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Review Article

AI and Dentistry: Bridging the Gap between Technology and Patient Care

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Abstract

The fourth industrial revolution has led to the rise of Artificial Intelligence (AI) as a significant contributor to various industries, including robotics, automotive, and healthcare. AI is particularly useful in dentistry, as it can diagnose conditions that surpass human capabilities. AI research in dentistry has permeated all domains, but there is a need for a comprehensive approach to study design, data allocation, and model performance.

AI has been increasingly used in various fields, including operative dentistry, periodontics, orthodontics, and orthodontics. In operative dentistry, AI has been used to identify dental caries, vertical root fractures, apical lesions, pulp space volume, and tooth wear. In periodontics, AI has been used to diagnose periodontitis and categorize potential types of periodontal diseases. In orthodontics, AI has been used to plan and predict treatment outcomes, simulate alterations in facial photographs before and after treatment, and facilitate communication between patients and dentists.

AI is playing a significant role in Oral and Maxillofacial Pathology (OMFP), specifically in detecting tumors and cancer using radiographic, microscopic, and ultrasonographic images. In prosthodontics, AI has been used in restoration design, enhancing workflow efficiency and accuracy. AI-driven virtual dental assistants can perform tasks with enhanced precision and reduced errors and can accurately detect genetic predisposition to oral cancer.

AI has significantly transformed the field of oral surgery, forensic odontology, dentistry, and bioprinting. Robotic surgery, image-guided cranial surgery, and voice-activated dental chairs have shown efficacy in clinical settings. Bioprinting, a technology that generates living tissue and organs, has the potential to reconstruct oral tissues lost due to pathological or unintentional factors. However, the potential for AI to replace dentists remains uncertain, and its generalizability and reliability need to be assessed using external data.

Keywords: Computing Machinery; AI; Artificial Intelligence; Machine Learning

Introduction

The advent of the fourth industrial revolution has ushered in a novel digital era, wherein Artificial Intelligence (AI) emerges as a pivotal and significant contribution. As electronic devices become increasingly prevalent in people's lives, the data stored by these devices has become more extensive.

Artificial intelligence enables the seamless utilisation and analysis of data derived from electronic devices. AI is experiencing rapid growth and expansion across various industries. It can acquire knowledge from human expertise and perform tasks that require human intelligence. One of the definitions of artificial intelligence is the study and advancement of computer systems capable of executing tasks that typically necessitate human intelligence, including but not limited to visual perception, speech recognition, decision-making, and language translation [1].

Artificial intelligence (AI) has been implemented in various industrial sectors, including robotics, automotive, innovative city development, and financial analysis. Furthermore, it has found applications in medicine and dentistry, such as medical and dental imaging diagnostics, decision support systems, precision and digital medicine, drug development, wearable technology, hospital monitoring, and robotics.

AI is often considered a valuable tool for dentists and clinicians to alleviate their workload. In addition to utilising a singular information source focused on a specific disease, AI can acquire knowledge from various information sources (multi-modal data) to diagnose conditions that surpass human capabilities. For instance, fundus photographs, in conjunction with additional medical information, including age, gender, BMI, smoking habits, blood pressure, and the probability of developing diabetes, have been employed as predictive tools for heart disease [2]. Hence, the AI can identify