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Review Article

Artificial intelligence in Corneal Topography: A Short Article in Enhancing Eye Care

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ABSTRACT

The eye is a critical part of the human being, as it provides complete vision and the ability to receive and process visual details, and any deficiency in it may affect vision and loss of sight. Corneal topography is one of the essential diagnostic tools in the field of ophthalmology, as it can provide important information about the cornea and the problems that appear in it. Artificial intelligence strategies contribute to the development of the healthcare domain through a group of approaches that have a significant and vital impact on improving the field of ophthalmology. The primary purpose of this paper is to highlight the efficiency of artificial intelligence in extracting features from corneal topography and how these techniques contribute to helping ophthalmologists diagnose corneal topography. Furthermore, the focus is on the performance of AI algorithms, their diagnostic capabilities, and their importance in helping physicians and patients. The effects of this paper confirm the effectiveness and efficiency of artificial intelligence algorithms in the clinical diagnosis of various eye concerns.

1. INTRODUCTION

Topographic images are visual representations of the front and back surfaces of the human cornea that convey information and provide details of the corneas, whether healthy or unhealthy [1-3]. They are diagnostic tools that assist ophthalmologists in identifying hidden areas in the eye. Through these images, maps are created using a system called Pentacam that helps doctors diagnose corneal defects by supplying important and hidden details [4][5]. The role of artificial intelligence has occurred in the evolution of ophthalmology, as it contributes to the analysis of clinical data on corneal topography and the analysis of medical images [6-10]. The computer provides essential tools for ophthalmologists in diagnosing the cornea through software that assists in analysing extensive data that is noteworthy in making decisions. The cornea is the outer part of the human eye and has fantastic focusing power. Corneal topography has been relied upon in ophthalmology by providing a detailed map of the corneal surface. The cornea is dome-shaped, transparent, and curved. It has an ideal tissue organization and does not contain any substances or blood vessels. The shape and curvature of the cornea are noteworthy explanations for eye conditions, ranging from refractive errors to keratoconus, and give visual paths and problems found in the ectopic eye. Enter artificial intelligence in the field of data processing and identify the behaviour and patterns found in it [11-13]. This science plays a significant role in identifying features and determining clinical relationships between datasets by providing the appropriate diagnosis for each patient case. Artificial intelligence has contributed to creating and developing a digital environment that assists in diagnosing and interpreting corneal data and enhances patient care [14][15]. It allows ophthalmologists to explain the biomechanical response of the cornea in post-operative cases, as the cornea is responsible for 75% of the power of vision. Therefore, any deficiency in it may lead to vision problems and disorders, including

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astigmatism [16], Hyperopia [17], and Myopia [18]. The presence of artificial intelligence in the field of ophthalmology has a significant impact on diagnosing corneal topography, early detection of corneal disorders, providing appropriate treatment, and improving patient outcomes. A scanner called the Pentacam is used to study the parts of the eye and help ophthalmologists examine the cornea's front surface.

Technology is a tool humans design to complete human work in various domains. Technology and applications are a feature of human glory, proving that a person cannot live only to eat but requires more than that to develop his skills and complete his work quickly and accurately. Technology can empower the intangible components of human life, namely feelings, thoughts, intuition, and ideals, in many areas in order to create life and build a promising future for society. Technology also demonstrates a manifestation of the intelligence of the human mind. Artificial intelligence is a branch of computer science that makes machines inside a computer, and then these machines can do the work themselves without being managed by a programmer; that is, they work on their own. The programmer's role is essential when it comes to AI, as the programmer only ensures the operation of the AI without monitoring it continuously. Computer science has many branches, but it is different from artificial intelligence; this branch is something that can work like humans, who can do everything that humans do. Experts and researchers gathered at Dartmouth College to discuss the ability of computers to imitate or emulate human intelligence. Participating scientists included Allen Newell, Herbert Simon, Marvin Minsky, Oliver Selfridge, and John McCarthy. One area of technology that is a significant contributor to digital transformation is the domain of artificial intelligence. Artificial intelligence is the growth and integration of the fields of electronics, computer science and mathematics. Simply, artificial intelligence systems can work like humans, such as thinking, making decisions, classifying a situation, or estimating future conditions. Health is a part of human life and a goal to continue living. Health does not focus on physical fitness but includes a healthy spirit where individuals can be tolerant and accept differences. The stress during the global pandemic (COVID-19) has caused many disorders such as fear and anxiety in themselves and those close to them; Changes in sleeping and eating patterns; feelings of depression and difficulty concentrating; boredom and stress due to constant presence at home, especially children, in addition to the emergence of psychological disorders. The influence brought by artificial intelligence technology makes medical work in the hospital easier. Thus, artificial intelligence methods are contributing to the development of the healthcare environment and supporting physicians in making health decisions and tracking the spread of diseases.

The main contribution of this article is to concentrate on the role of artificial intelligence techniques in the field of ophthalmology through diagnosing corneal topography and visual disturbances and the role of machine learning algorithms in interpreting corneal data.

2. AI IN CORNEAL TOPOGRAPHY

Artificial intelligence techniques are characterized by strategies and practices in the area of corneal topography, as it is the latest qualitative shift in the way in which various eye conditions are diagnosed and managed, and reports are generated about each eye condition [19][20]. Corneal topography is a diagnostic tool that helps ophthalmologists diagnose the eye by mapping the curvature and shape of the cornea as well as creating a diagram of the transparent anterior surface of the eye. This information is vital in diagnosing and managing conditions such as astigmatism and others. It helps in planning refractive surgeries such as LASIK (changing the shape of the cornea using a laser). Artificial intelligence techniques contribute to the growth of surgical operations, enhance accuracy, efficiency, and overall quality in patient care, improve their health condition, and assist specialists in identifying areas where disease occurs. These techniques improve the accuracy of corneal measurements through modern practices that help ophthalmologists correct the eye path with high accuracy and efficiency. The traditional methods that are implemented in health institutions are not helpful, give unsatisfactory results, and are likely to be subject to errors. AI-based topography devices use machine learning algorithms to accurately analyse corneal images and provide precise details and more reliable data. Machine learning algorithms have the ability to study data behaviours, survey results, and predict disease development. The accuracy provided by machine learning algorithms is of great importance to ophthalmologists to help diagnose all problems that occur in the eye, as early detection is extremely significant and necessary in saving the eye from damage. In addition, these techniques provide the possibility of creating treatment plans through more advanced practices than the traditional systems implemented in health institutions. This is done by analysing a large set of data in analysing the topography of the cornea and arriving at the results of providing the appropriate treatment for each patient case. Machine learning algorithms can identify patterns and relationships, design treatments more accurately, improve visual outcomes, and reduce the risk of complications from vision loss. These algorithms assist in determining the ideal parameters for laser vision correction procedures, ensuring patients achieve the most useful visual acuity in the shortest possible time. Machine learning algorithms accelerate the diagnosis process in corneal topography and improve treatment. Traditional methods require a great deal of time and experience in interpreting corneal topography and making clinical decisions. Also, these algorithms provide real-time and automated analyses that allow ophthalmologists to make diagnoses and determine treatments faster than traditional methods. Traditional procedures and practices need to give satisfactory results for patients who find it difficult to cooperate with lengthy examination procedures. Machine learning algorithms allow access to clinical data on corneal topography that helps ophthalmologists perform corneal examinations and laser operations. These procedures are helpful in improving patient outcomes and helping them obtain health care with high efficiency, less effort, and lower costs. Early detection of eye diseases is one of the most critical priorities of artificial intelligence, as it is done by analysing corneal topography data and identifying subtle changes that indicate conditions such as diabetic retinopathy. Early detection of any disease allows physicians and healthcare workers to intervene promptly and prevent vision loss or any other condition affecting the eye. At large, artificial intelligence techniques help ophthalmologists diagnose corneal topography with high accuracy and efficiency, customize treatment plans, speed up diagnosis, and contribute to early eye disease detection.

3. CONCLUSIONS

Artificial intelligence techniques contribute to the diagnosis of eye diseases by providing a set of practices that help ophthalmologists diagnose the topography of the cornea and identify affected areas in the eye. Much literature has involved machine learning algorithms to analyse corneal data with high accuracy and efficiency. Artificial intelligence techniques maintain the confidentiality and privacy of data and do not allow unauthorized persons to tamper with or change it. The implemented practices help ophthalmologists diagnose and perform surgeries and laser operations accurately and without human errors. In the future, studies will be conducted on the use of machine learning algorithms in diagnosing corneal topography data.

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Conflicts Of Interest

The author's disclosure statement confirms the absence of any conflicts of interest.

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