



Monkeypox Detection using Modified VGG16 & Custom CNN Model

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Abstract- Monkeypox is a contagious viral disease that has recently gained global attention due to its rapid spread and similarity to other skin-related infections. Early and accurate detection of monkeypox is crucial to control outbreaks and provide timely medical treatment. However, traditional diagnostic methods rely heavily on laboratory testing and expert analysis, which can be time-consuming, expensive, and not easily accessible in all regions.

To address these challenges, this paper proposes an automated monkeypox detection system using advanced deep learning techniques. The proposed approach combines a Modified VGG16 model with a Custom Convolutional Neural Network (CNN) to effectively classify skin lesion images into Monkeypox and Normal categories. The system utilizes image preprocessing techniques such as resizing, normalization, and noise removal, along with data augmentation methods like rotation, flipping, and zooming to improve model robustness and handle dataset limitations.

The Modified VGG16 model leverages transfer learning to extract deep and meaningful features from images, while the Custom CNN is designed to capture specific patterns in the dataset. Experimental results demonstrate that the proposed system achieves high accuracy, with Modified VGG16 reaching approximately 98% accuracy and the Custom CNN achieving up to 99% accuracy. These results highlight the effectiveness of the hybrid approach in improving classification performance.

Overall, the proposed system provides a fast, reliable, and scalable solution for monkeypox detection. It can assist healthcare professionals in early diagnosis, reduce manual effort, and support better decision-making, especially in resource-limited environments.



I. INTRODUCTION

Monkeypox is an emerging viral disease that has become a global health concern due to its rapid spread and similarity to other skin-related infections. It is primarily transmitted through close contact with infected individuals and is characterized by symptoms such as fever, rashes, and skin lesions. Early detection of monkeypox is essential to prevent further transmission and to provide timely medical treatment. However, traditional diagnostic methods rely on laboratory testing and clinical expertise, which can be time-consuming, costly, and not always accessible in remote or resource-limited areas.

In recent years, Artificial Intelligence (AI) and Deep Learning have played a significant role in transforming the healthcare sector, especially in medical image analysis. Deep learning models, particularly Convolutional Neural Networks (CNNs), have demonstrated high accuracy in image classification tasks by automatically extracting meaningful features from images. These models eliminate the need for manual feature extraction and provide faster and more reliable results.

Transfer learning techniques, such as VGG16, have further enhanced the performance of deep learning systems by utilizing pre-trained models that are capable of identifying complex patterns in images. By combining transfer learning with custom-designed CNN architectures, it is possible to build efficient systems that perform well even with limited datasets.

In this paper, a deep learning-based approach is proposed for the detection of monkeypox using a combination of Modified VGG16 and a Custom CNN model. The system processes input skin images, applies preprocessing techniques, and classifies them into monkeypox or normal categories. The main objective of this work is to develop an accurate, efficient, and automated detection system that can assist healthcare professionals in early diagnosis and reduce the overall burden on medical infrastructure.

II. LITERATURE SURVEY

Recent studies show that deep learning models are widely used for disease detection:

- Transfer learning models like VGG16 and ResNet are commonly used for medical image classification.
- CNN-based approaches provide better feature extraction compared to traditional machine learning methods.
- Existing monkeypox detection research achieved around 97% accuracy using VGG16 but faced issues like limited datasets and lack of generalization.

Despite advancements, challenges such as dataset limitations, computational cost, and model interpretability still exist.

III. PROBLEM DEFINITION, PROPOSED METHODOLOGY

Monkeypox is a viral disease that shows symptoms similar to other skin infections, making accurate detection difficult. Early diagnosis is important to control its spread, but traditional methods rely on laboratory tests and expert analysis, which are time-consuming and not easily accessible. Challenges such as limited datasets, similarity between diseases, and delays in manual diagnosis highlight the need for an automated detection system.

To address this, a deep learning-based approach is proposed using Modified VGG16 and a Custom CNN model. The system starts with data collection, followed by preprocessing steps like resizing, normalization, and noise removal. Data augmentation techniques such as rotation and flipping are applied to improve model performance.

The Modified VGG16 model is used for feature extraction through transfer learning, while the Custom CNN captures additional patterns in the images. Both models are trained using labeled data and then used to classify images into monkeypox or normal categories. The system is evaluated using metrics like accuracy, precision, recall, and F1-score.

This approach provides a fast, accurate, and reliable solution for early monkeypox detection and reduces dependency on manual diagnosis.

IV. ARCHITECTURE

The proposed system uses a deep learning-based architecture combining Modified VGG16 and a Custom CNN model for monkeypox detection. The process starts with input skin images, which are preprocessed using resizing, normalization, and noise removal.



Data augmentation techniques such as rotation and flipping are applied to improve model performance. The processed images are then passed to the feature extraction stage, where Modified VGG16 extracts deep features using transfer learning, and the Custom CNN captures additional patterns.

The extracted features are fed into fully connected layers for classification. Finally, the system predicts whether the image is Monkeypox or Normal.

This architecture ensures accurate and efficient detection suitable for real-time applications.

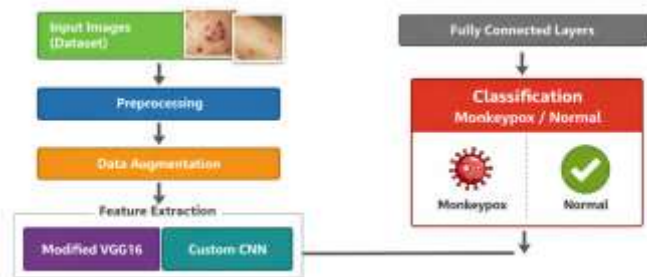


Fig: Project Architecture of Deep Learning-Based Monkeypox Detection Using Modified VGG16 and Custom CNN

DEEP LEARNING ALGORITHM

proposed system uses deep learning algorithms to detect monkeypox from skin images. Convolutional Neural Networks (CNNs) are used as they can automatically extract important features from images.

A **Modified VGG16** model is used for transfer learning to extract deep features, while a **Custom CNN** captures specific patterns of monkeypox lesions. Both models are trained using the **Adam optimizer** and **categorical cross-entropy loss function**.

This approach ensures accurate and efficient classification of images into monkeypox and normal categories.

V. CONCLUSION & FUTURE SCOPE

This paper presents a comprehensive deep learning-based approach for monkeypox detection using a combination of Modified VGG16 and a Custom Convolutional Neural Network (CNN) model. The proposed system effectively classifies skin images into monkeypox and normal categories with high accuracy and reliability. Image preprocessing techniques such as resizing, normalization, and noise removal are applied to improve input quality, while data augmentation methods like rotation, flipping, and zooming help in increasing dataset diversity and reducing overfitting.

The Modified VGG16 model, based on transfer learning, plays a significant role in extracting deep and meaningful features from images, even when the dataset is limited. In addition, the Custom CNN is designed to capture specific spatial patterns and characteristics of monkeypox lesions. The combination of these two models enhances the overall performance, making the system more robust and efficient.

The proposed approach reduces dependency on traditional diagnostic methods, which are often time-consuming and require expert intervention. It provides a faster, automated, and cost-effective solution for early detection of monkeypox. This can help healthcare professionals in making quick and accurate decisions, ultimately contributing to better disease control and timely treatment. The system is simple, scalable, and suitable for real-world healthcare applications, especially in areas with limited medical resources.

In the future, the system can be improved by using larger and more diverse datasets to increase accuracy and generalization across different conditions. It can also be developed into a real-time mobile or web-based application for easy accessibility by users and healthcare providers. Integration with healthcare systems and telemedicine platforms can further enhance its practical usability.

Moreover, advanced deep learning models such as ResNet, EfficientNet, or hybrid architectures can be explored to further improve performance. The use of explainable AI techniques can provide better insights into model predictions, increasing transparency and trust. The system can also be extended to detect multiple skin diseases, making it a more versatile and powerful diagnostic tool.

Overall, the proposed work demonstrates the potential of deep learning in medical image analysis and provides a strong foundation for future advancements in automated disease detection systems.



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