

**Literature Review: Transforming Dental Caries Diagnosis Through Artificial Intelligence-Based
Techniques**

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Tooth decay is one of the most common diseases affects 3.5 billion people worldwide (Anil et al. 2023). At present, the diagnosis of tooth decay mainly relies on clinic check and X-rays. Their accuracy and consistency are limited because of their subjective nature.

As the usage of artificial intelligence (AI) developed in the last few years, AI has great potential in the field of tooth decay diagnosis, it can bring better clinical results through its high accuracy and high efficiency in data processing in the dental industry.

Types of AI-Based Techniques in Dental Caries Diagnosis

Deep Learning Algorithms

Deep learning, particularly Convolutional Neural Networks (CNN) (Anil et al. 2023), has shown exceptional accuracy in analyzing dental radiographs. CNNs can recognize spatial hierarchies in images, making them highly effective for image classification and object detection tasks (Anil et al. 2023).

Machine Learning Algorithms

Machine learning (ML) analyzes large datasets to point out patterns associated with tooth decay. Some of the commonly used ML models are Support Vector Machines (SVMs) (Anil et al., 2023) which are well suited for complex data and class of problems but difficult to interpret. Random Forests (Anil et al., 2023) is another model that constructs several decision trees to predict outcomes. It doesn't make mistakes easily and works well even if the data is incomplete or unbalanced, which is common in medical cases.

Hybrid Models and Advanced Techniques

Combining ML and deep learning techniques has been explored to improve diagnostic accuracy. For example, integrating SVM and CNN models allows for the handling of both structured and unstructured data, providing a more comprehensive analysis.

Existing AI-Based Technologies in the Dental Industry

AI-based technologies already exist in the dental industry, at least three AI tools for dental caries diagnosis have been reported and marketed. For example, Pearl analyzes dental radiographs with greater accuracy. Overjet enables accurate interpretation of dental images. Denti.AI employs machine learning for real-time diagnosis and treatment planning, overcoming variability in radiograph interpretation. These tools improve precision and consistency in dental practice (Anil et al. 2023). But need to solve problems like data privacy, bias, and legal issues to use AI properly in dentistry. More research is still needed for AI to fully help in oral health care.

Conclusion

AI, especially CNN, has demonstrated considerable promise in improving the accuracy and efficiency of AI-based techniques for the diagnosis of dental caries. AI systems such as Pearl, Overjet, and Denti.AI already proven its ability to help standardize diagnostic practices, reduce human error, and ultimately improve patient outcomes.

References

Anil, S., Porwal, P., & Porwal, A. (2023). Transforming Dental Caries Diagnosis Through Artificial Intelligence-Based Techniques. *Cureus*, 15(7), e41694. <https://doi.org/10.7759/cureus.41694>