2020.

[4] A. Dogga, S. R, and S. S, "Hybrid vision transformer and graph neural network model with region-adaptive attention for enhanced skin cancer prediction," *Scientific Reports,* vol. 16, no. 1, p. 5385, 2026.

[5] M. Z. Alom, T. Aspiras, T. M. Taha, and V. K. Asari, "Skin cancer segmentation and classification with improved deep convolutional neural network," in *Medical Imaging 2020: Imaging informatics for healthcare, research, and applications*, 2020, vol. 11318: SPIE, pp. 291-301.

[6] M. M. Mijwil, "Skin cancer disease images classification using deep learning solutions," *Multimedia Tools and Applications,* vol. 80, no. 17, pp. 26255-26271, 2021.

[7] H. Chauhan, D. Jain, K. Kumar, and K. Sharma, "Skin Cancer Classification Using Machine Learning," in *2026 5th International Conference on Innovative Practices in Technology and Management (ICIPTM)*, 2026: IEEE, pp. 1-6.

[8] L. Sahukar, B. V. Yerra, V. Kasi, and R. Mandaloju, "DeepSkin: A Deep Learning Approach for Skin Cancer Classification and Detection," *International Journal of Data Science and IoT Management System,* vol. 5, no. 2, pp. 1080-1091, 2026.

[9] V. A. V. Romo, E. D. G. Garcia, C. G. N. Dino, J.-M. Mejía-Muñoz, J. D. D. Roman, and S. V. T. Arguelles, "Decision Support System in Smart Healthcare: System for Diagnosis of Skin Cancer Using Deep Learning," in *Decision Support Systems for Industrial and Scientific Applications*: Springer, 2026, pp. 91-108.

[10] I. S. Rajput, A. Kumar, J. S. Koranga, M. Papola, T. Bisht, and T. P. Singh, "An explainable fine-tuned transfer learning approach for multi-classification of skin cancer disease," *Engineering Applications of Artificial Intelligence,* vol. 177, p. 114972, 2026.