An AI-aided Solution to Open-angle Glaucoma Screening in Developing and Rural Countries

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Glaucoma is the second leading cause of blindness, responsible for 15% percent of the total world blindness. It is a chronic eye disease that damages the optic nerve and causes irreversible blindness at its terminal stage. Open-angle glaucoma is the most common and unpredictable form of glaucoma due to its nature of asymptomatic. Although treatable at its early stage, most patients with open-angle glaucoma are unaware of it and thus receive no treatment, especially in developing/rural countries with limited access to vision care. This research proposes a feasible and accurate system to detect open-angle glaucoma and deploy it into a web application called Glaucomark. Using a combination of two deep learning architectures: You Only Look Once v3(yolov3) and Visual Geometry Group Neural Network (VggNet), the system can accurately extract the optic disc area from a picture of the retina and detect glaucoma patterns on it. This paper innovative design to combine object detection and object classification neural networks, improving performance significantly, and allowing for training with large-scale training datasets without manual preprocessing. The training datasets were obtained from multiple public databases, consisting of 5532 images of fundus, including 3670 images labeled with the optic disc areas, 901 normal fundi, and 761 fundi with open-angle glaucoma. The system achieves 97.9% accuracy (AUC=0.994) after testing with a separate dataset of 332 images of the fundus. The demo of this system is deployed on www.glaucomark.com. To acquire high-quality retina images, a pocket-sized, inexpensive, and non-mydriatic retina imaging camera is in the progress of building to incorporate with the Glaucomark.

Awards Won:
Third Award of $1,000