

How a Neural Network Can Use Dental X-Ray Imagery to Make a Diagnosis



The Diagnocat project relies on AI-based technology that uses 3D scans to determine the condition of teeth, find problems, and suggest treatment. Currently, the company is operating in Russia, China, the United States, and Italy.

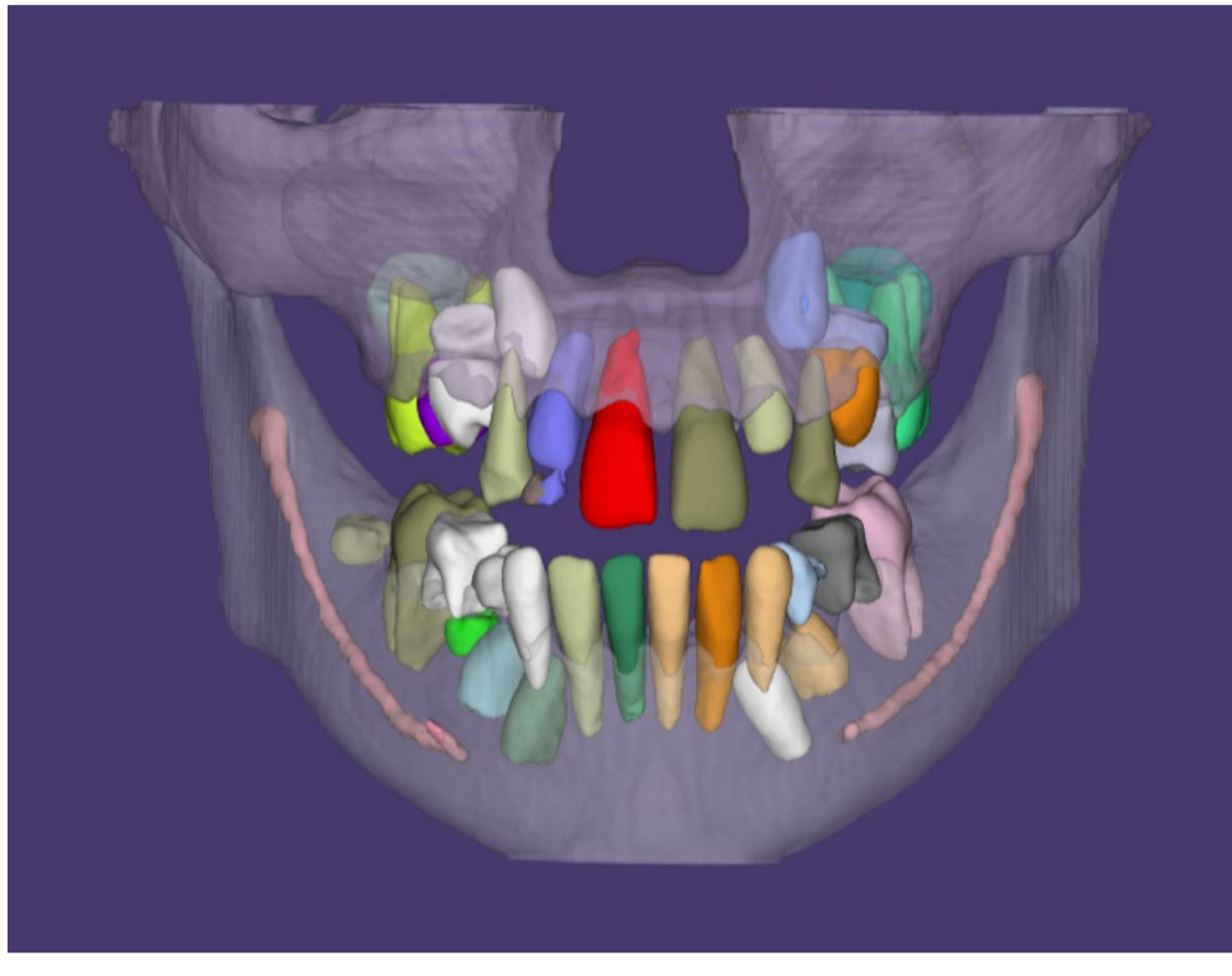
Objective

To create a service application for dentists using AI-based analysis of all types of dental images which would improve the quality of treatment for patients.

Background and Motivation

The planning of treatment and its quality directly depend on the human factor, including the dentist's qualifications and personal experience. At the same time, dentists often have to deal with uncommon cases and complications by involving a team of various dental specialists in the treatment.

After taking images (ranging from a "simple" X-ray image to a 3D computed tomography scan) and consulting several dentists, a patient may get different diagnoses and recommendations. In essence, the patient's health depends on how accurately the dentists are able to interpret the studies and use available data to prepare a treatment plan. The impact of the human factor can be minimized by using artificial intelligence, which will never get tired or distracted or miss any critical findings.



Solution

A service for analyzing dental images based on artificial intelligence and computer vision was launched by Vladimir Alexandrovsky, the owner of a chain of dental clinics, along with Yevgeny Nevgen and Sergey Gonchar, the founders of MSQRD, a service for applying digital face masks to online images.

Implementation

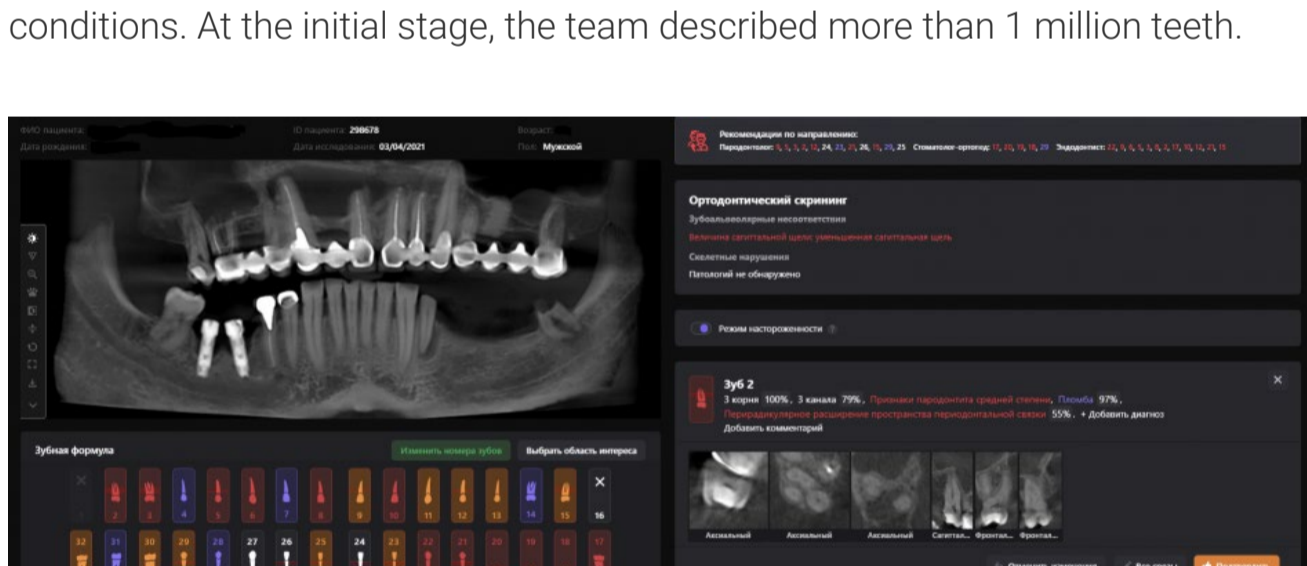
An initial small team of engineers was brought together in March 2017 and created the first minimum viable product (MVP). This was a prototype solution capable of using X-ray imagery to recognize a particular tooth and identify its structure and pathologies. Tens of thousands depersonalized CT scans of patients have been used to train the artificial intelligence. These scans were manually tagged by radiologists to identify caries, periodontitis, and other dental conditions. At the initial stage, the team described more than 1 million teeth.

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Today, Diagnocat includes several dozen neural networks operating in two areas:

1. localizing the problem, i.e., identifying the anatomical formations within the human skull, such as teeth, bones, channels, sinuses, etc.;

2. finding signs of pathology, i.e., identifying abnormalities in a tooth, canal or bone.

To determine the efficacy of the solution, the testing was conducted in Moscow, where two groups of ten dentists made diagnoses based on dental images of real patients. For a month, one group relied only on their own knowledge, while the second group used Diagnocat. After a month, they switched roles and continued the experiment; however, they had to work with the same images that they had examined at the first stage. The study revealed that the use of Diagnocat reduces the number of errors by 30%. Without the service, the dentists either fail to identify diseases or overstate the number of diagnoses.

Results

The first sales of Diagnocat began in 2019 and are growing on average by 15% a month. A pay-by-case model was used at the initial stage (where a dentist would upload an image and receive its AI-based analysis for a fee). In early 2020, monthly revenue exceeded 2 million rubles, and the steady demand from dentists for the Diagnocat service made it possible to move to a monthly subscription model.

Diagnocat provides the patient with a second expert opinion about his or her dental health. Moreover, this opinion is objective and independent. The report generated by the system is simple and clear. The patient can see what exactly requires treatment and can be sure of avoiding overdiagnosis.



At the end of the Q1 2021, Diagnocat was being used by dentists in more than 350 clinics in Russia and the CIS.

Plans and Prospects

The company plans to expand internationally. The most promising markets for Diagnocat include Japan, Europe, and the United States. Diagnocat is in the process of obtaining approval from the U.S. Food and Drug Administration (FDA) in order to operate in the United States. Sales are expected to start before the end of 2021.