

THE ROLE OF ARTIFICIAL INTELLIGENCE IN DIAGNOSING DENTAL DISEASES

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Artificial intelligence (AI) is significantly transforming our lives by enhancing convenience, personalizing experiences and improving fields like healthcare, education, and transportation. It enables faster decision-making, automation of repetitive tasks and the ability to analyze vast amounts of data with speed and accuracy far beyond human capacity.

The role of AI in dental diagnostics is growing rapidly and is fundamentally transforming how doctors detect, interpret and predict oral pathologies. By leveraging advanced algorithms and machine learning techniques, AI is enhancing diagnostic precision, enabling earlier detection of dental diseases, and supporting more informed clinical decision-making. One of the most prominent applications is the automated analysis of dental radiographs, such as bitewing and periapical X-rays, where AI systems are trained to identify subtle indicators of caries, periapical lesions, periodontal bone loss, root resorption, and other abnormalities that may go unnoticed by the human eye.

Particularly, convolutional neural networks (CNNs) have shown remarkable performance in analyzing dental images. These models can not only classify types of caries but also highlight suspicious regions within an image using heatmaps or bounding boxes, guiding the doctor's attention to areas of concern. Studies have demonstrated that CNN-based diagnostic tools can achieve accuracy levels comparable to or even exceeding those of experienced dentists, especially in early-stage caries detection and differentiation of periapical changes[1]. This technology is especially valuable in large-scale screenings, tele-dentistry, and decision support systems, where speed and consistency are critical. Figure 1 illustrates an example of AI-based caries classification, with highlighted zones representing regions of potential demineralization or decay.

