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A Novel Approach for Malaria Identification using Deep Learning

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ABSTRACT

People today deal with a variety of health problems, including malaria, which affects all ages and is prevalent. A female Anopheles mosquito bite can cause the serious disease malaria, which is transmitted from one person to another. The conventional method of diagnosing malaria involves a skilled technician visually examining blood smears to identify red blood cells that are infected with malaria-parasites under a microscope. Due to the lack of lab equipment, this method is ineffective, and a person's seniority or level of expertise is a major factor in the diagnosis. Here, we'll determine whether malaria parasites are present or not. To solve the issues ,we create an automated approach to detect malaria parasites in place of the conventional malaria detection method. We use an image-containing dataset as input for this approach. Here, we employ deep learning algorithms to find malaria parasites in samples of human blood.

Keywords:Malaria Disease, Blood Smears, Red Blood Cells (RBC), Deep Learning, Convolutional Neural Network (CNN).

1. Introduction

According to recent research, around 25% of deaths worldwide are caused by infectious diseases. The World Health Organization (WHO) just released a report that estimates that malaria caused 435,000 deaths worldwide in 2017. The life of the sick person can be saved if the malaria infection is discovered in its early stages and treated. As a result, the analysis is directly influenced by the pathologists' experience. The results are very hard to duplicate and the process takes a long time. By looking at the parasite genus Plasmodium under a microscope, this disease can be manually found. Here, the procedure is based on the calibre of the blood smear and the pathologist's skill in reviewing the blood smears. the procedure for diagnosing The pathologists won't be able to analyse many smear samples quickly, and this delay in diagnosis outcomes could have a serious impact on malaria sufferers. Deep learning techniques have the benefit of being able to learn features from the provided input data. With less computing time and greater accuracy, CNN is employed to determine the findings. Using image processing techniques, the cells of microscopic images are utilised to detect the presence of malaria-infected parasites, a form of parasite that significantly reduces the number of deaths that occur.

2. Literature Survey

In paper [1]**.**The innovative Stacked Convolutional Neural Network architecture that is suggested in this study enhances the automatic detection of malaria. Additionally, they used various layer counts and filter sizes until we got the greatest outcome. Re-sampling and normalising incoming photos are the first pre-processing techniques we use. Then, using filters, kernels, and strides along with max-pooling and dropout layer, we apply stacked CNN.

In paper [2].In this case, they suggested an efficient multi-magnification deep residual neural network (MM-ResNet), where we fully automatically categorise the microscopic blood smear images as either infected or non-infected. To evaluate the performance of the created Multi-magnification deep residual neural network, 1182 photos from the AI research group at Makerere University were utilised as the dataset (MM-ResNet). We conducted the trials with a patient level of fivefold cross-validation, randomly splitting the entire dataset into 80% training data and the remaining 20% for testing data, with an average accuracy of 98.08%.

In paper [3].In this paper, we concentrate on performing this whole blood cell count on blood smear images using a convolution neural network. The Isfahan University of Medical Science (IUMC) database, the MAMIC database, the KAGGLE database, and a mix of all three, are where the photos required to create the training, testing, and validation datasets were found. To strengthen the network and restructure the final convolution layer into the necessary number of output elements, four further new convolution layers are added in this stage. A validation accuracy of 97.07% is attained after 31 epochs.

In paper [4] We have created the first smartphone-compatible deep learning technique that can identify malaria parasites in photos of thick blood smears. Our process entails two steps of processing. To locate potential parasites, we first use an intensity-based Iterative Global Minimum Screening (IGMS), which quickly screens a thick smear image. The next step is to categorise each candidate as either a parasite or a backdrop using a customised Convolutional Neural Network (CNN). The modified CNN model is effective in differentiating between positive and negative picture patches in terms of the following performance: accuracy (93.46%), AUC (98.39%), sensitivity (92.59%), specificity (94.33%), and precision (94.25%), according to a patient-level five-fold cross-evaluation.

In paper [5].This study provides an overview, investigates recent developments in the field of microscopic malaria detection, and discusses the use of deep learning for parasite detection in malaria. In this study, we looked at different deep learning models and tracked which of them offered a better accuracy and faster resolution than previously employed deep learning models. According to our findings, the Resnet 50 model had the maximum accuracy of 97.55%. When there is a lack of data, transfer learning (TL) techniques are utilised to improve pretrained DL models for annotated medical imaging.

3. Data Collection

The information is gathered from sources from the official hajj and Kumbhmela websites. The information gathered here pertains to those who performed the hajj and the Kumbhmela.

4. DEEP LEARNING.

Artificial intelligence (AI) and machine learning techniques known as "deep learning" model how people acquire specific types of information. Data science, which covers statistics and predictive modelling, includes deep learning as a key component. Algorithms are made up of processing units that allow us to replicate and perceive the human brain. Deep-Learning models have a higher degree of originality and are organised in a hierarchy of increasing complexity and abstraction. The most fascinating area of research is deep learning, which can improve overall system accuracy while reducing machine learning's drawbacks.

A subset of machine learning is deep learning. Deep learning systems can perform better than typical machine learning algorithms, many of which have a limited capacity to learn regardless of the amount of data they collect.with access to more data: the machine version of more experience. After machines have gained enough experience through deep learning, they can be put to work for specific tasks such as driving a car, detecting weeds in a field of crops, detecting diseases, inspecting machinery to identify faults, and so on.Deep learning networks learn by discovering intricate structures in the data they experience. By building computational models that are composed of multiple processing layers, the networks can create multiple levels of abstraction to represent the data.

For instance, a convolutional neural network, a type of deep learning model, can be trained using a lot (like, millions) of photos, such as ones with cats. This kind of neural network often picks up information from the pixels in the photographs it collects. It has the ability to categorise sets of pixels that are typical of cat traits, with sets like claws, ears, and eyes indicating the presence of a cat in a picture.

Deep learning differs from traditional machine learning in key ways. In this case, a domain expert would have to invest a lot of effort in developing a traditional machine learning system to identify the characteristics of a cat. All that is required for deep learning is to provide the system with avery large number of cat images, and the system can autonomously learn the features that represent a cat.

5. Methodology

The process for identifying malaria in microscopic blood smear images can be broken down into the following steps:

1) Loadingthedataset.
2) Preprocessingthedataset
3) Splitting thedataset intotrainand testsets.
4) Buildingthemodel.
5) Trainingthemodel.
6) Prediction

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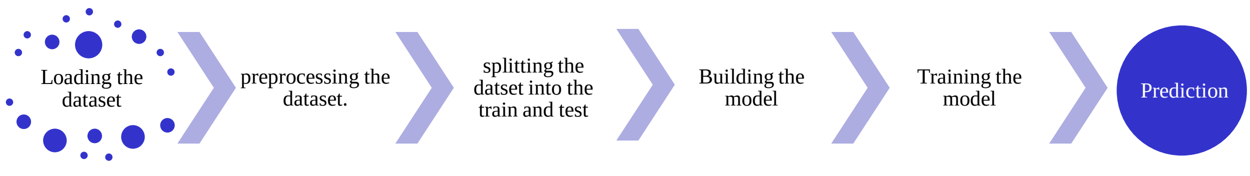


Figure.The overall frame work for detecting malaria from the microscopic bloodsmear images.

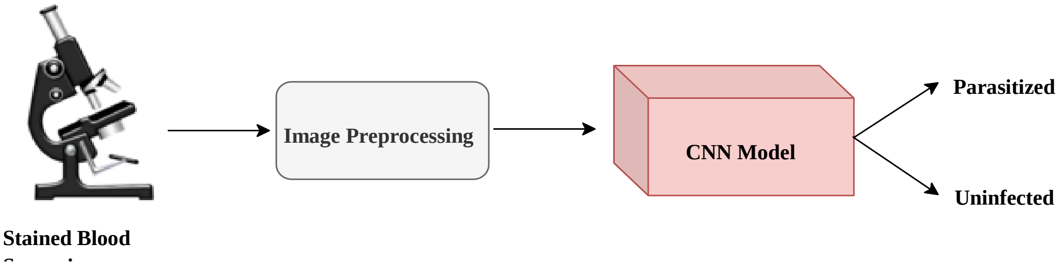


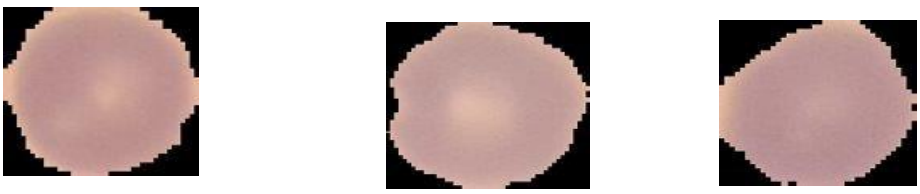
Figure.Pipeline of our proposed architecture

7. Results and Discussion

INPUTIMAGES:

Parasitized:

Uninfected:



• For our model to work, the image must be binary 0 or 1 (i.e., infected or uninfected). Binary cross-entropy is the loss function used for binary judgments.

•Photos are divided into a training set with 22046 images and a test set with 5512 images after the data is split using the test-size of 0.2.

Precision (95.6%), Recall (95.5%), and F1 score (95.57%) are some of the evaluation measures that were employed after the model had been trained.

	Accuracy	Precision	Recall	F1- Score
Adam Optimizer	**95.6%**	**95.6%**	**95.5%**	**95.5%**
SGD Optimizer	**94.9%**	**93.9%**	**95.6%**	**94.9%**

8. Conclusion

Anopheles mosquitoes, which are present in tropical climates, are the source of the deadly disease malaria. Typically, the pathologist who uses a microscope to identify the disease's symptoms will be the one to make the diagnosis. Later, with the advancements in science, this became simpler because automated systems for diagnostic and decision assistance are now commonplace. In this study, the slide photographs of blood cells both afflicted and uninfected by the disease are processed without the involvement of any humans. The obtained findings demonstrate that convolutional layers may extract various abstract level characteristics for classification with varied filter sizes and depths. Utilizing the method, the pathologist will obtain theimproved outcomes, will enhance the doctors' decision-making process, provides reliable results, and will speed up or shorten the duration of the inspection.

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