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An automated machine learning approach to detect ***Leishmania*** parasites: An alternative tool for Leishmaniasis disease diagnosis

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Leishmaniasis is a neglected tropical disease caused by a protozoan parasite that poses a significant threat to human life on a global scale. Leishmaniasis is endemic in 99 countries with more than 12 million people infected. Despite being the primary diagnostic method, microscopy needs technical expertise. Since there is no systematized surveillance programme for Leishmaniasis in Sri Lanka, trained personnel to be involved in disease diagnosis by microscopy is limited and only a few health care institutions have such trained individuals. Therefore, this study aimed to study the feasibility of using an automated machine learning programme to detect *Leishmania* parasites in the microscopic fields. A machine learning model is built on the TensorFlow framework and employs a combination of Convolutional Neural Networks for feature extraction and classification. A total of 150 views of 75 microscopically positive slides for *Leishmania* parasites (amastigotes) were photographed. Slides that were negative for the parasites were also captured in similar numbers. All captures were fed into the model and tested with 25 positive and negative fields. The machine learning model developed in this study detected 94.1% (n=34) negative fields as negative for *Leishmania* parasites. Of the positive fields, 93.3% (n=32) of them were detected as positive for the parasites by the developed model. The model indicated 92% accuracy for the detection of *Leishmania* parasites in the microscopic fields. This level of accuracy can significantly enhance early detection and prompt treatment, potentially reducing the disease burden, complications, and healthcare costs in regions where resources are limited. The model's versatility permits this approach to be adapted for the detection of other parasitic diseases in Sri Lanka which are not common at present. The proposed method would be a better alternative to disease diagnosis in low-resource settings with limited technical expertise. However, it is recommended to validate the model with more sample data to obtain a better accuracy and applicability.

Keywords: Machine learning, Leishmaniasis, Automated Diagnosis, Parasites.