

## Commentary: Artificial intelligence in ophthalmology: Potential challenges and way ahead

Artificial intelligence (AI) has made tremendous advancements in the field of health care. Newer applications of AI are making a fruitful impact in ophthalmology as well. They have shown potential in diseases like diabetic retinopathy (DR), retinopathy of prematurity, age-related macular degeneration (ARMD), glaucoma, cataract grading, refractive error prediction, etc.<sup>[1,2]</sup> The present study has described in detail the uses of AI and its role in ophthalmology.<sup>[3]</sup> Currently, the role of AI is mainly in medical image identification and auxiliary diagnosis. AI has helped in achieving quality, accessibility, and availability in the field of health care. With the limited number of specialists and increasing population, the limitation of resources is always there. This can lead to late diagnosis, late initiation of treatment, and late referral of common treatable and preventable causes of blindness. Machine learning is one of the most commonly used principles in AI.<sup>[4]</sup> This involves the training of machine by providing a large amount of data followed by validation. The machine uses various models to draw its own inference pattern like convoluted neural networks. Keeping in mind its enormous potential, the NITI Aayog has formulated National Strategy for AI in June 2018 and is mandated to establish a

national program on AI in critical sectors like agriculture, health care, etc.<sup>[5]</sup>

There are also some unanswered questions and challenges which must be addressed in the future. The legal implications of AI in India and other parts of the world are one of the major hurdles. The legal issues involved with the development and implementation of AI algorithms are considerable. Regulation regarding legal causes of action such as medical malpractice and product liability, intellectual property rights, data security, and patient privacy are major contentious issues.<sup>[5]</sup> It is very difficult to set responsibility of the decisions/actions made by the machine on the developer or the user/customer, in case of misdiagnosis. The AI is not infallible. Current AI applications cater to diagnose only a single disease. A negative (normal report) finding of AI may give a false sense of security to the primary physician and patient leading to delay in the management of other serious eye conditions. For example, IDX DR can only diagnose and refer cases of DR. It will miss other co-existent ocular conditions like glaucoma, cataract, dry eye, etc., Thus, AI cannot replace a comprehensive dilated ocular examination by an ophthalmologist. The machine can have high false-positive rates which can lead to unnecessary fear and overtreatment in patients. For example, in ARMD, the machine can pick up the smallest of drusens which may not warrant any treatment. Most of the AI-based retinal applications examine patients in undilated pupils. These can miss important findings

in the peripheral retina which could be early markers of disease. Eye diseases can have regional variations as well. AI needs to be customized to the region and target population. The US-based data set cannot be strictly applied to Indian eyes. One such welcome step is Google Inc. collaborating with Aravind Eye Hospital to develop an AI algorithm for DR screening in India. Patient privacy and confidentiality of highly sensitive patient information, also need some legal regulation.

As it is still in the evolving stage, the high cost of AI can be a hindrance in resource-limited countries. It can only be used for diseases that have a high prevalence and high morbidity. Also, we don't know how the machine draws a certain pattern.<sup>[4]</sup> A good quality image data set for training and experienced annotators for validation are the basis of a good AI-based algorithm. Nguyen *et al.* have described how a machine can make a mistake.<sup>[6]</sup> It can also give wrong results if the relationship between input and expected output variables is complex as the machine is unable to build the model.<sup>[7]</sup>

In conclusion, AI can help in providing relief to the overburdened healthcare system and also help in reducing social inequality. The downsides of AI should always be kept in mind. AI cannot replace doctors but it can make them better.

**Divya Agarwal, Atul Kumar**

Dr. Rajendra Prasad Centre for Ophthalmic Sciences, All India Institute of Medical Sciences, Ansari Nagar, New Delhi, India

Correspondence to: Dr. Atul Kumar,  
Retina Services, Dr. Rajendra Prasad Centre for Ophthalmic Sciences, All India Institute of Medical Sciences, Ansari Nagar, New Delhi – 110 029, India.  
E-mail: atul56kumar@yahoo.com

## References

1. Padhy SK, Takkar B, Chawla R, Kumar A. Artificial intelligence in diabetic retinopathy: A natural step to the future. *Indian J Ophthalmol* 2019;67:1004.
2. Akkara JD, Kuriakose A. Role of artificial intelligence and machine learning in ophthalmology. *Kerala J Ophthalmol* 2019;31:150-60.
3. Dutt S, Sivaraman A, Savoy F, Rajalakshmi R. Insights into the growing popularity of artificial intelligence in ophthalmology. *Indian J Ophthalmol* 2020;68:1339-46.
4. Coyner AS, Campbell JP, Chiang MF. Demystifying the jargon: The bridge between ophthalmology and artificial intelligence. *Ophthalmol Retina* 2019;3:291-3.
5. National Strategy on Artificial Intelligence. NITI Aayog. Available from: <https://niti.gov.in/national-strategy-artificial-intelligence>. [Last accessed on 2020 Mar 29].
6. Nguyen A, Yosinski J, Clune J. Deep neural networks are easily fooled: high confidence predictions for unrecognizable images. In: *Proceedings of the IEEE conference on computer vision and pattern recognition*. 2015. p. 427-36.
7. Du XL, Li WB, Hu BJ. Application of artificial intelligence in ophthalmology. *Int J Ophthalmol* 2018;11:1555-61.

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

Access this article online	
<b>Quick Response Code:</b>	<b>Website:</b> www.ijo.in
	<b>DOI:</b> 10.4103/ijo.IJO_737_20

**Cite this article as:** Agarwal D, Kumar A. Commentary: Artificial intelligence in ophthalmology: Potential challenges and way ahead. *Indian J Ophthalmol* 2020;68:1347-8.