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Artificial intelligence: An innovation shaping modern eye care

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Has anyone ever considered how Netflix is able to recommend films tailored to your preferences after only a few days, or how Siri on the Apple iPhone can promptly respond to commands? Additionally, the current phenomenon, ChatGPT, offers boundless potential in education and business.[1] All of these innovations are powered by artificial intelligence (AI), which has permeated modern society and seamlessly integrated into our daily lives, to the extent that many tasks are now dependent on its use. Eye care has not been exempted from the impact of the Fourth Industrial Revolution, and it is important to highlight the transformative role AI plays in the evolution of eye care in the 21st century. Acknowledging and appreciating the significant contributions of AI in clinical applications and research is crucial, as it continues to push the boundaries of modern eye care.

The utility of clinical AI lies in its ability to enhance patient care and improve health outcomes. Artificial intelligence can be integrated into healthcare facilities to directly interface with patients, utilising deep learning algorithms to analyse retinal and optical coherence tomography (OCT) images in conditions such as diabetes, glaucoma and age-related macular degeneration (AMD). This assists clinicians in staging disease progression and informing care decisions, particularly in the early detection of conditions to prevent progression towards visual impairment.[2] Technologies such as ocular biometry and digital applications are employed in myopia control, guiding clinicians by considering fundamental factors such as refractive error, axial length and associated risk factors. Over time, these tools can predict the severity of myopia progression, helping eye care practitioners recommend appropriate treatment options aimed at reducing axial elongation and the resulting myopia-related visual impairment.

In certain cases, AI is capable of providing automated diagnoses, offering valuable guidance to inexperienced clinicians and aiding in screening where access to care is limited. Artificial intelligence's role in telemedicine is particularly transformative for eye care, extending specialised services to remote areas that may otherwise lack access to expert clinicians via a simple internet connection. Moreover, advancements in remote cybersurgery and robotics offer a solution to geographical barriers and the shortage of surgeons, allowing for the performance of unique ocular procedures that are sight saving.[3] This technology holds the potential to significantly improve care in resource-constrained settings.[4]

None of these advancements would have been possible without research driven by machine learning, neural networks and data analytics applications, which enable the study of eye science at a granular level. This research generates new knowledge, fuelling innovations that benefit both patients and clinicians at the frontline of care. Today, AI can analyse extensive datasets to study diverse populations, allowing for the discovery of hypotheses in ways previously unimaginable with traditional small sample sizes. An example of this is the identification of new biomarkers for diseases such as AMD and glaucoma.[5]

The application of AI in clinical trials significantly enhances the automation of multicentre patient recruitment and enables the handling of complex analyses, providing alternative insights that improve treatments across diverse populations – far surpassing the capabilities of traditional human-led statistics. Artificial intelligence's use of predictive modelling and simulations represents a potential breakthrough. Artificial intelligence-generated models, built from large datasets and powered by modern computing technologies, offer the ability to predict the progression of conditions such as diabetic retinopathy, glaucoma and myopia.[2,6]

The widespread use of AI in eye care in Africa like other parts of the world still has a few challenges. Most datasets used in training AI algorithms have not been inclusive of significant data from people of African descent. This might result in AI systems that may perform less accurately among our population, potentially leading to misdiagnosis or unequal care.[7] Large volume, high-quality

datasets and images are, however, required in order to be well integrated into AI research. We also need to develop robust regulatory and ethical frameworks to ensure patient protection and accountability for AI applications in clinical practice.[8] This is thus a wake-up call for eye care practitioners in Africa to invest in and be more involved in AI research.

The responsibility placed upon ophthalmic researchers around the world comes at a time of immense promise, where their work has the potential to benefit humanity in unprecedented ways. As clinicians, laboratory scientists and public health researchers in the field of eye care, it is crucial that we continue to collaborate in order to sustain the momentum and harness the vast possibilities brought forth by this ongoing revolution in eye care. Those involved in advancing this field deserve our deepest appreciation for their invaluable contributions. From the data collectors who provide the foundational big data, to the engineers developing today's supercomputers, the scientists who model and code and the clinicians who save vision, humanity owes them sincere gratitude.

While researchers are not necessarily expected to code, it is essential that they collaborate with data scientists, software engineers and other specialists, working within multidisciplinary teams to address the pressing challenges in eye care. We welcome submissions to the journal that embody this spirit of collaboration and innovation and that have the potential to revolutionise the field of eye science.

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