

# Artificial Intelligence in Pediatric Dentistry Toward Safe Ethical and Clinically Valid Intelligent Systems

**Vinutha Ragavaiah Sethupathy Sarma and Nasar Mohammed**

Department of Medical Sciences, Saveetha Dental College and Hospitals, Chennai, India

Department of Healthcare Administration, Valparaiso University, IN, USA

nasar.mohammed.connect@gmail.com

ORCID: <https://orcid.org/0009-0006-8946-2448>

**Abstract:** *AI is revolutionizing the healthcare industry by opening up new avenues for improving clinical effectiveness, therapeutic customization, and diagnostic precision. Applying AI to pediatric dentistry has benefits and drawbacks since children's bodies, thoughts, and behaviors differ from those of adults. This study offers a thorough investigation and experimental methodology for assessing AI-powered kid oral health care solutions. The study looks at the current applications of gamified platforms and intelligent agents in tasks including automated caries diagnosis, tooth segmentation in mixed dentition, calculating dental age, predicting orthodontic therapy, and behavior management support systems.*

*We use pediatric-specific datasets, such as intraoral pictures and panoramic radiographs, together with stringent preprocessing and annotation guidelines to circumvent the problems that come with adult-trained models. Advanced deep learning designs, including transformer-based models for classification, convolutional neural networks, and U-Net variants for segmentation, are assessed using cross-validation and external testing. Clinically useful metrics including the Dice coefficient, ROC-AUC, sensitivity, specificity, and calibration indices are used to evaluate the model's performance.*

*This research looks at the effectiveness of AI as well as the privacy, legal, and ethical issues that come up when it is used on children, including explainability, algorithmic bias, data protection, and informed permission. To guarantee the safety of clinical adoption, the suggested approach strongly emphasizes human-in-the-loop validation and adherence to the recommendations. According to the results, artificial intelligence (AI) holds great promise for improving the diagnosis and treatment of dental issues in children; yet, it needs to be tested in a range of contexts, be open about its operation, and be customized for kids. The groundwork for creating AI systems in pediatric dentistry that are trustworthy, safe, and directly affect patients is established by this work.*

**Keywords:** AI, clinical decision support, dental radiography, dental radiography, dental age estimation, dental radiography, caries detection, tooth segmentation, deep learning, and medical image analysis. Ethical use of AI in healthcare

