

Artificial intelligence and deep learning in ophthalmology

Ting DSW (1) , Pasquale LR (2) , Peng L (3) , Campbell JP (4) , Lee AY (5) , Raman R (6) , Tan GSW (7) , Schmetterer L (7,8,9,10) , Keane PA (11) , Wong TY (7)

1 Singapore Eye Research Institute, Singapore National Eye Center, Duke-NUS Medical School, National University of Singapore, Singapore, Singapore daniel.ting.s.w@singhealth.com.sg.

2 Department of Ophthalmology, Mt Sinai Hospital, New York City, New York, USA.

3 Google AI Healthcare, Mountain View, California, USA.

4 Casey Eye Institute, Oregon Health and Science University, Portland, Oregon, USA.

5 Department of Ophthalmology, University of Washington, School of Medicine, Seattle, Washington, USA.

6 Vitreo-retinal Department, Sankara Nethralaya, Chennai, Tamil Nadu, India.

7 Singapore Eye Research Institute, Singapore National Eye Center, Duke-NUS Medical School, National University of Singapore, Singapore, Singapore.

8 Department of Ophthalmology, Lee Kong Chian School of Medicine, Nanyang Technological University, Singapore, Singapore.

9 Department of Clinical Pharmacology, Medical University of Vienna, Vienna, Austria.

10 Center for Medical Physics and Biomedical Engineering, Medical University of Vienna, Vienna, Austria.

11 Vitreo-retinal Service, Moorfields Eye Hospital, London, UK.

Artificial intelligence (AI) based on deep learning (DL) has sparked tremendous global interest in recent years. DL has been widely adopted in image recognition, speech recognition and natural language processing, but is only beginning to impact on healthcare. In ophthalmology, DL has been applied to fundus photographs, optical coherence tomography and visual fields, achieving robust classification performance in the detection of diabetic retinopathy and retinopathy of prematurity, the glaucoma-like disc, macular oedema and age-related macular degeneration.

DL in ocular imaging may be used in conjunction with telemedicine as a possible solution to screen, diagnose and monitor major eye diseases for patients in primary care and community settings. Nonetheless, there are also potential challenges with DL application in ophthalmology, including clinical and technical challenges, explainability of the algorithm results, medicolegal issues, and physician and patient acceptance of the AI 'black-box' algorithms. DL could potentially revolutionise how ophthalmology is practised in the future. This review provides a summary of the state-of-the-art DL systems described for ophthalmic applications, potential challenges in clinical deployment and the path forward.

Br J Ophthalmol. 2018 Oct 25. pii: bjophthalmol-2018-313173. doi: 10.1136/bjophthalmol-2018-313173.

<http://www.ncbi.nlm.nih.gov/pubmed/30361278>