Detecting Common Retinal Diseases Through Use of Convolutional Neural Networks

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The analysis of OCT scans aid ophthalmologists in screening patients for common blinding retinal diseases. Such analyses take up a significant amount of time and the implementation of medical imaging technology faces challenges with reliability and interpretability. My deep learning algorithm utilizes convolutional neural networks (CNN) to detect Drusen, Choroidal Neovascularization, and Diabetic Macular Edema diseases through machine learning techniques to help classify 86,000 Optical Coherence Tomography images accurately and swiftly. In order to train and test a CNN for implementation, Google Colab was utilized for computational purposes. Transfer learning was incorporated when the ResNet and VGG16 pre-trained models were modified and trained with the available data. Hyper parameters such as the activation function, hidden layers, and steps per epoch were modified to fine tune the model's accuracy. Following the training of the models, the models were evaluated through the use of a confusion matrix. The modified VGG16 model has a classification accuracy of 90.1% and a logarithmic loss of 1.08 and it outcompetes its Resnet counterpart when classifying normal, CNV, Drusen, and DME diseases. The model correctly classifies normal, CNV, Drusen, and DME diseases at 98%, 99%, 93%, and 86% respectively over a 400 image test data sample. Due to the limited number of Drusen and DME training images, an imbalance in available data is responsible for lower Drusen and DME classification accuracy. My model exceeds medical industry diagnosis standards in literature. I have developed an interface that allows ophthalmologists to upload OCT scans to determine classifications.

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