Detecting Glaucoma From Retinal Fundus Images Using Machine Learning

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The purpose of my project is to provide a cost-effective, portable, and accurate solution to diagnosing glaucoma. Glaucoma is a major health issue in less developed countries (LDCs), where the density of ophthalmologists is critically low, leading to undiagnosed cases of glaucoma. Untreated glaucoma commonly leads to irreversible blindness. My application, in the form of a mobile app, uses on-device machine learning to recognize glaucoma using a simple device camera. My original approach was to train the model on full-size retinal fundus images, but low validation scores led me to the conclusion that other eye features such as the macula and blood vessels were throwing off the model. My new approach focused on an important glaucoma indicator called “cup-to-disc ratio”. This is the area of the optic cup (bright depression in the center of the optic disc) divided by the area of the optic disc (spot where the optic nerve connects to the retina). I added this model to my mobile app, which was programmed in Java using Android Studio. My mobile app allows the user to select an image from their camera roll or take a new image from the phone camera and import it to the app. The user can then run the model and receive the result of the model’s prediction on their fundus image (image of the retina). The conclusion is that on device machine learning can successfully be used to classify retinal fundus images to diagnose glaucoma on a mobile device. This app has potential to allow populations of low-income countries with limited eye care resources to diagnose glaucoma without having to visit an ophthalmologist. As a result, more people will know to seek out care for their glaucoma whether that be eye drops, medication, surgery, or a combination of these.

Awards Won:

Fourth Award of $500

Central Intelligence Agency: First Award: $1000 award