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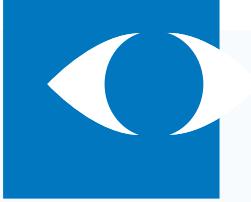


AI in Ophthalmology: Clinical and Technical Considerations

1. Artificial intelligence
2. Deep learning
3. Clinical unmet need in global ophthalmology
4. Clinical translation
5. Potential challenges in AI ophthalmology

Summary

The real-world application of artificial intelligence (AI), machine learning (ML) and deep learning (DL) has generated significant interest among the computer science and medical communities in recent years. DL has revolutionized the computer vision field and achieved substantial jumps in diagnostic performance for image recognition, speech recognition, and natural language processing. In Ophthalmology, this technique has shown promising diagnostic performance in detection of diabetic retinopathy (DR), glaucoma and age-related macular degeneration from fundus photographs and OCTs. Given the surge in the number of publications in the literature, it is, therefore, important to understand the clinical and technical considerations in building a DL-based AI system. This paper will focus on 2 aspects – 1) clinical aspect: the unmet needs and; 2) technical aspect the concepts of convolutional neural networks (CNN), the data distribution and characteristics for training, validation and testing, reference standards, performance metrics and the methods to explain diagnosis.



Descriptive CV

Dr Daniel Ting is currently the 3rd year vitreo-retinal fellow with Singapore National Eye Center, holding an academic appointment as the Assistant Professor in Ophthalmology with Duke-NUS Medical School Singapore. In 2017, he was selected as the US-ASEAN Fulbright Scholar, representing Singapore to visit Johns Hopkins University (JHU) School of Medicine and Applied Physics Laboratory to evaluate the use of artificial intelligence, big data analytics and telemedicine in the field of Ophthalmology. To date, he has published close to 80 peer-reviewed papers, book chapters and educational articles, including 20 AI articles published in JAMA, Nature Medicine, Nature Biomedical Engineering, IAAI, MICCAI and ACCV; and also diabetic retinopathy (DR), age-related macular degeneration (AMD) and choroidal imaging papers in Lancet, Ophthalmology, JAMA Ophthalmology, American Journal of Ophthalmology and Nature Scientific Report. The DR published papers ranged from novel screening techniques, epidemiology, screening practices, reviews and commentaries on clinical trials. He has also received approximately 1.5 Million USD as the principal investigator and 25 Million USD as co-investigator/collaborator research funding for his AI and DR research work. Together with a few co-inventors, he has filed the provisional patent for the AI system in detecting retinal diseases and co-founded a spin-off company.

He serves as the section editor for AI and retina in British Journal of Ophthalmology, and also a regular reviewer in major medical journals, including JAMA, Nature Medicine, Nature Communication, Nature Biomedical Engineering, Diabetes Medicine, Ophthalmology, JAMA Ophthalmology, American Journal of Ophthalmology, Retina and IOVS. For his AI work, he has awarded the highly prestigious Macula Society Evangelos Gragoudas Award (2019), SingHealth Distinguished Young Researcher Award (2018), Asia-Pacific Academy of Ophthalmology (APAO) Young Ophthalmologist's Award (2018), the Asia-Pacific Tele-Ophthalmology Society (APROS) Young Innovator Award (2017) and Singapore General Hospital Young Investigator Award (2017). He was also the finalist of 2018 Singapore Young Scientist Award and 2018 Asia-Pacific Economy Corporation (APEC) Science Prize for Innovation, Research and Education (ASPIRE), an award given to the scientists under 40 across all domains in science, technology and education. He has been a regular invited speaker, abstract reviewer, chair and course organizer for AI Ophthalmology in ARVO, APROS, APVRS and APAO.

Academically, he graduated as the Valedictorian of SingHealth Residency in 2016 (across all specialties) for maintaining 1st ranking nationally in the US OKAP (International) exam for 3 consecutive years, winning the prestigious UK FRCOphth McCartney Prize and a total of 9 outstanding awards during his residency period. He is married with one boy, and also an avid basketball player who represents the Singapore Medical Association team to play in the annual inter-professional games.