Editorial

Revolutionizing Ophthalmology: The Empowering Role of Artificial Intelligence

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Zahid Kamal Siddiqui[1], Muhammad Moin[2], Hafiza Sadia Imtiaz[3]

[1]Rahbar Medical and Dental College, Lahore [2,3]Department of Ophthalmology, Mayo Hospital, Lahore

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Artificial Intelligence holds immense importance in today's world and has the potential to alter our future in various domains. The importance of AI lies in its ability to automate tasks, enhance decision-making, personalize experiences, solve complex problems, and drive innovation. Choosing not to adopt AI may result in inefficiency, missed opportunities, limited innovation, reduced insights, and higher operational costs. It won't be long before the lives of those who benefit from AI and those who don't will diverge significantly. According to Stephen Hawking. "**Intelligence is the ability to adapt to change."**

Artificial Intelligence is transforming various sectors of healthcare, and ophthalmology is no exception. Use of Artificial Intelligence in ophthalmology has been there for quite some time, however, it remains relatively uncommon in our region. Nevertheless, its integration has revolutionized various facets of ophthalmology, resulting in enhanced accuracy, efficiency, and ultimately, improved patient outcomes.

Screening for ocular problems is of paramount importance, particularly for conditions with a high disease burden and severe consequences if not diagnosed and managed promptly. The most common are refractive errors, diabetic retinopathy, retinopathy of prematurity, glaucoma, age-related macular degeneration. AI enables cost-effective, large-scale screening programs for these eye diseases. We discuss some of the applications used for ophthalmology under the umbrella of AI.

Eye Artis an AI-assisted application that helps in diabetic retinopathy screening. It assists in automated detection of diabetic retinopathy through retinal image analysis and facilitating early intervention. According to a study, Eye Art had 81% accuracy for diagnosis and 83% accuracy in referrals while keeping retina specialist as the gold standard.[1]

Peek Acuity uses Artificial Intelligence to help users to check their visual acuity, thus prioritizing those who need immediate attention. It is especially helpful in areas where there is limited access to eye care services. The CBM-PEEK project is working in few districts of Pakistan from 2018 and efficiently reduced the load of refractive error patients in rural areas from 41% to 1% in 3 years duration.[2]

i-ROP DL system is another application that utilizes retinal images with AI-Algorithms to screen ROP. It helps in early diagnosis, and detection of plus disease. Various studies have compared the efficacy of i-ROP DL system in automated detection of ROP and found comparable results with those of retinal experts.[3,4]

Keratodetect is an AI tool that analyzes corneal topography and thus helps in rapid screening of keratoconus with an accuracy of 99.33%.[5]

Artificial Intelligence can help ophthalmologists in diagnosing various diseases by analyzing retinal images alone or combining with OCT images that include diabetic retinopathy, glaucoma, macular degeneration, cataract, retinopathy of prematurity etc. for example ResNetuses AI algorithms to identify referable cataracts.[6] Optovue iWellness combines OCT imaging with AI algorithms to aid in screening and diagnosing retinal diseases including DR and AMD. Similarly, IDx-DR is an FDA-approved AI tool for the autonomous detection of diabetic retinopathy while

using deep learning algorithm to analyze retinal images. CIRRUS HD-OCT with Angio Plex combines OCT imaging with angiography to do analysis of retinal structures and blood flow.[7]

Few other similar AI-assisted tools for diagnosing retinal diseases include Topcon Harmony with Opht AI, Retina Net, Deep DR, Ilastic, VGG-16, Open DR, and optic disc segmentation tool.

AI is assisting ophthalmologists to a significant extent when it comes to therapeutics, like in refractive surgery, cataract surgery, ocular oncology, and robotic surgery. Robotic surgery is not the routine in ophthalmology, only two robotic platforms have been developed for vitreoretina and one for cataract surgery is in development.[8] In Refractive surgery, AI helps surgeons in developing personalized surgical plans, providing real-time guidance, predicting long term outcomes and the same parameters are also addressed during cataract surgery.

In ocular oncology, AI works in many ways helping in early detection of intra-ocular tumors, their classification, precise treatment planning, and predicting prognosis and potential treatment outcomes.[9]

Artificial Intelligence helps researchers in analyzing vast datasets, providing the whole framework for research, suggesting new ideas, and doing statistical work. There are various AI assisted research tools that include Chat PDF, Consensus, Scite, Elicit, Sci Space, Academic Semantics, and Research Rabbit. Their free as well as paid versions are available online.

Ophthalmologists who are busy in teaching and training, may require AI assistance in creating ophthalmic presentations and videos and it would be so valuable for a busy academic ophthalmologist. AI assisted tools for this purpose include Lumen5, Powtoon, Visme, Prezi, Slide Bot, Microsoft Office AI, and DALL-E.

For training of surgical and clinical skills to ophthalmic residents, there is use of Virtual Reality (VR), Augmented Reality (AR) and the use of 3D simulators. The most widely used tool for performing virtual ophthalmic surgery is Eyesi Surgical simulator (VRmagic), that is used to train trainees in cataract and vitreoretinal surgery, another being Help Me See simulator.[10] Studies have shown that virtual reality trained residents in cataract surgery had less operating time and low intra-operative complications compared to those without supplementary virtual training.[10]

AI-guided apps are making eye care facilities more reachable globally particularly in remote areas, thus helping in disease monitoring while offering personalized eyecare through patient engagement. Some of these AI tools include; Eye Que (AI-guided mobile app that allows users to test their vision and monitor changes in their refractive error), Blink Health (AI-driven app reminds users to take prescribed eye drops or medication at prescribed times), Ocushield (it uses AI to manage screentime for those who have problems with digital eye strain and reminds them to take short breaks and offers eye exercises) and My Eye App which utilizes AI to help individuals with severe visual impairments by reading texts aloud, identifying objects, and recognizing faces, thus enabling them to move around independently.

In short, AI revolutionizes eye care and the integration of AI into ophthalmology field aptitudes a brighter future.

There are some limitations of AI too. AI works only for data it is trained on as algorithms are dependent on the quality of input data. Legal issues as well as medical insurance related issues arise when AI makes a wrong call. Thus, by addressing legal and ethical considerations, Artificial Intelligence is set to be a cornerstone in the future of ophthalmology.

"A computer would deserve to be called intelligent if it could deceive a human into believing that it was human." - Alan Turing.

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