Scientists grade diabetic retinopathy automatically by machine learning technology

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Early diagnosis through regular screening is important for preventing diabetic retinopathy (DR), but it's time-consuming for ophthalmologists to diagnose.

Researchers from the Shenzhen Institutes of Advanced Technology (SIAT) of the Chinese Academy of Sciences proposed a multi-channel-based generative adversarial network (MGAN) with semi-supervision to automatically grade DR.

Previous studies from SIAT found that computer-aided diagnosis system by deep-learning technology could realize high-level features learning from DR images and automatically analyze the possibility of DR.

However, deep learning models are usually trained on a large amount of labeled DR data. For the labeling process of DR images, the grading of DR requires the clinician to extract the lesions and measure the area of the lesions manually, which is highly time-consuming. Due to the lack of high-quality labeled data in real applications, it is difficult to apply the general deep learning method for DR diagnosis.

The newly proposed method solved these difficulties, and it could make full use of labeled data and unlabeled data to recognize DR automatically without losing the original DR features.

To deal with the challenge that the effective DR features are diffuse in the high-resolution fundus images, the researchers developed a multi-channel-based GAN model, which could generate a series of sub-fundus images including effective local features. All the sub-fundus images were then combined to obtain the most representative features of the entire fundus image.

Additionally, the researchers incorporated a feature extraction scheme into the proposed multi-channel-based GAN framework. This scheme reduced interference from the original fundus images and extracted the scattering lesion features, improving the performance of discriminator.

In order to demonstrate the advantages of the proposed method, the researchers employed 100 labeled DR samples and a large number of unlabeled DR samples to train the model.

The results exhibited that the proposed model could deal with a classification problem when the labeled samples were limited, and outperformed other representative models in terms of accuracy, area under the curve, sensitivity and specificity.

The study was published in *IEEE Transactions on Automation Science and Engineering*.

More information: Diabetic Retinopathy Diagnosis Using Multichannel Generative

Adversarial Network With Semisupervision. *IEEE Transactions on Automation Science and Engineering*. DOI: 10.1109/TASE.2020.2981637