New deep-learning model helps the automated screening of common eye disorders

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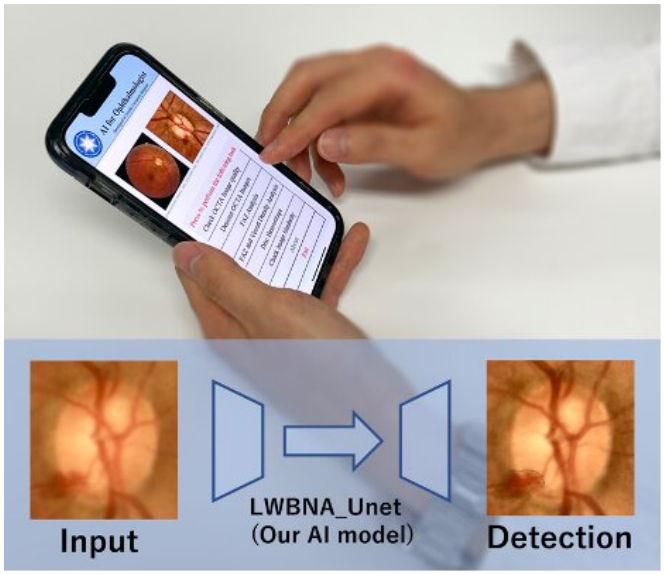

AI for the eye. The developed lightweight model precisely and rapidly detects image abnormalities related to diseases of the eye. The model is expected to provide accurate analysis on mobile devices/low CPU-GPU resource single board computers used in standalone self-monitoring devices. Credit: Tohoku University

Automation in disease diagnosis is reliant on deep learning models that can accurately and efficiently identify measurements of tumors, tissue volume, or other sorts of abnormalities. Now, researchers from Tohoku University have unveiled a new, resource-light model capable of identifying many common eye diseases.

A new deep learning (DL) model that can identify disease-related features from images of eyes has been unveiled by a group of Tohoku University researchers. This "lightweight" DL model can be trained with a small number of images, even ones with a high-degree of noise, and is resource-efficient, meaning it is deployable on mobile devices.

Details were published in the journal *Scientific Reports* on May 20, 2022.

With many societies aging and limited medical personnel, DL models reliant on self-monitoring and tele-screening of diseases are becoming more routine. Yet, deep learning algorithms are generally task specific, and identify or detect general objects such as humans, animals, or road signs.

Identifying diseases, on the other hand, demands precise measurement of tumors, tissue volume, or other sorts of abnormalities. To do so requires a model to look at separate images and mark boundaries in a process known as segmentation. But accurate prediction takes greater computational output, rendering them difficult to deploy on mobile devices.

"There is always a trade-off between accuracy, speed and computational resources when it comes to DL models," says Toru Nakazawa, co-author of the study and professor at Tohoku University's Department of Ophthalmology. "Our developed model has better segmentation accuracy and enhanced model training reproducibility, even with fewer parameters—making it efficient and more lightweight when compared to other commercial software."

Professor Nakazawa, Associate Professor Parmanand Sharma, Dr. Takahiro Ninomiya, and students from the Department of Ophthalmology worked with professor Takayuki Okatani from Tohoku University's Graduate School of Information Sciences to produce the model.

Using low resource devices, they obtained

measurements of the foveal avascular zone, a region with the fovea centralis at the center of the retina, to enhance screening for glaucoma.

"Our model is also capable of detecting/segmenting optic disks and hemorrhages in fundus images with high precision," added Nakazawa.

In the future, the group is hopeful of deploying the lightweight model to screen for other common eye disorders and other diseases.

More information: Parmanand Sharma et al, A lightweight deep learning model for automatic segmentation and analysis of ophthalmic images, *Scientific Reports* (2022). DOI: 10.1038/s41598-022-12486-w

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