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Editorial

Role of artificial intelligence in periodontology and implantology

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The development of computer systems that allow machines to mimic human behaviour is known as artificial intelligence (AI). This is being utilised more frequently as a support tool to aid clinicians in the diagnosis and treatment of diseases. One of the most prevalent diseases in the world, periodontitis results in the degeneration and loss of the tissues that support the teeth. The goal of artificial intelligence (AI) is to create computer programmes that can mimic human behaviours. Commentators feared that AI would eliminate clinical employment in medicine and dentistry as early as the 1970s; nevertheless, this has not happened. Science fiction will portray AI as a comprehensive, all-encompassing intelligence, but this is not the case in reality.[1] Up till now, AI development has succeeded in resolving issues in particular fields by mastering various thought processes and perspectives.

The sixth most common disease worldwide is periodontitis. It is characterised by host-mediated inflammation that is microbially related and causes the loss of alveolar bone and periodontal attachment, which can result in tooth loss.[2] The well-reported but complex interactions of this disease with a number of other physiological systems have a negative impact on overall health and quality of life.[3]

Clinicians find it difficult to effectively identify and diagnose periodontitis. Current best practise emphasises radiographic imaging for evaluating hard tissues and graded probes for measuring soft tissues. Due to changes in probing pressure and radiography angulation, these approaches exhibit low inter- and intra-operator reliability.[4]

As a result, diagnosing periodontitis presents a problem because the disease process has complicated interactions between risk factors, making it challenging for physicians and scientific methods to completely understand. The research of this disease can benefit from the application of AI to better understand how these complicated aspects affect diagnostics or our understanding of its aetiology.

It's crucial to distinguish AI from conventional software development. The researchers describe a sequence of processing steps and, optionally, a data-dependent technique to achieve the results in the conventional approach to software development. This is best explained as follows: an input 'A' is received, it is computed using the pre-defined strategy of sub-tasks, and an output 'B' is returned. As a result, even though technology performs very useful jobs for humanity, it also risks offering only a little degree of availability for adapting to unforeseen events. In contrast, artificial intelligence operates differently. Both the input "A" and the necessary output "B" are provided when constructing an AI-based tool; the AI technique will then tweak the tool to harness the relationship between inputs and outputs, which can subsequently be used on new (unseen) data sets with typically outstanding performance.

AI is being used more frequently in dentistry and medicine as a supporting tool, and it is increasingly seen as a need for delivering secure and efficient healthcare. Deep

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learning (DL) has more recently been the foundation of this effort, primarily due to its applications arising from the use of artificial neural networks (ANN) that exhibit a very high degree of complexity.[5]

In these networks, numerous artificial neurons (or nodes) are connected to form layers, and hundreds or thousands of layers are then put together to form specific structures known as architectures. Electronic health records, imaging data, wearable device sensor collections, and DNA sequencing are among the activities that DL networks can analyse vast volumes of data to execute. AI is becoming more prevalent as a supporting tool in health and dentistry. These are typically employed in the medical fields for computer-aided diagnosis, individualised treatment plans, genetic analysis, and therapy response evaluation.

Convolutional neural networks (CNNs), a subclass of ANNs, are created especially for processing image input. The idea of CNN was to imitate the visual cortex and distinguish patterns in an image. Traditional neural networks are severely limited in the quantity of the images they can analyse because they normally need to process each pixel separately. The output of CNNs, on the other hand, is a new collection of data that replicates the original layout of the image while increasing or decreasing the information recorded at each position. CNNs are capable of working with the image data in its spatial layout. In order to "highlight" important features that will help accomplish the task at hand, for example, choosing different facets of an object to detect its presence in the image, this method is comparable to adding a number of digital filters to an image.

Radiographs are used in dentistry together with a thorough clinical examination, special tests, and other diagnostic tools to help with assessment, diagnosis, and treatment planning. Depending on the disease or pathology being studied or the operation being performed, a radiograph may be acquired using bitewing, periapical, or orthopantomography techniques. The diagnosis of dental caries, the staging and grading of periodontal disease, the identification of apical pathology, or the evaluation of peri-implant health are some common reasons for collecting dental radiographs. However, it has been demonstrated that inter-rater and intra-rater agreement is low in identifying dental caries and periodontal bone loss, supporting CNN's analysis.

AI is still in its relative infancy and has not yet been fully utilised in periodontology and implantology. It would seem that much may be achieved by using this technology given the benefits of diagnostic support, data analysis, and comprehensive regression. This scoping review sought to evaluate the most recent data on the application of artificial intelligence in the field of periodontics and implant dentistry given the relative dearth of research in the domain.

Over the past ten years, the usage of CNNs in periodontal and dental research has increased steadily. The majority of studies concentrated on image processing and structure recognition. Virtual help in diagnosis will be pertinent to the doctor given that both imaging modalities are advised in the evaluation of patients with periodontitis. The majority of these research were more concerned with image segmentation than pathology identification. We can only presume that this was brought on by a detection tool's higher level of complexity compared to segmentation. However, moving ahead, a helpful technique would be relative detection from subsequent radiographs or additional pathology identification.[6]

Conclusion

In conclusion, this article provides information about the use of machine learning in the discipline of periodontology. Every attempt should be made to align future studies with the increasingly acknowledged gold standard for periodontology and implantology research and reporting.

Conflict of Interest

None.

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