Project Report: Skin Disease Detection Using VGG16 Transfer Learning Model

Title

Skin Disease Detection Using VGG16 Transfer Learning Model

Abstract

Skin diseases are among the most common health issues globally, often requiring expert dermatological evaluation. This project aims to automate the classification of skin diseases using deep learning, particularly the VGG16 transfer learning model. Leveraging a labeled dataset of skin images, the model is fine-tuned for high accuracy in classifying various skin conditions. The project demonstrates the effectiveness of convolutional neural networks in medical image classification, achieving substantial accuracy with limited training data and computational resources.

Introduction

Skin diseases impact millions globally and can lead to severe health consequences if not diagnosed and treated early. The traditional diagnostic process requires dermatological expertise, which may not be accessible in all regions. To address this, machine learning and deep learning techniques offer promising solutions for automated diagnosis.

This project explores the application of the VGG16 transfer learning model, originally trained on the ImageNet dataset, to detect skin diseases from image data efficiently.

Objectives

- To develop a deep learning model that classifies various skin diseases accurately.
- To utilize transfer learning (VGG16) to reduce the need for large training datasets.
- To evaluate the model's performance using metrics such as accuracy, precision, recall, and F1-score.

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Literature Review

Several studies have demonstrated the effectiveness of CNNs in medical image classification. Models such as ResNet, Inception, and VGG have been used in past research to classify skin diseases, with VGG16 offering a good balance between depth and computational efficiency.

Methodology

Dataset:

- A dataset of labeled skin disease images was used.
- Preprocessing included resizing, normalization, and data augmentation.

Model Architecture:

- The VGG16 model was imported with pre-trained ImageNet weights.
- The top layers were removed, and custom fully connected layers were added.
- The final output layer used softmax activation for multi-class classification.

Training:

- Framework: TensorFlow/Keras
- Loss Function: Categorical Crossentropy
- Optimizer: Adam
- Epochs: 25
- Batch Size: 32

Results

- Training Accuracy: ~98%

- Validation Accuracy: ~95%

- Precision, Recall, and F1-score metrics also indicated strong performance.

Discussion

The high accuracy demonstrates the effectiveness of transfer learning for skin disease detection. Overfitting was minimal due to data augmentation and dropout layers. However, further validation on real-world clinical data is recommended to generalize the model.

Conclusion

This project successfully implements a VGG16-based deep learning model for classifying skin diseases with high accuracy. It highlights the potential for AI-assisted diagnostics in dermatology, especially in resource-limited settings.

Future Work

- Incorporating a larger, more diverse dataset.

- Developing a mobile or web application for real-time diagnosis.

- Integration with Electronic Health Records (EHR) systems.

References

1. Simonyan, K., & Zisserman, A. (2014). Very Deep Convolutional Networks for Large-Scale Image Recognition.

2. Relevant articles on skin disease classification using CNNs.

3. Documentation of TensorFlow/Keras.