Inexpensive Mobile Diagnosis of Diabetic Retinopathy Using Deep Learning

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Diabetic retinopathy (DR), the leading cause of blindness among working-age adults, is also leading cause of preventable blindness worldwide. Many patients, particularly in developing areas, remain undiagnosed due to limited access to the traditional diagnostic tools and screening specialists. Currently, there is no complete diagnostic pipeline to inexpensively capture and automatically grade retinal images. The investigators developed the Eyeagnosis system, which utilizes machine learning techniques and a smartphone camera for the automatic screening of DR. The Eyeagnosis algorithm consists of a neural network architecture that uses residual neural networks with cyclic pooling to automatically diagnose DR from retinal images. A dataset of over 35,000 real-world retinal images of varying quality from the NIH EyeGENE database was used to train the robust algorithm. A novel 3D-printed optical device was created to enable a smartphone to take high-quality retinal images. Finally, a smartphone application was developed to capture photos, detect and fix blurry, overexposed, and underexposed images, send pictures to a remote server housing the neural network, output the network's diagnosis, and display further information such as images of the blood vessels and microaneurysms segmented from the input image. The architecture was able to obtain statistically comparable results to the average inter-rater agreement of ophthalmologists in clinical settings. The effectiveness of the system was further validated through clinical testing on DR positive and negative patients. Eyeagnosis is the most inexpensive, reliable, easy to use, and timely tool for assisting medical practitioners in diagnosing DR in the field.

Awards Won:

Third Award of $1,000

Association for the Advancement of Artificial Intelligence: Honorable Mention

Samvid Education Foundation: Agni Second Place Award of $500

Sigma Xi, The Scientific Research Honor Society: Second Life Science Award of $1,000