Developing an Algorithm for Detecting Diabetic Retinopathy from Retinal Images Using Machine Learning

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Purpose: Diabetic retinopathy, an eye disease that damages the light-sensitive retina, affects an estimated total of 93 million people globally. As one of the leading causes of blindness, it is imperative that this disease be diagnosed early. However, for the 270,000 patients suffering from diabetes in Ghana, there are only 2 ophthalmic nurses qualified enough to take the fundal pictures needed to assess retinal damage, which would, in turn, take at least two days. In order to discover a more efficient method of diagnosis, we explored using machine learning to diagnose diabetic retinopathy using fundal images. Procedure: First, fundal images were imported and converted to matrices of pixel values from 0 to 255. Next, features were extracted from these matrices via various extraction methods, including using pretrained Convolutional Neural Networks and Principle Component Analysis. The data accompanying these images was extracted and converted into labels, which was used to train and test different classification models. The precision and efficiency of each classification model was printed out after training and testing. Results: The highest attained accuracy was 80%, using either the SVM classification model (with the rbf or sigmoid kernel), the NearestNeighbours classification model (with at least 13 Neighbours) or the Gaussian process (with the ConstantKernel kernel) for the Resnet34, Resnet18 and VGG11 extraction methods. Conclusion: The results prove that the trained model can diagnose a patient with diabetic retinopathy based on fundal images, and can return the accuracy of its diagnosis.

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