

THE IMPORTANCE OF ARTIFICIAL INTELLIGENCE IN STOMATOLOGY IN DETERMINING DAMAGE TO TEETH AND SOFT TISSUE CONDITION

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Abstract. The article contains information about the importance of artificial intelligence in dentistry, which is becoming popular today.

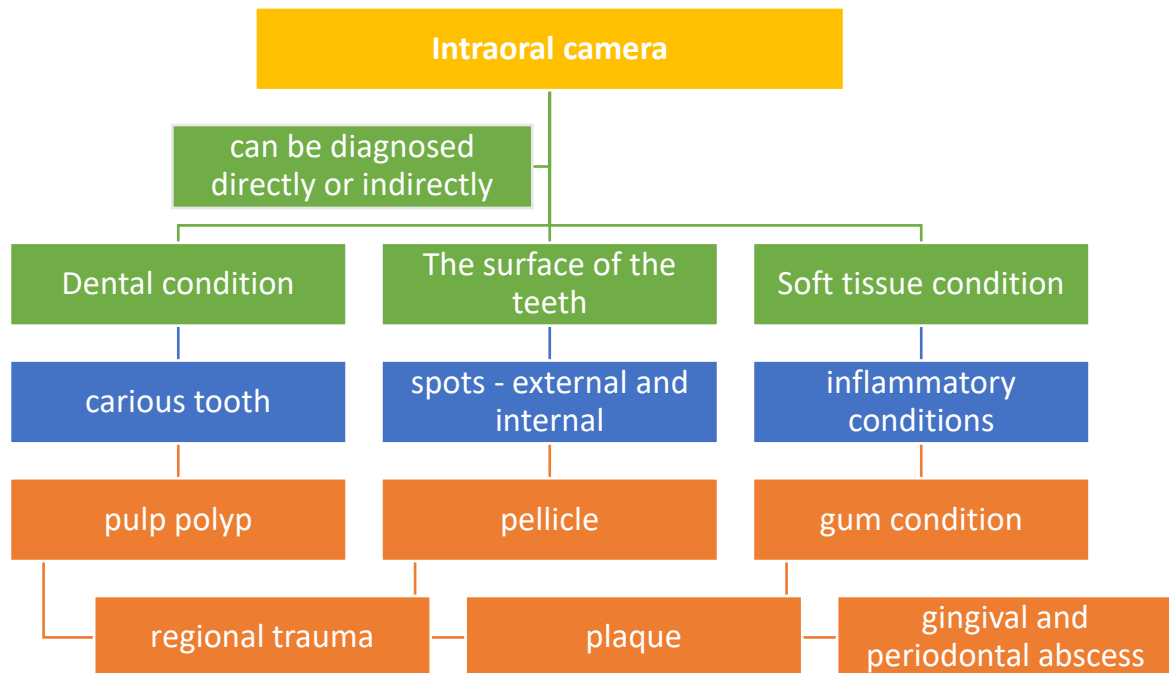
Key words: artificial intelligence, intraoral cameras, CNN, ANN, neural networks, radiographs.

Enter. As dentists, it is important to stay abreast of the latest advances in the field in order to provide the best care for patients. Over the years, technology has played an important role in revolutionizing dentistry, and one of the most recent advancements is the use of artificial intelligence in dentistry. Artificial intelligence has been around for a long time, but its use in dentistry is relatively new. Artificial intelligence technology involves the use of algorithms to perform tasks that normally require human intelligence. In dentistry, artificial intelligence can assist in a number of functions, from diagnosis and treatment planning to patient communication and education [3,7].

Dental AI tools include products that allow dentists to remotely analyze oral photos sent by patients via smartphone. Imaging tools use artificial intelligence to guide patients in taking pictures of their teeth and then refer the dental care team for signs of poor oral health [1,3,5,12].

Many advances in dental technology have made the most important dental services, such as checkups, much easier to perform. One of these technologies is intraoral cameras. In visual assessment of teeth, the analysis of intraoral photographs in machine-readable form can be considered equivalent to visual inspection and provide the imaging data that is a key requirement for automated analysis [2,4,7,8,10].

Technique: caries lesions reflect infrared light. In this way, we can detect caries lesions on approximal surfaces early.



Advantages of an intraoral camera include:

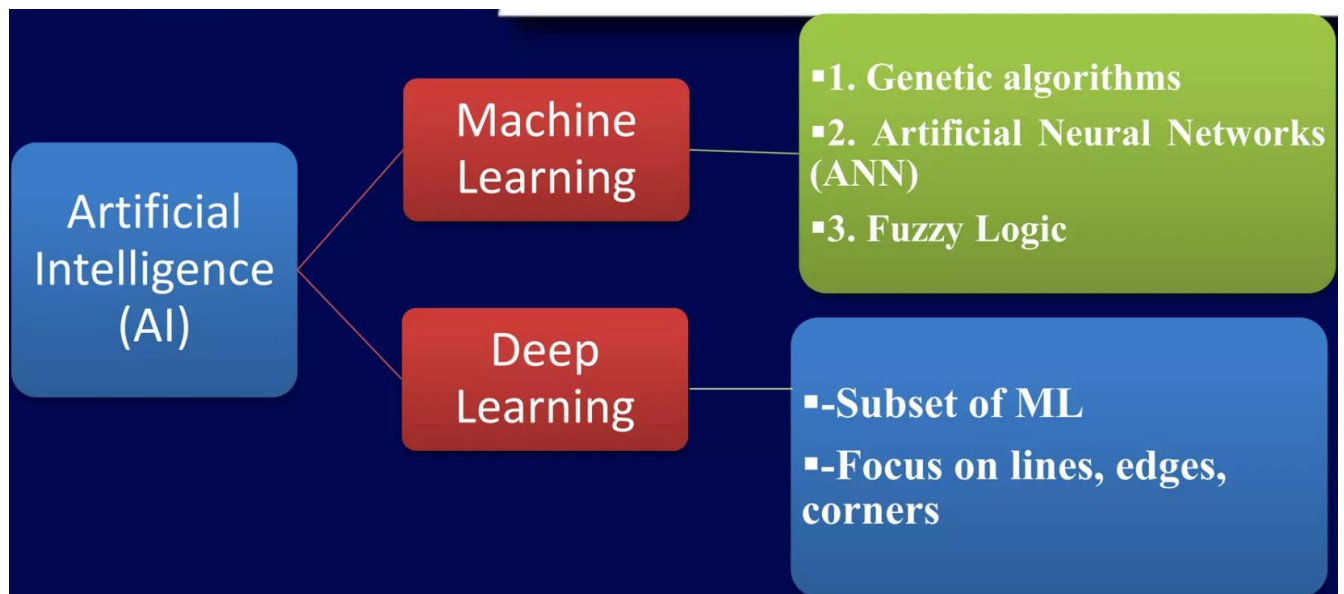
1. Detects oral problems earlier – can detect early signs of dental problems, especially problems that may be invisible to the naked eye.
2. Improves Patient Relations – If a patient prefers to "see" when it comes to their oral health, this device is perfect.
3. Enhanced precision for procedures – with an intraoral camera, dentists can zoom in on parts of the mouth and examine areas that are more difficult than using a hand-held dental mirror or traditional microscope.

Artificial intelligence technology in dentistry, if more widely adopted, could save dentists valuable time and money by allowing them to predict abnormalities and read radiographs more accurately. It is the simulation of intelligent human processes by machines, especially computer systems. In general, AI systems work by taking large amounts of labeled training data, analyzing it for correlations and patterns, and using those patterns to make predictions about future states.

It focuses on 3 cognitive states

- ❖ Learning
- ❖ Reasoning
- ❖ Self-correction

Types of artificial intelligence in the field of medicine:



Deep learning is a complex multi-layered system with more interconnected neurons and has the ability to see simple features.

Mechanism learning involves adjusting parameters relative to the underlying technique. That is: the number of neurons, layers in the neural network technique, the number of population, the rate of mutation and the crossing over rate in the genetic algorithm technique [1,11,12].

The most commonly used algorithm in the field of medicine is Convolutional neural Network -CNN and artificial neural networks - ANN.

The most advanced Artificial Intelligence method is carried out by detecting caries in dental x-rays. 3000 apical radiographs were evaluated using depth-learning-based CNN and an accuracy of over 80% was achieved [2,5,9].

In this work, it was shown that CNN can correctly classify caries in 92.5% of images considering all input images. 93.3% of all tooth surfaces can be correctly classified to detect caries-related cavitation. In addition, diagnostic indices were calculated for each of the caries classes; Here, the highest accuracy is shown for caries-free surfaces (90.6% accuracy), followed by non-cavitated caries (85.2%) and cavitated caries (79.5%).

In this image taken through the intraoral camera, according to the color scale:

- ✓ 0-1.0 - green - healthy tooth enamel
- ✓ 1.0-1.5- blue - the initial stage of enamel caries
- ✓ 1.5-2- red - deep enamel caries
- ✓ 2-2.5- orange - dentine caries
- ✓ >2.5- yellow - deep dentine caries

In this diagnostic study, AI algorithms were shown to detect caries and caries-related cavities in machine-readable intraoral photographs with at least 90% accuracy. Thus, the intended learning objective has been achieved. In addition, a web tool was developed for independent evaluation of the Artificial Intelligence algorithm by dentists. offers interesting possibilities for future clinical applications: carious lesions can be captured using intraoral cameras and evaluated almost simultaneously and independently of dentists to provide additional diagnostic information. This work is part of a recent effort to automatically evaluate diagnostic images using artificial intelligence techniques [1,4].

Clinical application of artificial intelligence methods may be possible in the future, but more fundamental research is needed to overcome the existing limitations and the relevant differential diagnosis results should be taken into account. Based on the existing work, it can be concluded that under ideal conditions more than 90% agreement can be achieved in caries detection using intraoral photographs using a trained CNN. We hypothesize that the results can be further improved by, firstly, adding more images and secondly, applying accurate image segmentation. In addition, subsequent pathological findings such as developmental defects or tooth restoration should be considered when using clinical photographs as a potential machine-readable source of information for diagnostic purposes [1,4,7,12].

The advantages of artificial intelligence are as follows: carious lesions can be photographed with intraoral cameras and evaluated almost simultaneously and independently of dentists to provide additional diagnostic information. Early diagnosis of cavities can prevent pain and invasive and expensive treatments such as root canals or extractions. Clinical rigor is strengthened across practices, ensuring that patients receive standardized care and an enriched experience using dental AI as a clinical decision aid [2,5,9].

Dental artificial intelligence can help improve the accuracy of caries detection and improve patient-provider interactions. Can improve patient education and provide continuous presentations to help patients better understand what is going on in their mouths. Supports the growth of new patient flow as it improves diagnostic accuracy for new and existing patients and is programmed to provide timely and appropriate patient care. Dentists can provide patients with the most appropriate treatment options for accurate diagnosis, improving patient confidence and clinical outcomes. The most advanced method of artificial intelligence is carried out by detecting caries in dental X-rays.

Conclusion. Future strategies to improve AI-based caries detection in intraoral images should consider image segmentation as an alternative technique that should be performed by well-trained and calibrated dentists under highly skilled supervision.

Although many studies have shown the potential use of artificial intelligence in dentistry, these systems cannot replace dentists. On the contrary, it should be considered as an additional asset to help dentists.

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