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MALARIA DETECTION USING TRANSFER LEARNING

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ABSTRACT

Malaria has been around ever since humans are there and is one of the deadliest parasite-related long- term disease. It is caused by a parasite known by the name of plasmodium. It comprises a wide variety of parasites, but only a handful are enough to contaminate. In 2018, 228 million were infected and 405'000 people died, making it a significant health concern and problem. In. At least 4 lakh cases occurred in India out of which 96 died. The most effective way is to detect malaria in its early stage by providing a rapid diagnose with an accurate result. There are two main problems with this, one being the non-availability of medical personnel and facility in developing countries, and the other being the overestimation of the number of infected individuals even with proper resources. Overdiagnosis is also one of the major problems which needs to be solve. This results in the use of malaria treatment and medication to a healthy person which could end in the shortage of malaria drugs. Also, the misuse of medication lowers the resistance towards malaria in the patient's body by making it adapt to the medication and its side effects weakening its effect towards actual malaria parasitized cells. A.I (Artificial Intelligence) can be the answer to these problems. The detection of malaria using machine learning and artificial intelligence programs not only saves countless lives by giving more accurate result in less time but also saves our money which can be put to better use. This research paper focuses on a system that can detect malaria using a technique of deep learning called transfer learning. We trained the model with thousands of images of infected as well as uninfected blood cells. Transfer learning helps in the reuse of relevant part of the pre-trained models in new but similar problems. Then, we input an 100x image of a blood sample of the person who has to be checked for malaria. The system will return true or false based on its accuracy of training and validation.

KEYWORDS: *Malaria, Deep learning, Transfer learning, Malaria Detection, Image processing.*

1. INTRODUCTION

Malaria is one of the most serious chronic diseases that humans have ever experienced. Therefore, it is important that we try every possible way to prevent the spread of this disease and to stop it at its onset. This program is done using an in-depth learning approach called transfer learning. It will be distributed as an online web application that will make it easily accessible to people responsible for testing blood samples. The system that can be used by people of various pathological labs who test for malaria using manual labor, so that they can use their resources efficiently and the time they take to study the results of any tests will be reduced. The lab administrator should only include a 1000x microscopic image of the blood sample of the person to be tested in this application. We have to train our model on roughly 27,000 pictures of infected as well as uninfected blood samples. It will use various libraries such as ImageDataGenerator to enhance its database and VGG-19 which

is a pre-trained CNN model that will be used to use the transfer learning method. The good thing about using this process is that it will save you a lot of time counting by freezing CNN's early layers which will lead to the saving of user resources. The output provided by the application will be a true or false statement about whether or not a sample person has been tested for malaria or not. Because of its increasing accuracy, it will prevent the problem of overdose that commonly occurs in the malaria testing program. The user interface of this application will be based on technologies such as HTML, CSS, JavaScript and Flask. This web application will be implemented using cloud service provider Heruko.

2. LITERATURE SURVEY

Gautham Shekar et al. [1] proposed a new and robust machine learning model based on an in- depth study method called CNN (Convolutional Neural Network) used to detect and predict infected cells in a blood smear using a standard microscope slide. In 27,500 single-cell images of infected as well as uninfected blood samples, a ten-fold layer is used to confirm the divergence of the convolutional neural network. By comparing the accuracy of three different types of CNN models, namely, Basic CNN, VGG-19 Frozen CNN, and VGG-19 Fine-tuned CNN, the ones with the highest accuracy are obtained.

F. borey el. [2] created a research paper to detect malaria through reading transfer which is an in-depth study method. It aims to detect malaria parasites in giemsa stained blood smear. In transfer learning, visual features are learned by large data sets and the problem-solving problem can be solved successfully using only certain data sets for limited problems. We use a pre-trained CNN model called VGG-19 and trained 20 epoch at 1428 P. Vivax, 1425 P. Ovale, 1446 P. Falciparum, 1450 P. Malariae and 1440 non-parasite samples . Up to 80%, 83%, 86%, 75% accuracy and 83%, 86%, 86%, 79% f-measure in 19 test images.

Sumagma Dey at el. [3] base their research paper on the basis of small-scale photography using a passionate deep network and transfer learning. They proposed a computer-assisted diagnostic program to detect malaria automatically in blood smears using CNN through transmission studies to improve the process of selecting traits. Layer embedding is extracted from intermediate conversion layers using a matrix element to test the selection of intermediate layer elements as a protection. They also suggested the full use of the ResNet 152 model with a deep, selfish network for training, resulting in improved guessing quality.

S.N. Panda at el. [4] have proposed a paper-based approach to detecting malaria using deep-seated networks with portable microscope paper. This program uses multiple images as input and integrates each Resnet output into their final layer followed by a full, final linked layer. They proposed an expanded MM-resNet framework that separates infected blood smear images and non-infected erythrocytes images with an average accuracy of 98.080%. It has the great advantage of storing information in all layers and the line system preserves additional information.

Divyansh Shah el. [5] Contributed his knowledge to a research paper based on the diagnosis of malaria based on the use of an in-depth study method. It helps us to provide a faster and cheaper way to get malaria. This model consists of three flexible and complete layers that are connected to each other. The neural network is a cascade of a few transformation layers each with its own filters, which helps to provide exceptional accuracy. The CNN category performs below the rated resources with almost 95.0% accuracy.

Zhaohui Liang el. [6] gathered information from his peers to compile a research paper on malaria diagnostics using CNN-based image analysis. This model automatically separates a single cell as infected or uninfected from a blood test using standard microscope slides. With tenfold confirmation in all of the 27,580 cell images, the average accuracy of our 16-layer CNN model is 97.370%, while the transfer learning model achieves only 91.999% accuracy in the same images. The CNN model proved to be superior to the transfer learning model in these respected performance indicators namely, sensitivity, clarity, accuracy, F1 school , and Matthews coefficient.

Millind Raj at el. [7] The evolution of malaria detection laboratories has been achieved through the use of Artificial Intelligence and Medical Imaging. This paper presents a deep learning-based image classification method that is designed to detect the presence of parasites in blood smear images. It uses Convolutional Neural Network. The paper shows how the CNN can detect the presence of parasites without hesitation using image data. It achieves 93.470 percent accuracy.
Mohammad Zubair Khan at el. [8] used his knowledge in this paper which presents a computer-aided detection (CAD) scheme for detecting malaria parasites in blood smear images. It uses a pre-trained neural network and an automatic encoder to identify the presence of the malaria parasites. This algorithm achieved an accuracy of 89.102% with a sensitivity of 93.904% in detecting malaria parasites in blood smear images. This scheme helps us providing higher effectiveness and efficiency than other deep learning techniques for a higher efficient diagnosis of malaria.

Matthias Elter at el. [9] share his knowledge in the creation of a research paper which focuses on a system that uses a two-stage algorithm for the detection of malaria parasite in thick blood films. The first stage focuses on the high sensitivity of detection with the accepting of false-positive images detection. The later stage reduces the number of these false-positives while maintaining the sensitivity of detection. This algorithm detects plasmodium with a sensitivity of 0.970 with a mean number of detections that are false-positives per an image. This algorithm proves to be a suitable development for computer-aided malaria screening.
Aliyu Abubakar at el. [10] contributed his knowledge on the creation of a research paper which is based on the system that detect malaria on blood smear images by first, extracting six different features and then train these feature using classifiers. Precision, Recall, Accuracy, F-1 score and computational time. This model achieved an accuracy of 94.00% in detecting malaria. Computational time was introduced by 44.00%.
Krit Sariporn at el. [11] provide his knowledge and research to a research paper that is based on the fact that Image processing equipment and a computer-aided diagnostic system are the two medical instruments that help medical doctors make better decisions on treating malaria. 7000 Xception, Inception-V3, ResNet-50, NasNetMobile, and NasNetMobile pictures were used in this study. Verification and analysis using the VGG-16 and AlexNet models. These models classify the image precision as well as use a rotating ethod to improve their validation training as well as their dataset with CNN models. Convolutional neural network models are being built using the Xception training dataset, which makes advantage of increase in effectiveness. This model achieved a combined score of 99.200% which include factors like performance, accuracy, recall, F1 measure and precision.

3. CONCLUSION

Studying all these research papers on various techniques that are involved in the detection of malaria, we have come to some conclusions. The basic of them is that we need to use computer-aided diagnosis on malaria as it can prevent both the wastage of resources as well as predicting the correct result using best accuracy. The proposed system of using the transfer learning technique is best as not only it uses a pre-trained model on large datasets which saves precious time as it helps in freezing down the weights of early CNN layers, which results in the decrease of computational time while not losing much accuracy which also helps it in providing the most accuracy among all the techniques. It will be deployed as a web-app , so the user only needs the microscopic image of the blood sample.

4. FUTURE WORK

This project can be use by various pathological labs in the detection of malaria without any human effort, with minimum resources and the result can be known in less time , which makes it time efficient and the resources saved from this method can be of other better use.

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