

Using Deep Learning in Lyme Disease Diagnosis

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Abstract : Untreated Lyme disease can lead to neurological, cardiac, and dermatological complications. Rapid diagnosis of the erythema migrans (EM) rash, a characteristic symptom of Lyme disease is therefore crucial to early diagnosis and treatment. In this study, we aim to utilize deep learning frameworks including Tensorflow and Keras to create deep convolutional neural networks (DCNN) to detect images of acute Lyme Disease from images of erythema migrans. This study uses a custom database of erythema migrans images of varying quality to train a DCNN capable of classifying images of EM rashes vs. non-EM rashes. Images from publicly available sources were mined to create an initial database. Machine-based removal of duplicate images was then performed, followed by a thorough examination of all images by a clinician. The resulting database was combined with images of confounding rashes and regular skin, resulting in a total of 683 images. This database was then used to create a DCNN with an accuracy of 93% when classifying images of rashes as EM vs. non EM. Finally, this model was converted into a web and mobile application to allow for rapid diagnosis of EM rashes by both patients and clinicians. This tool could be used for patient prescreening prior to treatment and lead to a lower mortality rate from Lyme disease.

Keywords : Lyme, untreated Lyme, erythema migrans rash, EM rash

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