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Detection of Malaria Using CNN and Deep learning

Manipal Reddy, Bhargav Ram, Krishna Chaitanya and Simhadri Reddy

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Manipal Reddy[1] **and Bhargav ram**[2]

[3]**Krishna Chaitanya**
[4]**Simhadri reddy**

ABSTRACT

Malaria is a life-threatening disease caused by female anopheles mosquito bitesthat are prevalent in many regions of the world. We introduce a deep convolutional neural network (CNN) to improve malaria diagnosis accuracy using patches segmented from microscopic images of red blood cell smears. We design the automatic parasite detection in blood from Giemsa-stained smears using three CNN pre-trained models such as VGG19, ResNet50, and MobileNetV2. As the CNNs are poorly performing for small datasets, we introduce the transfer learning technique. Transfer learning involves acquiring visual features from large general datasets and resolving issues using small datasets. We use a transfer learning approach to detect and classify malaria parasites with three CNN pre-trained models. We evaluated proposed CNN models experimentally using the National Institute of Health (NIH) Malaria Dataset.

Keywords: Cnn ,Deep Learning,Neural Network,VGG19, ResNet50, and MobileNetV2.

INTRODUCTION

Malaria is a deadly, infectious mosquito-borne disease caused by Plasmodium parasites. These deadly parasites c an live in your body for over a year without any problems! Thus, a delay in the right treatment can lead to complicati ons and even death. Hence early and effective testing and detection of malaria can save lives. Convolutional Neural N etwork (CNN) have the ability to automatically extract features and learn filters. A Machine Learning solution for the detection of malaria requires manual input of the parameters — for example, size, color, the morphology of the cells, whereas implementing a Convolutional Neural Network (CNN) algorithm would greatly speed up prediction time whi le mirroring (or even exceeding) the accuracy of clinicians. Malaria is a transmittable disease caused by the parasites which belong to the Plasmodium family. Malaria disease can be spread by the bite of the female mosquito. Every year around 228 million people are affected by mala ria around the globe. The number of deaths due to malaria disease is almost 4,05,000. The number of children who di ed because of malaria disease is 67 percent (2,72,000) around the globe. The Africa region is inflicted by high malaria cases and high death rates.

In general, malaria symptoms are two types: they are Uncomplicated and Severe. Uncomplicated malaria consists of symptoms like cold, hot, and sweating together with the development of the symptoms. The symptoms development are given below:

- Feeling of cold accompanied by shakings.
- Headaches, vomiting, and Fever.
- Annexation occurs in younger people.
- Sweats come when the temperature comes back to normal with exhaustion.

IN THIS PROJECT ,WE INTRODUCE THE DEFINATION OF DETECTION OF MALARIA USING DEEP LEARNING AND CNN TECHNIQUES.

LITERATURE SURVEY

Title: : A Deep Learning Model for Malaria Disease Detection and Analysis using Deep Convolutional Neural Networks. AUTHORS: Mahendra Kumar Gourisaria1 , Sujay Das 2, Ritesh Sharma3 , Siddharth Swarup Rautaray4 and Manjusha Pandey4. They proposed a model of Deep Convolutional network (DCNN) . DCNNs are capable of handling and processing audio, video and images etc. DCNN proves as a very good feature extractor among all kinds of data as it has a complex set of hidden convolutional layers within it. After training our model for 30 epochs, we have tested our model on a test dataset which is giving us an accuracy of 95.23 percent and the model is working well as a whole. We are evaluating our model in various parameters which are very important for analysis of results. 2. TITLE: A Novel Stacked CNN for Malarial Parasite Detection in Thin Blood Smear Image. Author: MUHAMMAD UMER 1 , SAIMA SADIQ 1 , MUHAMMAD AHMAD 2,3, SALEEM ULLAH 1 , GYU SANG CHOI 4 , AND ARIF MEHMOOD 5. They proposed a model a novel Stacked Convolutional Neural Network architecture that improves the automatic detection of malaria without considering the hand-crafted feature. Applying the CNN model directly to the dataset images gave a poor accuracy value of 49.61percent accuracy. It is evident from Table 5 stain normalization remarkably improved the performance of our proposed model by 50 percent. The model was trained with approximately 27000 images and achieved 97.0 percent accuracy, specificity and sensitivity which is higher than transfer learning. 3. Title : Literature Review of Disease Detection in Tomato Leaf using Deep Learning Techniques. Author : Hepzibah Elizabeth David1, Hemalatha Gunasekaran, K. Ramalakshmi, R. Venkatesan.

This paper also reviews the merits and drawbacks of the methodologies proposed. This paper finally proposes the early disease detection technique to identify tomato leaf detection using hybrid deep learning. The input image undergoes preprocessing and segmentation initially before feature extraction to avoid noises in extraction. Then the feature extraction is done in a preprocessed image, where the selected feature values from the input and the dataset are being trained with RNN. Now, image reconstruction takes place. Then the output from trained RNN is fed as an input to a hybrid CNN-RNN classifier. The classifier does the prediction and the expected outcome will be achieved. 4 Title : Air Pollution Forecasting Using CNN-LSTM Deep Learning Model. Author : Lenche Jovova, Kire Trivodaliev University . A deep learning model based on Convolutional neural network (CNN) and Long Short Term Memory (LSTM) network is developed. Additionally, a Dropout layer is added for regularization and one fully connected dense layer. LSTM neural networks are a special type of recurrent neural networks which solve the problem with longer dependencies in the data, i.e. they can remember the information from further in the past. This is achieved by a special part in the LSTM neuron called cell state. The aim of this paper is to develop a CNN-LSTM deep learning model for predicting next hour PM10 concentration from sensor data augmented with meteorological, seasonal, and temporal features. This objective is achieved using data for the city of Skopje and the final model is validated by comparing its performance with classical machine learning methods using standard evaluation metrics.

5. Title : Deep Learning Based Image Semantic Feature Analysis and Image Classification Techniques and Models. Authors : Tianyuan Yue School of Cyberspace Security Beijing University of Posts and Telecommunications Beijing, China. The relevant factors affecting the performance of convolutional neural networks and the conventional application methods of convolutional neural networks in image classification In the image preprocessing, the normalization and whitening of the image are involved; in the neural network training with the training Restrictions apply. set, the cross-validation set is usually used to determine when to stop the training, the loss function needs to be minimized in the network training, which involves the optimization of the BP algorithm, and the problems related to image classification in the convolutional layer,pooling layer, activation function and softmax regression.

Conclusion : This paper first introduces the development process of deep learning algorithms and techniques, and gives a brief introduction to the restricted Boltzmann machine model, and then focuses on the principles and application methods of convolutional neural networks and deep belief networks in the field of image classification, laying the foundation for further research later Deep learning techniques can also be applied in many fields in the future, including behavior prediction, human-machine interaction, fraud detection, etc. In recent advancements towards disease detection, particularly in the context of malaria, innovative approaches leveraging deep learning techniques have emerged. The first research paper introduces a robust Deep Convolutional Neural Network (DCNN) model for malaria detection, achieving an impressive accuracy of 95.23 on test data. The second paper proposes a novel Stacked CNN architecture, emphasizing the automatic detection of malarial parasites without relying on hand-crafted

features. Despite initial challenges, the model achieved a remarkable 97.0 percent accuracy after stain normalization. Shifting focus to agricultural applications, the third paper explores disease detection in tomato leaves using deep learning. This comprehensive review introduces a hybrid deep learning approach combining CNN and RNN for early disease detection, emphasizing its significance in agriculture. Lastly, addressing urban environmental challenges, the fourth paper introduces a CNN-LSTM deep learning model for air pollution forecasting. The model utilizes smart sensor networks, meteorological features, and historical pollution data to predict future pollution concentrations. As these studies collectively underscore the potential of deep learning in diverse domains, ranging from healthcare to agriculture and environmental monitoring, they pave the way for transformative applications in disease detection and environmental management.

1 EXPERIMENTL SETUP

1.1 HARDWARE REQUIREMENTS

Processor : Intel(R) Core(TM) i5-8265U Main Memory : 8 GB RAM
Hard Disk : 500 GB SSD
Monitor : Standard Monitor
Keyboard : Standard Keyboard
Mouse : Scroll Mouse

1.2 SOFTWARE REQUIRMENTS

Operating Systems : Windows 11
Software : GOOGLE COLAB
Browser : Google Chrome
Technologies : Python

2 IMPLEMENTATION

In this project we have to collect the data from the kaggale it contains 27000 infected and un infected images firstly

- We have to collect dataset from Kaggele
- Preprocessing the data (it means data cleaning visualization etc)
- We have to split the data for testing and Training
- train the dataset
- Fit the train data to Cnn Algorithm
- Predict the class label for test data
- Deploy the model.

2.1 Image of Dataset

3 EXPERIMENTAL RESULT:

Malaria Cell Image dataset consists of 27559 images. We divided the dataset into an 80-20 split ratio i.e. 80 percent (22046) images for training and 20 percent (5512) images for testing. Precision, recall, and f1-score achieved using Convolutional Neural Network. After training our model for 50 epochs, we have tested our model on a test dataset which is giving us an accuracy of 97.01 percent and the model is working well as a whole. We are evaluating our model in various parameters which are very important for analysis of results.

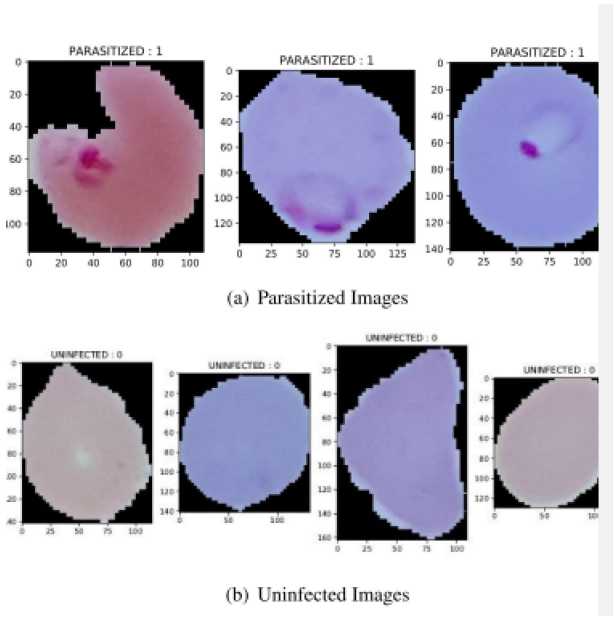

Figure 1. Caption

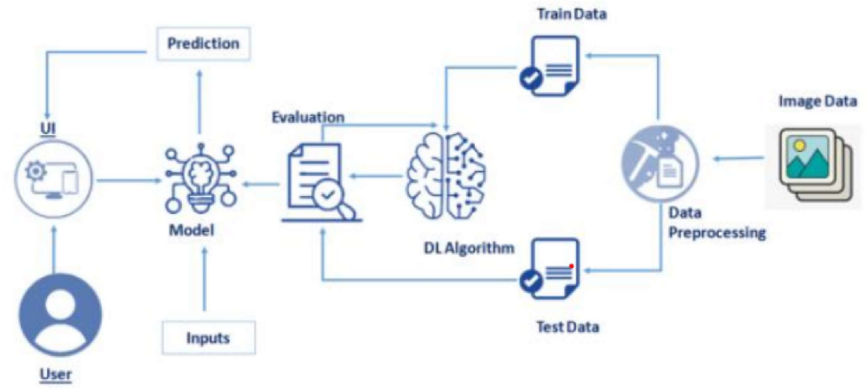

Figure 2. Model Diagram

4 FUTURE WORK:

As per the discussed model the system is identifying whether the parasite is present or not. In future we are focussing on making the classification multiple. we have to increase the accuracy value to 100 which gives the better prediction than now. The Future Work is directed towards improving the performance and enhancing the algorithm and denoising the images of blood cell for better detection of Malaria. Another direction of future work is by implementing this model into a single application which can be operated on any Smartphone to detect malaria easily.

5 CONCLUSION:

Malaria is a deadly disease that has claimed countless lives and is about to claim many more. It affects not only humans but also many living creatures. This is a disease that even the World Health Organization is concerned about. Early diagnosis of malaria is important to save lives. Our proposed model uses a well-known deeplearning technique, commonly known as deep convolutional neural network (DCNN). The plan is to use images of blood samples, for example blood thinning medications, and detect the presence of malaria in the smear. This formula is effective in the early treatment of malaria. Disease diagnosis and treatment using artificial intelligence can be a new step in modern business transformation and digitalization. We can develop a mature and effective application and website for malaria diagnosis in the future. We can also place the sensor along with the camera to capture microscopic images in the microscope to diagnose malaria. We offer malaria diagnosis using deep learning technology. This malaria detection method is effective in detecting the disease in a shorter time and with fewer errors. This type of automation is very useful in situations where there are few experts and no resources. In this proposed study, a neural network algorithm was applied to malaria cell data to identify malaria cells in human blood samples and achieve approximately 97.01 percent accuracy. Our automatic malaria testing machine is very useful for malaria diagnosis. Also, our electronic technology prevents tuberculosis, cancer, etc. It can also be used in the diagnosis of other diseases.

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