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MONKEY POX DISEASE DETECTION AND CLASSIFICATION USING DEEP CONVOLUTION NEURAL NETWORK AND MODIFIED VGG-16 MODEL

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Abstract: Monkeypox is caused by the Zoonotic Orthopoxvirus, which is related to both cowpox and smallpox and is a member of the Poxviridae family. (a member of the genus Orthopoxvirus). It is mostly spread by primates and rodents, but human-to-human transfer is also prevalent. Although the Monkeypox virus is not as lethal or infectious as COVID-19, new instances are recorded on a daily basis from all over the globe. As a result, it will come as no surprise if the world experiences another global epidemic due to a dearth of effective preventative measures. As a consequence, because the Monkeypox-related disease infected human skin, an image of the diseased skin can be recorded and used to further diagnosis the illness. We use the "Monkeypox2022" dataset, which is open source and can be obtained from the GitHub repository. Data collection and data enhancement techniques will be used. Deep Convolution Neural Network and VGG-16 is the method we are employing. Our concept is simple to execute because it is both cost-effective and time effective. There is no need for extensive PCR or microscopy work. As a result, our proposed model could be used to evaluate real-time monitoring of people for Monkeypox pox symptoms. In this case, we want to assess temporal complexity, sensitivity, and true positive rate, as well as accuracy.

***Index Terms* - Monkey pox, Deep Convolution Neural Network, VGG-16, Data augmentation, Data collection.**

I.INTRODUCTION:

The rise of Monkeypox in 2022, as noted by several countries, shows another worldwide worry, just as the emergence of COVID-19 in 2020 did. Monkeypox is an infectious disease caused by the Zoonotic Orthopoxvirus, which has been connected to both cowpox and smallpox and is a member of the Poxviridae family (an Orthopoxvirus species). It is mostly spread by primates and rodents, but human-to-human transmission is also prevalent. The first human case of monkeypox was found in the Democratic Republic of the Congo [4]. It is transmitted through direct physical contact, animal bites, respiratory droplets, or mucus from the eyes, nostrils, or lips. Fever, body aches, and fatigue are early symptoms of Monkeypox infection, with a red bump on the skin as a long-term effect. Despite the reality that Monkeypox is not as contagious as COVID 19, the number of cases continues to rise. In West and Central Africa in 1990, there were only 50 instances of monkeypox. However, by 2020, the number of reported instances had increased to 5000. Monkeypox was believed to have only occurred in Africa in the past, but in 2022, numerous non-African countries in Europe and the United States revealed the identification of people infected with the virus.

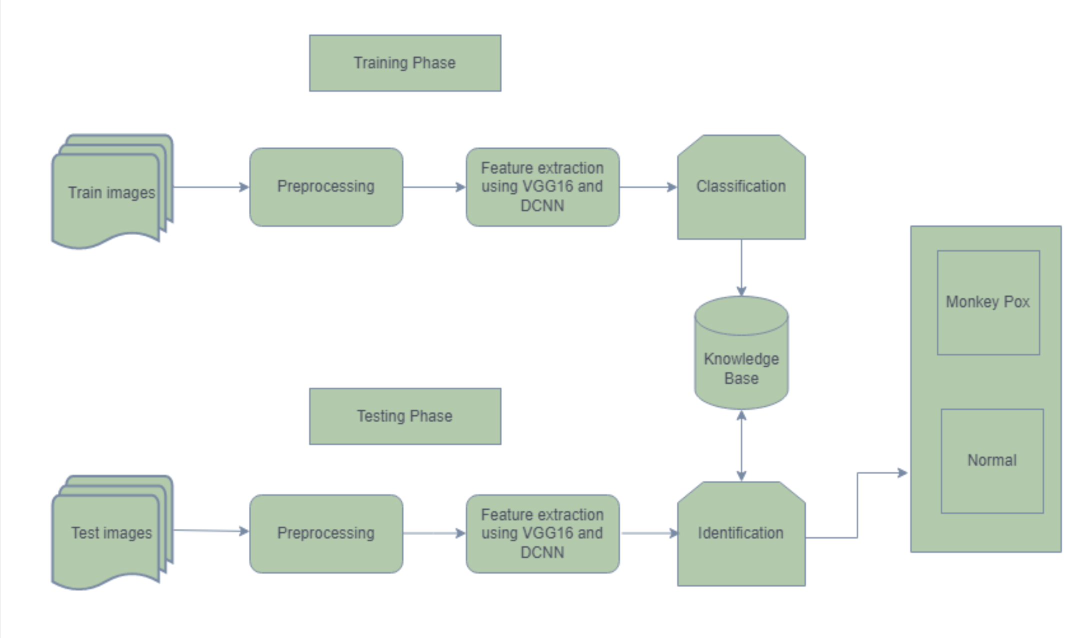
There is presently no viable therapy for the Monkeypox virus, according to the Centers for Disease Control and Prevention (CDC). Despite this, the CDC approved two dietary medicines, Brincidofovir and Tecovirimat, which were previously used to treat smallpox and are now used to treat monkeypox [10]. Vaccination, on the other hand, is the last line of defence against the Monkeypox virus. In other nations, vaccines for the smallpox virus are used to treat the monkeypox virus. Machine learning (ML) is a relatively novel branch of Artificial Intelligence (AI) that has shown potential in a wide range of applications, from decision-making tools to industrial industries to medical imaging and illness detection. Clinicians can use the specific properties of ML to accomplish secure, precise, and rapid imaging solutions, which have received global acceptance as a worthwhile decision

1.1 EXISTING MODEL

Public health is now jeopardized because of the current monkeypox outbreak's rapid expansion to more than 40 countries outside of Africa. In its early stages, monkeypox can be difficult to detect clinically since it mimics both chickenpox and measles. When confirmatory Polymerase Chain Reaction (PCR) assays are not readily available, computer-assisted monkeypox lesion detection may be beneficial for monitoring and rapid identification of suspected cases.

1.2 PROPOSED MODEL

We are using Deep learning algorithms: Deep convolutional neural networks and modified VGG-16 models to predict and detect the disease.



PROPOSED MODEL

II. RELATED WORK

[1]With the massive influx of multimodality data over the preceding decade, the significance of data analytics in health informatics has grown rapidly. This has also heightened interest in the creation of analytical, data-driven health informatics models based on machine learning.

[2]The purpose of this research is to develop an automated skin lesions categorization system with a higher classification rate by combining transfer learning theory and a pre-trained deep neural network. On the Alex-net, transfer learning has been used to fine-tune the architecture's weights, replace the classification layer with a softmax layer that works with two or three different types of skin lesions, and augment the dataset with fixed and random rotation angles.

[3] Three well-known datasets are used to evaluate and verify the proposed technique: MED-NODE, Derm (IS & Quest), and ISIC. The proposed DCNN weights were improved using the ISIC training and testing datasets, as well as MED-NODE and DermIS—DermQuest 10-fold cross validation. The metrics of accuracy, sensitivity, specificity, and precision are used to compare the suggested approach's performance to that of existing techniques.

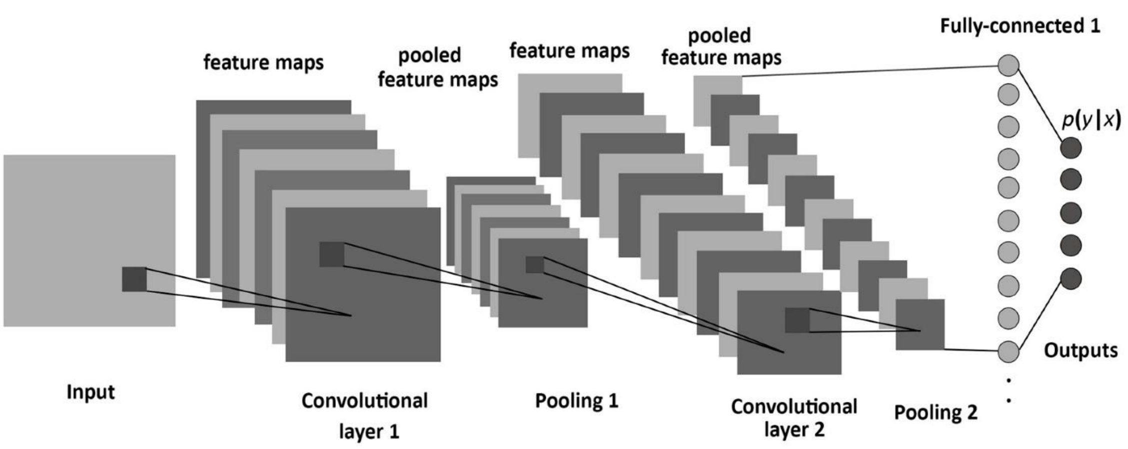
[4]Many machine learning and data mining techniques assume that the training and future data must be in the same feature area and distribution. To address this problem, transfer learning has emerged as a novel learning framework in recent years. This survey centres on classification and includes a talk of new transfer learning advancements for classification, regression, and clustering problems. In this study, we discuss the relationship between transfer learning andother pertinent machine learning methods such as domain adaptation, multitask learning, sample selection bias, and covariate shift. Furthermore, we address some possible future challenges in transfer learning studies.

[5] This survey concerns Data Augmentation, a data-space answer to the issue of limited data. Data Augmentation refers to a variety of methods for boosting the quantity and quality of training samples in order to create more powerful Deep Learning models. This overview covers image augmentation methods such as geometric transformations, color dspace augmentations, kernel filters, image mixing, and random Erasing, as well as machine learning techniques such as adversarial training, generative adversarial networks, neural style transfer, and meta-learning. In addition to augmentation methods, this research will quickly examine various facets of Data Augmentation, such as test-time augmentation, resolution effect, end dataset size, and curricular learning. This survey will cover current Data Augmentation methods, potential innovations, and meta-level Data Augmentation concerns.

III. RESEARCH METHODOLOGY

VGG16:VGG16 is a Convolutional neural network, a special sort of feed-forward artificial neural network, that models their neuronal connectivity after the visual cortex. The first step is object localization, which involves finding items in an image that belong to 200 classes. The second step is picture classification, which involves labeling each image with one of the 1000 categories.

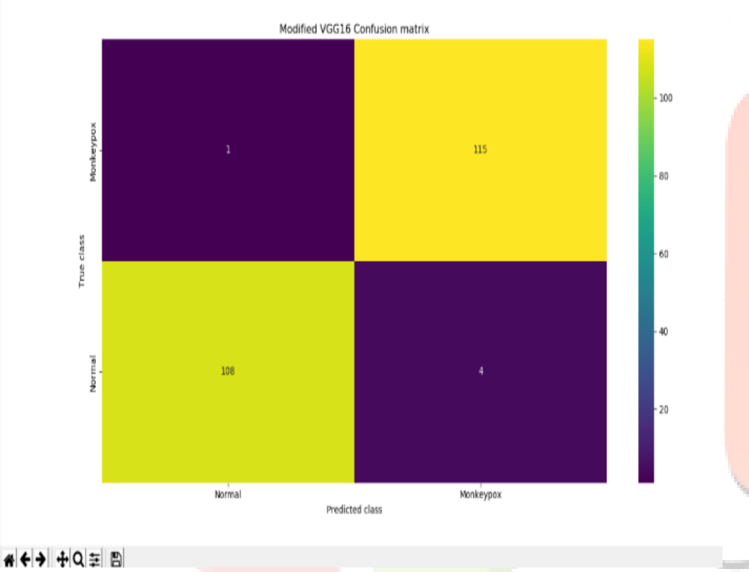
DCNN: Deep convolutional neural networks are the type most used to identify patterns in images and video. DCNNs have evolved from traditional artificial neural networks, using a three-dimensional neural pattern inspired by the visual cortex of animals. The architecture of a convolutional network typically consists of four types of layers: convolution, pooling, activation, and fully connected.

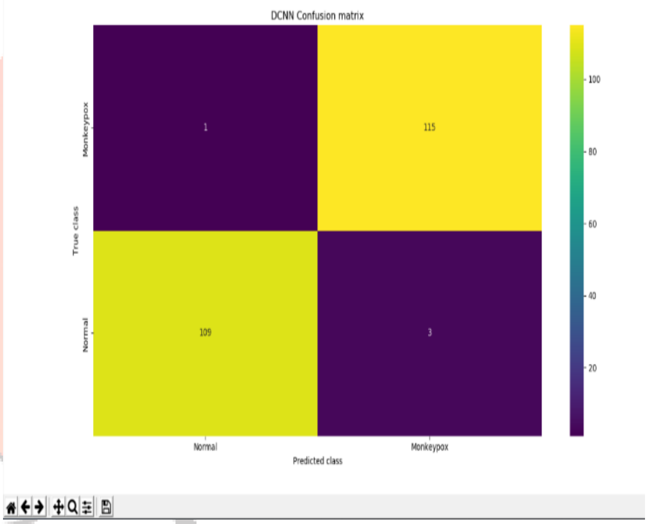


IV. RESULTS AND DISCUSSION

Once the models are trained with training images, the test images are tested with both of the algorithms and accuracy, precision, recall are found using model. A comparison graphs and tables are then built.

4.1 Confusion matrices of two models.

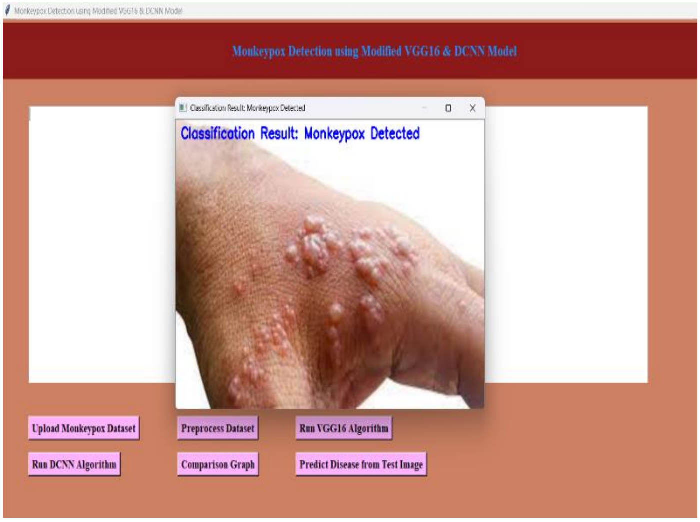


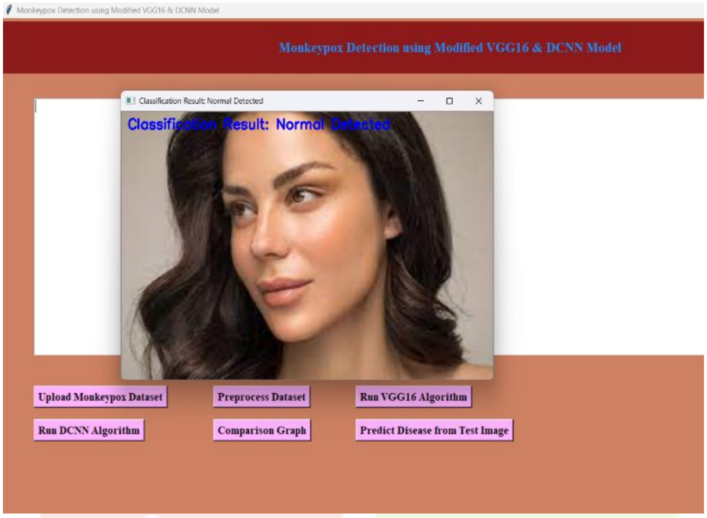


4.2 Comparison table

Algorithm Name	Accuracy	Precision	Recall	FSCORE
Modified VGG16	97.80701754385966	97.86061213476216	97.78325123152709	97.80494849330896
DCNN	98.24561403508771	98.27426810477658	98.22967980295567	98.24439824439824

4.3 Final prediction





V. CONCLUSION AND FUTURE SCOPE

In this study, we have presented Monkeypox detection using a modified VGG16 & DCNN model. The algorithms have achieved accuracies 97.8 and 98.2 respectively. Despite being a small dataset, the promising results obtained after 3-fold cross-validation reveal the potential to use AI-assisted early diagnosis of this disease. We believe that our proposed concept of the monkeypox suspects is to conduct preliminary screening from the comforts of home at the early stages of the infection.

Our model will inspire future researchers and practitioners to use the transfer learning approach in clinical diagnosis. Some of the constraints associated with our work can be overcome by continuously collecting new images of Monkeypox-infected patients, evaluating the proposed VGG16 model's performance on highly imbalanced data, and deploying our proposed model in the development of a mobile-based diagnosis tools.

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