

# AI Can Help Dentists Detect Cavities More Reliably

*Preventive measures are crucial for preventing tooth decay and reducing dental care costs, but early detection is also essential, AI can help.*

PRAGUE, CZECH REPUBLIC, June 11, 2024 /EINPresswire.com/ -- Researchers from the Faculty of Electrical Engineering (FEE) of the Czech Technical University (CTU) and the 1st Faculty of Medicine (1st LF) of Charles University (CU) have developed an artificial intelligence (AI)-based method for more reliable detection of tooth decay. This new method, based on deep learning, has demonstrated accuracy comparable to that of experienced dentists in diagnosing cavities from X-ray images.

Preventive measures are crucial for preventing tooth decay and reducing dental care costs, but early detection is also essential. Early detection can significantly reduce the extent and cost of dental treatment. X-rays complement visual and probe examinations, which may be insufficient, especially for detecting early interproximal caries. However, previous studies have shown frequent disagreements among dentists in their interpretations of X-rays.

The new research, published in the journal *Clinical Oral Investigations*, compared the performance of the automatic caries detection method with that of seven dentists, including three beginners and four experienced professionals. "Their task was to mark tooth decay on a hundred X-rays. The agreement between the experts was relatively low. As a result, the automatic method, which uses deep learning, consistently outperformed the novices and achieved similar or better results than even very experienced dentists," said Professor Jan Kybic, who works at the Department of Cybernetics at FEE CTU.

The idea of comparing the results of existing diagnostic methods with deep learning came from Dr. Antonín Tichý of the Stomatology Clinic of the 1st Faculty of Medicine of Charles University and the General Faculty Hospital in Prague. Dr. Valéria Nagyová of the same workplace also participated in the research.

"Unlike other medical disciplines, dentists make and interpret most of their own X-rays themselves. However, the evaluation of X-rays is to some extent subjective and can vary considerably between doctors, which was confirmed in our study. In this respect, AI-based automatic caries detection can reduce the risk of overlooking caries, for example, and visualization of caries on the image can facilitate communication between the doctor and the

patient. The motivation was also to use it in the teaching of dental students, which we do at our workplace," says Dr. Antonín Tichý.

As part of his diploma thesis, CTU graduate Ing. Lukáš Kunt made a significant contribution to the research by creating a dataset of image data and a neural network from almost four thousand anonymized X-rays with more than seven thousand tooth decays.

Automatic caries detection can assist both students and future dentists. The study by scientists from FEE CTU and 1st LF UK has shown that the automatic method can improve the accuracy and repeatability of caries detection, providing a useful second opinion even for experienced dentists.

"In radiology, the practice is that two doctors look at the images, and if they disagree, a third can come in. But a dentist in a typical practice does not have this option, as he is usually alone, so our method could help him the most, especially if he is a beginner with less clinical experience," summarizes Prof. Jan Kybic, highlighting the greatest potential for application.

"The user interface is almost ready for use, but first we need to test how useful the automatic method is as a tool for students. We want to find out by comparing the ability to detect tooth decay in students who will have our application available to them with students who are learning by standard methods, i.e., lectures and practical demonstrations with a supervising dentist. Depending on the results, we will continue to optimize and implement the application into teaching. The road to use by dentists in the field is still long, and it will be difficult to compete with commercial products that have more time and financial resources," explains Dr. Valéria Nagyová.

#### References:

Lukáš Kunt, Jan Kybic, Valéria Nagyová, Antonín Tichý. "[Automatic caries detection in bitewing radiographs: part I-deep learning](#)"

Antonín Tichý, Lukáš Kunt, Valéria Nagyová, Jan Kybic. "[Automatic caries detection in bitewing radiographs-Part II: experimental comparison](#)"

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