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Artificial Intelligence in Oral Pathology-The New Era -A Review

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Abstract:- Artificial intelligence (AI) are a wide range of new technologies that continue to have an impact on daily life. The advancement of AI allows for the analysis of large amounts of data, which gives reliable information and enhances decision-making. AI will most likely change the way we live and work. In the last decade, the exponential increase of knowledge in the field of AI and its branches has provided new potential for its application in healthcare, including oral pathology. The successful application of these strong technologies in pathology and medicine necessitates cross-disciplinary literacy, which includes basic knowledge and awareness of ideas that oral pathologists have historically been unfamiliar with. This article includes definitions and basic knowledge of AI and its component branches such as machine learning, artificial neural networks and deep learning. This review enlightens the possible applications of AI and the associated challenges in mainstream oral pathological research and diagnosis.

Keywords:- *Artificial intelligence; Machine learning; Implications in Oral pathology.*

I. INTRODUCTION

Computer-assisted diagnosis is now a reality because to the development of digital pathology technology such tiny cameras, high throughput scanning devices, and full slide imaging systems. Additionally, the generation of an abundance of digital disease data has stimulated creative study by utilising artificial intelligence (AI) methods like deep learning (DL) and machine learning (ML).[1].

II. HOW DO ARTIFICIAL INTELLIGENCE MODELS WORK?

Artificial intelligence (AI) functions in two phases: "training" in the first phase and "testing" in the second. The training data determines the parameters of the model set. Retrospectively, the model uses information from earlier examples, such as patient information or information from data sets with a variety of examples. After that, the test sets are subjected to these settings. In dentistry, the input data could be visual (pictures, spectral or radiographic images), text (medical or treatment records), vocal (handpiece noises), or text (experimental parameters). These data are inputs that the neural networks process and output [(3)].

III. ARTIFICIAL INTELLIGENCE IN DENTISTRY

A branch of computer science called artificial intelligence (AI) aims to give machines the appearance of human intellect or the ability to mimic intelligent human behaviour. In other words, artificial intelligence (AI) is intelligence demonstrated by machines, computers, and systems, whereas animal and human intelligence is natural intelligence. John McCarthy came up with the phrase. Dentists should be aware of how AI works and how it can aid them with activities like diagnosis and treatment since AI systems can assist them in creating clinical decision support structures(2). Its use drastically changes day by day. Dental imaging diagnostics, caries detection, radiography and pathology, robotic aid, and electronic medical records have all been impacted by the development of these technologies[(4)].

Applications in 2-D and 3-D now incorporate AI. Artificial intelligence (AI) is used in 3-D radiographs, such as tomography scans, to annotate anatomical landmarks and section bone.

Patient motivation and team communication have benefited from smile design. AI could help with decision-making in the field of orthodontics. For the diagnosis of extraction in orthodontic patients, a novel method utilising artificial neural network (ANN) models has been presented. [(3)]

Machine learning techniques were used in periodontics to investigate possible AI capabilities for comprehending periodontitis in a novel way.

A laboratory designing programme with AI capabilities will be in high demand given the present trend towards computer-aided design/computer-assisted production (CAD/CAM), and the fact that some materials in prosthodontics require a higher level of precision.

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IV. ARTIFICIAL INTELLIGENCE IN ORAL PATHOLOGY

Automation of image analysis, computer-assisted diagnosis, and content-based picture retrieval are all applications that are increasingly using machine learning and deep learning methods. In 1998, oral cytopathology was mechanised using the PAPNETTM, an interactive automated system for conventional cervical smears that had a 61% accuracy rate for detecting oral squamous cell carcinoma (OSCC). There has always been a strong correlation between oral epithelial dysplasia (OED) and substantial inter- and intra observer disagreement. Oral pathologists have therefore strongly supported the necessity for computer-assisted grading and diagnosis of OED in order to increase the accuracy of the grading systems. With an accuracy rate of 89.3%, Gupta et al. in attempted to categorise OED into mild, moderate, and severe epithelial dysplasia.

The disease-related protein expression is quantitatively estimated by IHC image processing employing DL methods, which also increases scoring reproducibility. To ensure that surgical resection margins were safe and tumor-free is the main purpose of histopathology reporting of these resection tissues. A lot of histological slides must be examined, advanced grossing procedures must be used, and the diagnosis process takes a long time. ML approaches have been utilised to accurately diagnose colorectal, breast, lung, and head and neck cancers in order to decrease the amount of human labour and diagnostic time required to report these specimens. Algorithms have been used to recognise lymph node micrometastasis, including Lymph Node Assistant, a Google AI-developed neural network for recognising cancer cells in lymph node biopsies. One of the best methods to lower death rates may be to use AI to diagnose OC in its early stages more quickly and accurately. The use of AI in oncology to increase the efficacy and accuracy of screening questionable lesions is currently gaining focus.

V. CONCLUSION

Pathology could be transformed by improving diagnostic efficacy and patient clinical outcomes because to the rapid growth of digital pathology and the research into prospective applications of AI(1). As AI is not equivalent to or capable of replacing our human brain, it should only be used in conjunction with professionals or radiologists in order to prevent errors. We can improvise our diagnosis and treatment planning with the help of this AI technology and integrate it with established approaches. This will also aid in overcoming the inconsistent current grading and staging results across pathologists and help to improve patient clinical outcomes[(7)]. Despite the perception that artificial intelligence poses a threat, it is possible that pathologists may benefit from AI technologies that generate and analyse huge picture data by having greater value, efficiency, accuracy, and personal pleasure.

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