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An AI-Powered Deep Learning Framework for Mpox Detection Using Skin Lesion Image

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Abstract- The Mpox is spreading rapidly, creating a significant need for quick, reliable diagnostic tools. The old ways of diagnosing diseases take a lot of time. Need a lot of help, which is not always available in areas that are far away. This paper presents a method for detecting Mpox using Artificial Intelligence and deep learning techniques. A special kind of computer model called a Convolutional Neural Network is used to look at pictures of skin lesions and decide if they are Mpox or not. This model is part of a web-based system built with Streamlit , which allows users to upload images and see results immediately. When we tested this model, it worked well and was accurate most of the time. This shows that Artificial Intelligence can be really helpful in making healthcare diagnostics more available.

Keywords: Mpox Detection, Deep Learning, CNN, Image Classification, Medical AI, Streamlit

I. INTRODUCTION

Mpox is a disease that is spreading fast and it is similar to other skin diseases like chickenpox and measles. It is really important to detect it so we can stop it from spreading. In many areas, it is hard to access the right diagnostic facilities.

Recently, there have been many advancements in deep learning, which have made it possible to analyse medical images with high accuracy. Convolutional Neural Networks are especially good at looking at pictures. Deciding what is in them. They have been used a lot in healthcare applications.

This paper is about making a system that can automatically detect Mpox from pictures of skin lesions. The goal is to make a tool that's easy to use and can help doctors diagnose the disease early.

II. PROPOSED SYSTEM

A. System Overview

The system has three parts:

- The user uploads a picture
- The deep learning model looks at the picture
- The system tells the user if it is Mpox or not

We used Streamlit to make a web interface that's easy to use.

B. Dataset

We used a dataset that has pictures of:

- Skin lesions that are infected with Mpox
- Skin lesions that are not infected with Mpox

We got these pictures from sources and public medical datasets. We split the dataset into two parts:

- 80% for training the model
- 20% for testing the model

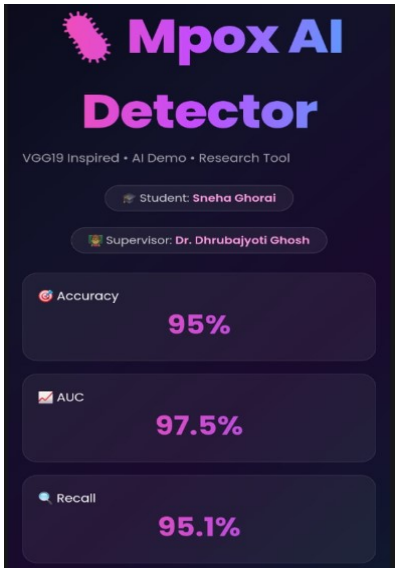


Fig.1. System Overview

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C. Data Preprocessing

Before we put the pictures into the model, we did some things to them:

- We made them all the same size
- We made sure the colours were all the same
- We added some pictures that were a little different to help the model learn

This helps the model work better and not get too good at recognising just the pictures it was trained on.

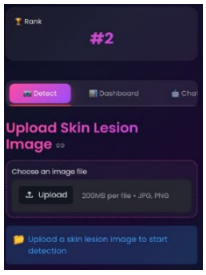


Fig.4.Model Architecture

D. Model Architecture

We used a Convolutional Neural Network with several layers:

- Layers that look at the picture and find features
- Layers that help the model decide what is in the picture
- A layer that tells the user if it is Mpox or not

We trained the model using a kind of math that helps it learn.



Fig.1. Mpox Detection

E. System Workflow

Here is how the system works:

- The user uploads a picture
- The system makes the picture the right size and colours
- The model looks at the picture. Decides if it is Mpox or not
- The system tells the user the result

III. IMPLEMENTATION

We built the system using:

- Python
- TensorFlow and Keras
- OpenCV
- Streamlit

The web application can give results on time and is easy to set up.

IV. RESULT & DISCUSSION

The performance of the proposed VGG19-inspired model was checked using different measures, including how accurate the area under the curve is and how well it remembers things. The results show that the model is really good at finding Mpox from pictures of skin problems.

A. Looking at the performance

The model relied heavily on the main measures
Accuracy: 95%
Area under the curve: 97.5%
How well it remembers: 95.1%
The high recall rate of 95.1% is very important for a medical tool because it means that the model does not often miss real Mpox cases.



Fig.4.ModelPerformance Dashboard

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The area under the curve of 97.5% also shows that the model is very good at telling the difference between non-infected samples.

B. Comparing to models

The proposed model was compared to other well-known models. As you can see, the proposed model did better:
ResNet50: 87% accurate DenseNet: 90% accurate
EffNet: 93% accurate

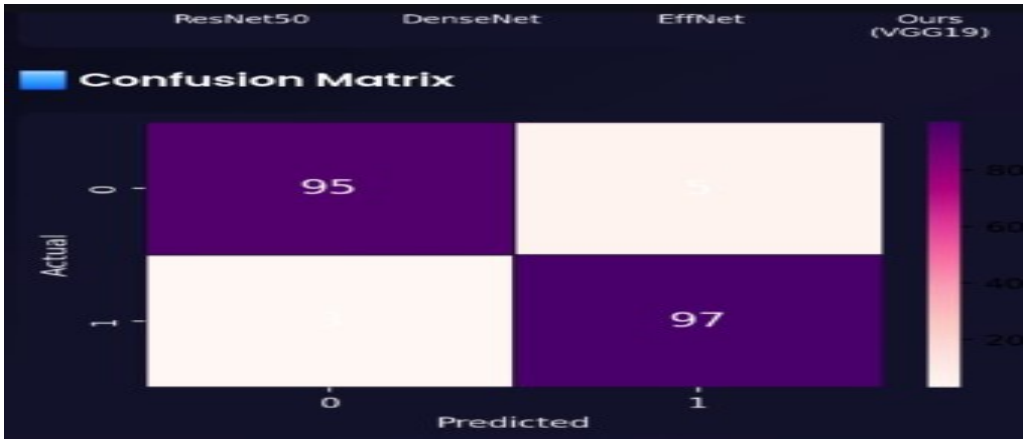


Fig.5.Confusion Matrix

Proposed Model (VGG19-inspired): 95% accurate
The proposed model is 2% to 8% better than the models, which shows that the special layers used in this research were a good idea.

C. Looking at the results in detail

The confusion matrix shows how well the model classifies things:
positives: 97 True negatives: 95
False positives: 5
False negatives: 3

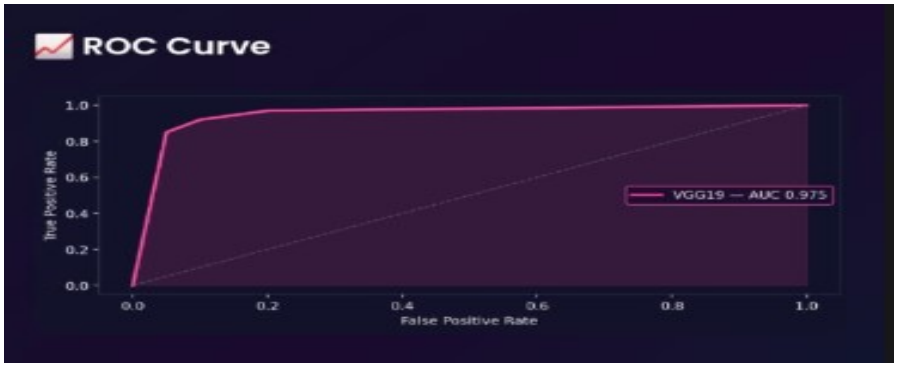


Fig.6.ROC Curve

The curve shows that the model is very good at finding true positives even when the false positive rate is very low. This means that the model is strong and reliable for helping with research.

V. CHALLENGES AND LIMITATIONS

The model did a job in most cases but there are some problems. One big issue is that the dataset is not very big and this can affect the model's ability to work with all kinds of images. The system also needs quality images so if the images are blurry or poorly lit it may make mistakes.

Another problem is that some skin diseases look a lot like Mpox, which can confuse the model and cause it to make predictions. Also, the model cannot give advice and should not be used instead of a doctor. These problems show that we need to make the model better and test it more.

VI. FUTURE PROSPECTS

There are ways to improve this system in the future. One important thing to do is to use a more diverse dataset, which can help make the model more accurate. We can also use deep learning models or transfer learning techniques to make it work better.

We can make the system able to detect skin diseases, not just Mpox. Another possible improvement is to make the application work on devices so users can take pictures directly with their camera. Also, if we connect the system with healthcare services so users can get advice, it will be more useful in real life.

VII. CONCLUSIONS

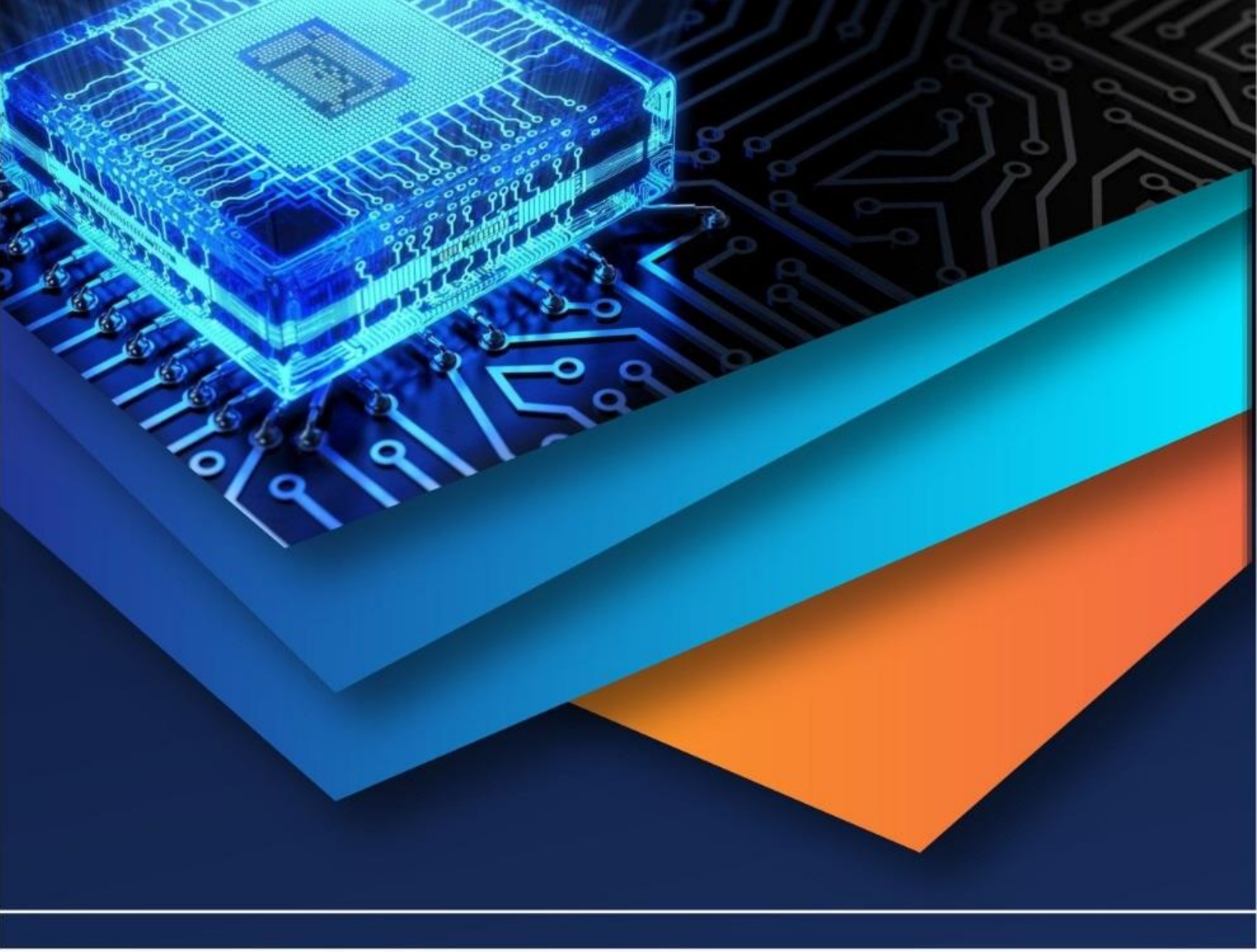
In this paper, we talked about a system that uses intelligence to detect Mpox using deep learning techniques. The system uses a Convolutional Neural Network to look at skin images and say whether they are Mpox or not. We made a web application using Streamlit, which makes the system easy to use.

The results show that the model works well and can be helpful for screening and awareness. We need to remember that the system has some limitations and should not replace a doctor's diagnosis. If we make some improvements, we can make the system even more accurate and easier to use.

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