

Development and validation of a code-free deep learning model in the multi-class classification of diabetic retinopathy and age-related macular degeneration from color fundus photographs

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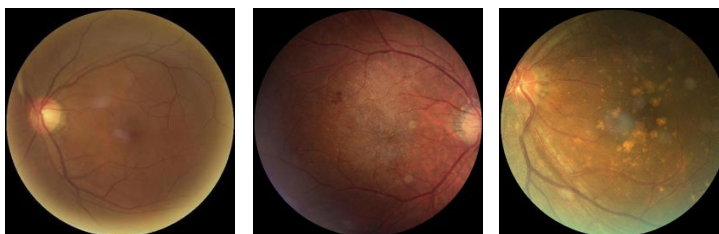
Objective: Code-free deep learning (CFDL) has emerged as a new tool to facilitate clinicians with minimal coding experience to develop their own deep learning models (DL). This study evaluated the discriminative performance of CFDL in differentiating diabetic retinopathy (DR) and age-related macular degeneration (AMD) from normal fundi using colour fundus photographs (CFP)s.

Methods: Using a publicly available CFP dataset (ODIR-K dataset), we carried out the CFDL model design using the Google Vertex AI AutoML platform. 1326 CFPs carrying a single label for DR, AMD, and normal fundi were retrieved from the ODIR-5K dataset and then uploaded. The uploaded dataset was split into 8-1-1 for training, validation, and testing. A multi-class classification model was devised and compared to bespoke DL multi-classifiers identified from a targeted literature search. External validation of the model was performed on an independent dataset with CFPs retrieved from the RFMiD dataset.

Results: The multi-class CFDL classifier achieved high diagnostic performance with an area under precision-recall curve (AUPRC) of 0.983, a F1 score of 0.98, a precision of 98.04% and a recall of 97.96% at the 0.5 confidence threshold. The per-class sensitivity and specificity, respectively, were 42.9% and 100% for DR, 64% and 96.19% for AMD, and 98% and 63.3% for normal. Upon external validation, the model's AUPRC, F1 score, precision and recall were 0.745, 0.727, 73.54% and 71.95% respectively.

Conclusion: The study demonstrated the feasibility and good diagnostic accuracy of CFDL in the simultaneous screening of DR and AMD on CFPs.

Image- Examples of CFDL training images per class



Normal class CFP DR class CFP AMD class CFP

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Biography

Carolyn Yu Tung Wong has been passionate and dedicated to ophthalmology research, especially in artificial intelligence. She is the first author of more than 10 review and original articles focusing on the developments of artificial intelligence in ophthalmology, as guided by mentors at Moorfields Eye Hospitals, including Professor Pearse A. Keane, Dr Fares Antaki, and Dr Peter Woodward Court. Besides, Carolyn has also presented her research at different international conferences, including the APACRS and ARVRS, and will soon be presenting her latest research findings on artificial intelligence in ophthalmology at ARVO2024, APGC2024, and APACRS2024, both in poster and oral formats. Carolyn has also been an active research member of Professor Pearse A. Keane's ophthalmology AI research team and is currently working on multi-institutional based artificial intelligence model developments for retinopathy of prematurity screenings.

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