IBM Machine Vision Technology Advances Early Detection of Diabetic Eye Disease Using Deep Learning

The IBM Research findings achieve the highest recorded accuracy of 86 percent by using deep learning and pathology insights to identify the severity of diabetic retinopathy

MELBOURNE, Australia, April 20, 2017 /PRNewswire/ -- IBM (NYSE: IBM) this week released the results of new research using deep learning and visual analytics technology to advance early detection of diabetic retinopathy (DR)[1]. The results, which classify the degree of severity of the disease in an eye image, exceed other currently published research efforts for severity classification using deep learning and pathology insights.

The research found that a new method created by the IBM team achieved an accuracy score of 86 percent in classifying the severity of the disease across the five levels recognized on the international clinical DR scale (no DR; mild; moderate; severe; proliferative DR). By being able to quickly and accurately identify both the presence and severity of diabetic eye disease, this research could potentially help doctors and clinicians have a better view of disease progression and determine treatment.

Diabetic retinopathy is one of the world's leading causes of blindness and affects one in three of the 422 million people who suffer from diabetes globally[2]. If left untreated, diabetic eye disease can lead to permanent blindness, however early detection and treatment can reduce the risk of blindness by 95 percent[2].

Based on more than 35,000 eye images accessed via EyePACS®, the IBM technology was trained to identify lesions such as micro-aneurysms, haemorrhages and exudates to indicate damage of the retina's blood vessels and assess both the presence and severity of the disease. The novel method for classifying the severity level of DR combines deep learning techniques, convolutional neural networks (CNN), with a dictionary-based learning to incorporate DR specific pathologies. Over time, IBM Research scientists will continue to advance the system to increase its understanding of diabetic retinopathy and the pathologies manifested in the retina from the disease.

"The alarming projections of the number of patients with diabetic retinopathy have major implications for the health system. The loss of vision from the condition can impose an enormous burden on the individual, including a loss of capacity to work and the need for intensive community support," said Dr. Peter van Wijngaarden, Principal Investigator at Centre for Eye Research Australia, Department of Ophthalmology, University of Melbourne. "To substantially reduce the number of people unnecessarily losing vision from diabetic eye disease, there is a real need for innovation to improve effective screening of those who are at risk to enable early sight-saving treatment."

Currently, DR is diagnosed through regular screening of diabetes patients, where an expert clinician examines specialized fundus photography of the retina to identify the presence of lesions. Interpreting these images requires specialized training and is often a manual, time-intensive and subjective process to rate them for the disease presence and severity.

About 90% of the world's visually impaired live in low-income settings and developing countries, some with limited access to transportation and specialists[3]. Emerging computer vision methods to identify and classify lesions in an image within 20 seconds could create new levels of efficiency, which could help clinicians screen a greater number of diabetes patients, and quickly refer those who need specialist care.

"Recent advancements in deep learning and image analytics technologies are showing significant promise in the potential to help solve some of the greatest health challenges we face today," said Dr. Joanna Batstone, Vice President and Lab Director of IBM Research Australia. "Automated and highly accurate DR screening methods have the potential to help doctors screen far more patients than currently possible."

IBM Research globally continues to advance research combining cognitive technology with medical images. Through its 12 collaborative labs worldwide, IBM Research is focused on research projects involving medical imaging analysis for diseases such as melanoma, breast cancer, lung cancer and eye disease.

The research results were presented at the IEEE's International Symposium on Biomedical Imaging (ISBI) this week in Melbourne.

Related Resources

IBM Research Healthcare & Life Sciences website -http://www.research.ibm.com/healthcare-and-life-sciences/

IBM Research Blog: Spotting Diabetic Retinopathy by analyzing medical images pixel by pixel - https://www.ibm.com/blogs/research/2017/04/spotting-diabetic-retinopathy/

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[1] A novel approach for severity assessment of diabetic retinopathy in colour fundus images, ISBI,April 2017.

[2] Retinopathy in Diabetes, Diabetes Care Journal, Jan 2004. http://dx.doi.org/10.2337/diacare.27.2007.S84

[3] World Health Organization, "Visual impairment and blindness" UpdatedAug 2014 http://www.who.int/mediacentre/factsheets/fs282/en/

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