Про бизнес November 19, 2018

Dental clinic owner launches a startup to look for dental problems (the creators of MSQRD invested in it)

Vladimir Aleksandrovsky. Photo from Vladimir's Facebook page

Vladimir Aleksandrovsky built a chain of dental clinics in Moscow, but wanted to «close the circle» and create an IT project (some time ago he had given up programming courses). 3 years ago he figured out how to do it. He is creating a technology that, based on artificial intelligence, determines the condition of the teeth and helps dentists make a diagnosis. The creators of MSQRD, Sergey Gonchar and Evgeny Nevgen, have already invested in Diagnocat. Vladimir Aleksandrovsky and the project's co-owner and CTO, Matvey Yezhov, told us their story.

Vladimir Aleksandrovsky: All my life I've been doing dentistry. I worked my way up from clinic attendant to clinic administrator, doctor, deputy director, and founder and owner of the Fantasy group of companies. Currently we have 5 premium-class dental clinics (Dental Fantasy for children, Belgravia Dental Studio for adults), the Fantasy pediatric clinic and DF Trade, a dealership of dental and other medical equipment. I haven't practiced dentistry for 7 years now; I'm mostly busy with healthcare management.

The Idea

Once I dreamed of becoming a programmer and attended courses (I think it was C++), but didn't understand what an «array» is, and dropped it:). However, the idea of «closing the circle», of returning to the creation of an IT product, did not leave me.

My favorite Harvard professor, Richard Bohmer, summed up the path of a medical organization's development perfectly:

1. Management of company and team values.

2. Resource management.

3. Treatment outcome management.

4. Process management.

5. And finally, the fifth step is the clinical decision support system (CDSS).

I think we have reached the fifth step. I've seen real problems in dentistry (even in our clinics). Doctors, depending on personal experience, views, mood and even health, can make different clinical decisions. Just like the well-known case: after a meal, judges hand down more acquittals or lenient sentences than they do when they are tired and hungry. But the patient wants to come to the doctor for help and get an objective diagnosis, a competent treatment plan for his specific situation. I decided that this kind of accuracy is almost impossible to achieve without artificial intelligence.

I follow medical innovations all the time and read about computer vision image recognition technologies. And I decided that it would be great to apply this approach in dentistry.

A truly high-quality diagnosis and treatment without modern X-ray technologies is a utopia. I'll tell you a little about what types of images dentists use today:

• Local focused images that can be done with high quality for 1-2 teeth.

• Panoramic 2D image. Such an investigation is also called an orthopantomogram (OPTG). This is an image of all the teeth, the bone tissue of the upper and lower jaw, the structure of the maxillary sinus and the structure of the temporomandibular joint.

• Complete three-dimensional reconstruction of the maxillofacial area – cone-beam computed tomography (3D CBCT). This is the most modern investigation method today.

Many advanced dentistry facilities are equipped with computed tomography (CT) scanners. This is a complex, expensive piece of equipment that came into use around 2006. Dentists were then forced to master a new profession—radiology, because working with CT images requires separate skills and practice. A radiology course at dental faculties, not only in Russia, but also in other countries, is very short and superficial.

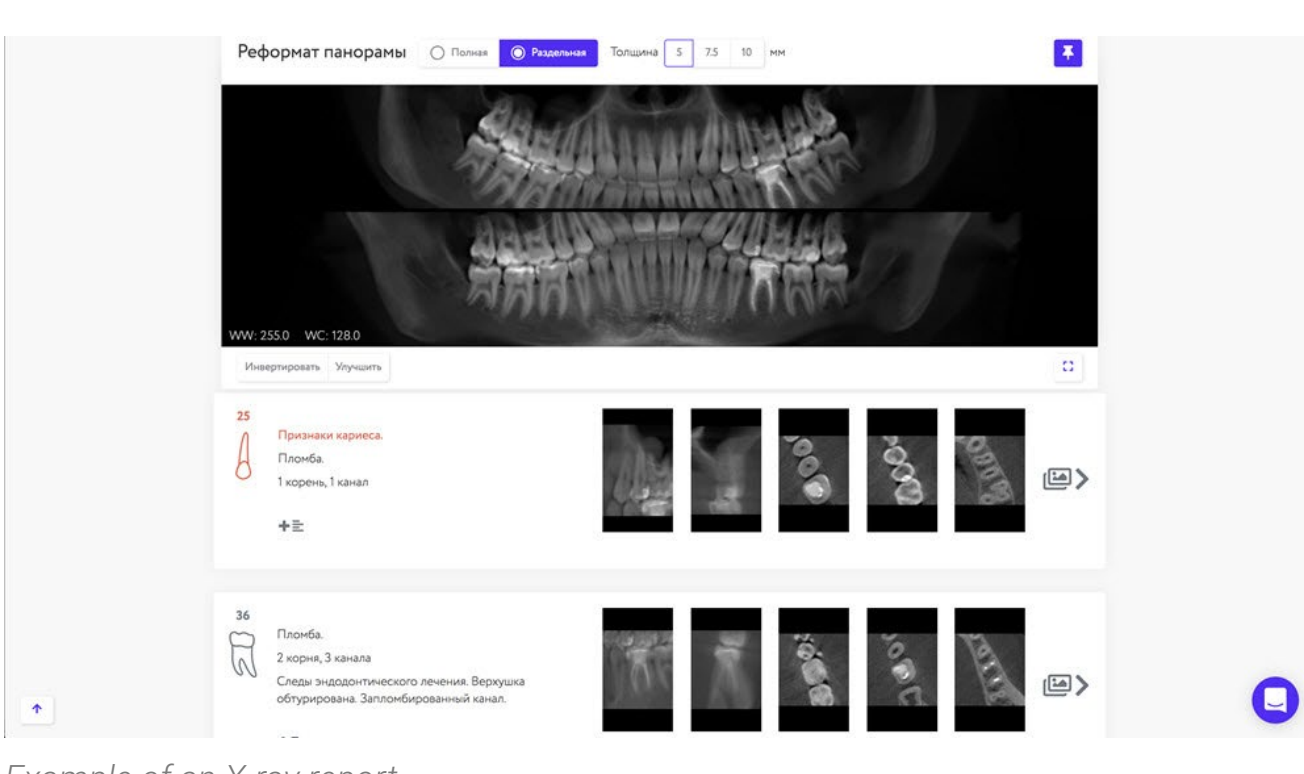
As a result, for example, in the USA, there are currently about 70,000 radiographers, but no more than a couple dozen people are employed in dentistry. In general, in every country, there are 15-20 radiologists for tens of thousands of dentists. These are «stars», who mostly teach at universities; they don't practice. Dentists are taught to work with CT scanners by these «stars» or even by equipment suppliers. But the interface through which the dentists view CT results is complex. I personally saw this when I bought the first scanner in my own clinic and learned to use it.

All this often leads to the fact that dentists don't use the capabilities of CT to the extent that they should, miss pathologies, and make inaccurate or erroneous diagnoses. And I decided that it was necessary to create a product based on artificial intelligence (AI) that would make it possible to analyze images of a dental scanner and determine the condition and pathology of the teeth.

Development of the technology explained by the project's CTO

Matvey Yezhov
Co-owner and CTO of Diagnocat

- Presently we have a system (pipeline) of 4 separate convolutional neural networks trained on several sets of investigations with several layers of tagging. We also have our own algorithms for image pre- and post-processing. One part of the networks works to separate anatomical regions, and another part to determine the conditions of teeth and other organs.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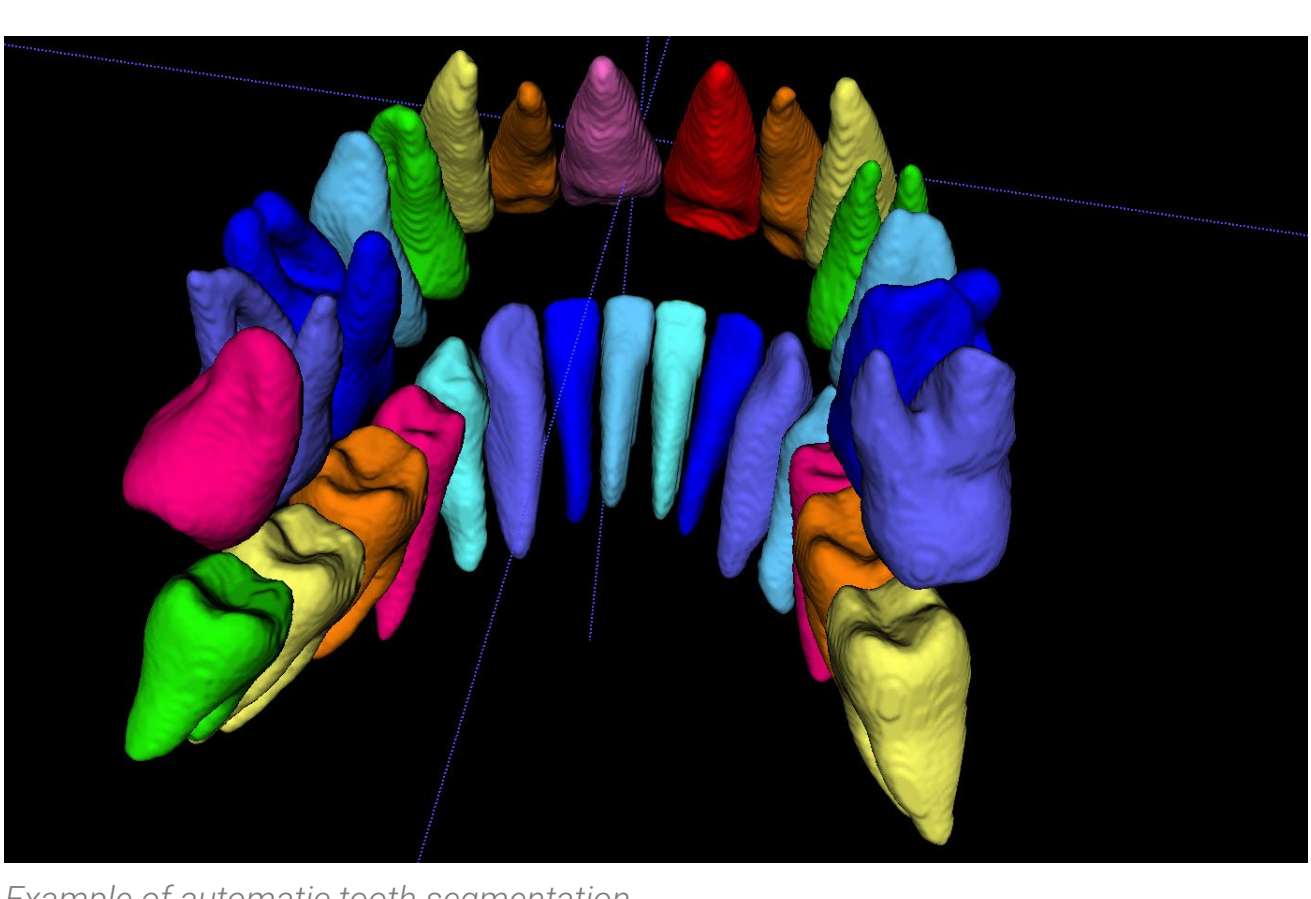
Признаки кариеса.
Пломба.
1 корень, 1 канал
36
Пломба.
2 корня, 3 канала
Следы эндодонтического лечения. Верхушка обтурирована. Запломбированный канал.

Example of an X-ray report

We pay great attention to expanding and improving datasets and tagging. A tag is a designation on medical images. To train the algorithm, doctors mark what the computer must automatically recognize: anatomical areas (teeth, jaws, sinuses) and pathologies and conditions (caries, periodontitis, fillings, crowns).

To do this, we create tagging tools and invest in attracting and training annotators and improving the methodology. Annotation is the first stage in the preparation of training material for the algorithm. The annotation specialist describes the required parameter in the tomogram or marks it in a special program. For example, the presence of an artificial crown on a particular tooth is indicated in the questionnaire, while the attribute of caries is "painted over" on the image.



Example of automatic tooth segmentation

Difficulties:

1. We have always understood that data is very important, but we did not immediately realize how important. If we were to start now, then, first of all, we would establish the processes associated with tagging the way we have them organized today. Previously, we tagged only the teeth, enclosing them with squares (bounding boxes), but now we tag all anatomical regions and structures with pixel precision. It is time consuming and expensive, but opens up new possibilities for the product. Generally speaking, the algorithm learns according to the same logic as a first-year student—first anatomy, then pathology, then methods of treatment. And you shouldn't jump to the next course too early.

2. Design of AI-based products for doctors. How to package the product so that it can be both useful and enjoyable for doctors.

The convenience of software for a practitioner is determined not only by how accurately the signs of diseases are recognized, but also how the diagnostic process is organized, how similar it is to the traditional diagnostic path. Here it is important to «show» the results of the program in familiar «pictures». After all, the doctor acts as a judge for the algorithm and is responsible for the diagnostic decision made.

We had to allocate an engineer who «tunes» pictures that a doctor understands, studies the habits of doctors, and makes adjustments to the appearance of the program

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3. Quality and safety for patients. We think about how to make sure that the clinical outcome does not suffer even in cases of various system failures.

The team

Vladimir Aleksandrovsky: Initially, we invested in development, hired guys for design work (everyone worked remotely), wrote a technical assignment, and once a week they reported on progress. But since there was no operational day-to-day management from us—the founders of the project—the first team lacked leadership. The first time the team did not succeed, and the motivation was lost.

We shouldn't have started such a project with outsourced developers and without operational management.

We gathered a new team. We now use various management tools; we combine strategic and agile management. We use a lot of applications in our daily work – Slack, Trello, Notion, Airtable, Zoom, etc. Several team members work remotely, and we need to communicate with them comfortably.

What we have undertaken is real research work. We have published 2 scientific articles and applied for a US patent. The team has over 20 members:

• Developers (full stack data scientists, data engineers, researchers)

• Product manager, designer

• Expert-level radiologists

• Annotators (X-ray technicians, medical students, dentists, radiologists).

Each has an individual task depending on the skill level.

The hardest part is finding good engineers. Fortunately, doctors are not such a problem—for many, working on such a project is simply interesting. And I also bring in doctors from my own clinics.

Monetization

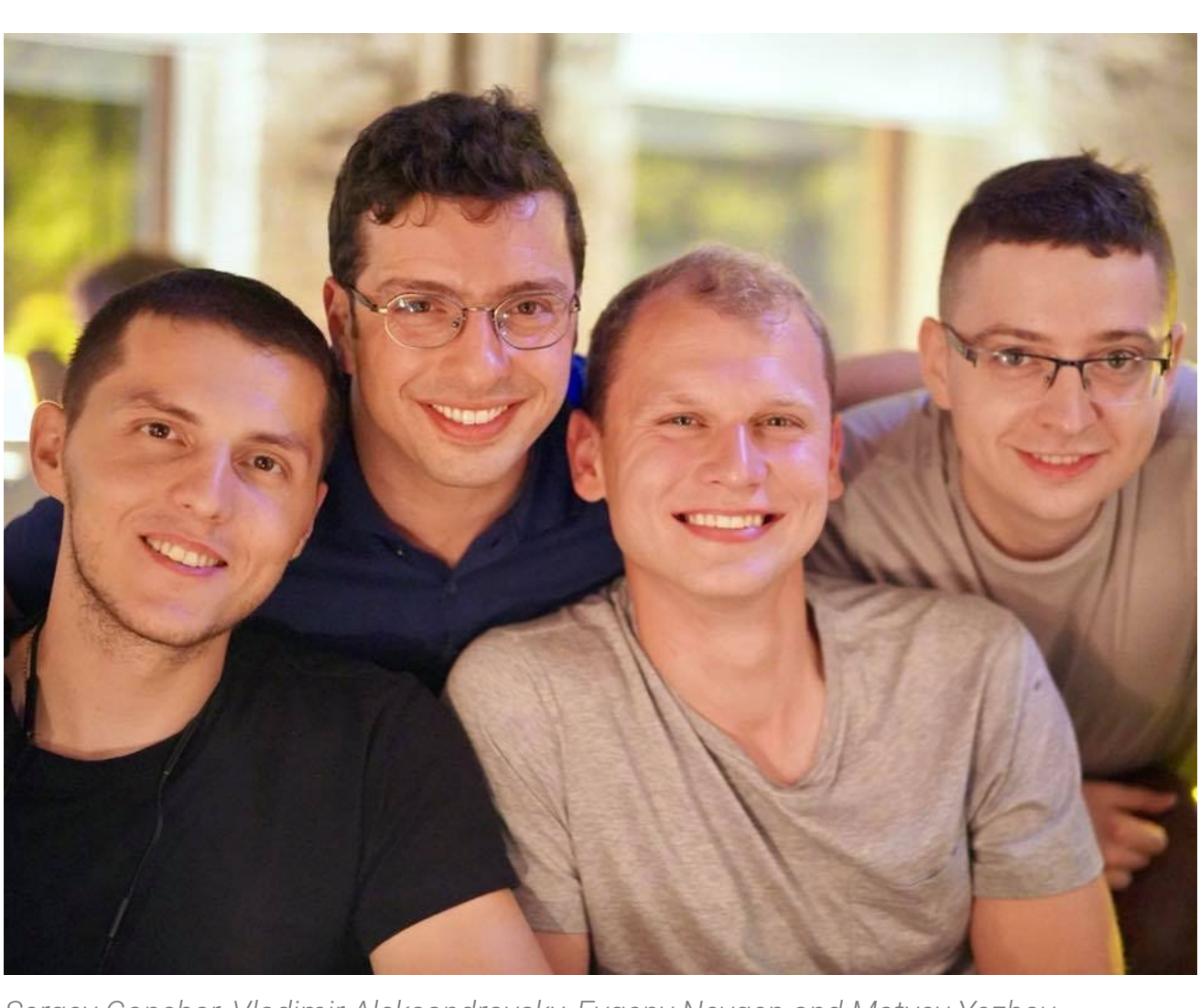
We primarily expect to enter the American and European markets. We will monetize in different ways: both by subscription and per click, that is, for the analysis of one CT scan investigation. But I'm not ready to disclose the price yet.

Based on our algorithms, we will create various products that are useful for dentists. For example, from a 3D investigation, we will generate a set of slices with all the dimensions of the jaw that are necessary for a maxillofacial surgeon to install a dental implant. A doctor needs currently 20 minutes for such an X-ray report and it can cost a couple of hundred dollars in the United States. Using the Diagnocat algorithms, this report will be automatically generated in a matter of minutes.

Attracting investments

We have invested several hundred thousand dollars of our own funds in development and are working on attracting investments.

About a year and a half ago, friends introduced me to Evgeny Nevgen and Sergei Gonchar, the creators of the MSQRD project that Facebook bought. They liked my idea and we invested together in the project. They generously share their experience and connections, and their names as investors helps a lot to fill vacancies for development engineers. They constantly challenge the team with their questions. For example, they suggest that we study a successful case of a startup and draw conclusions on how we can apply its approaches. These are my expectations from investors for future rounds.

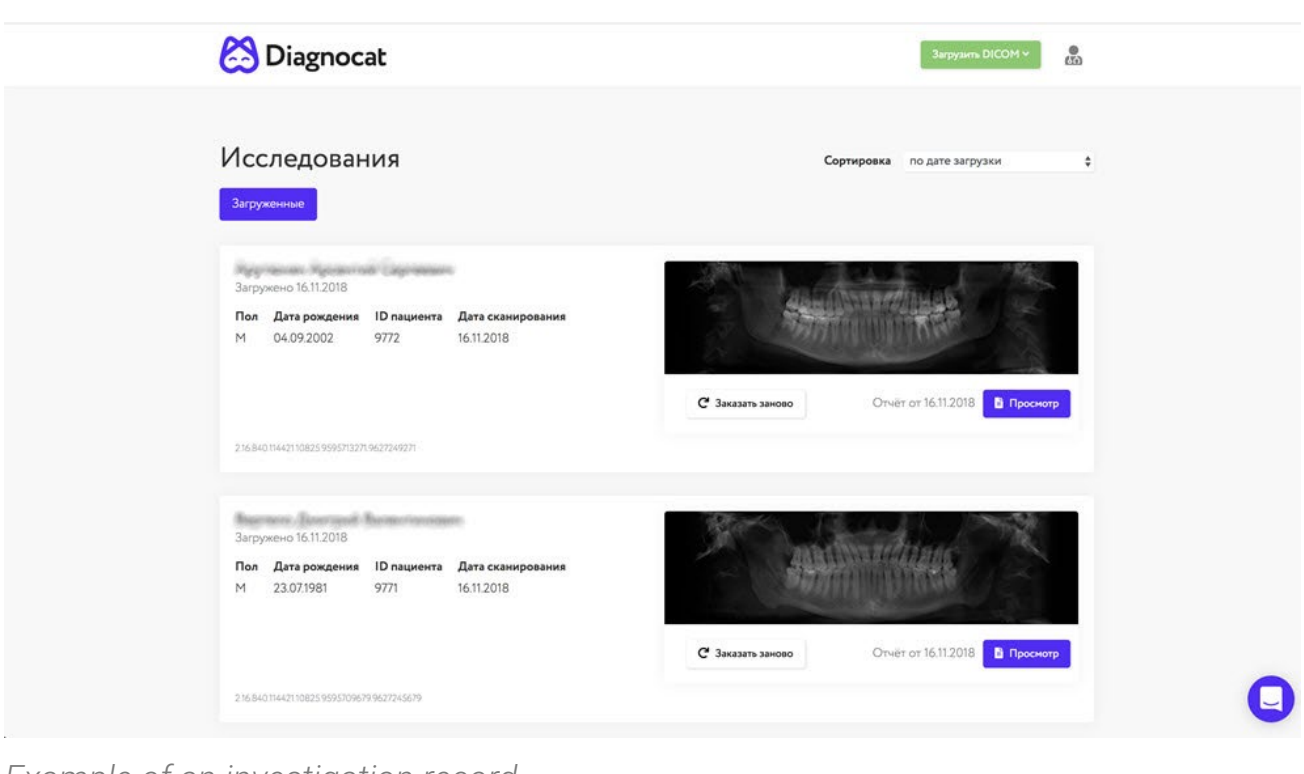


Sergey Gonchar, Vladimir Aleksandrovsky, Evgeny Nevgen and Matvey Yezhov. Photo from Vladimir's Facebook page

The project is to become large-scale, and it is difficult to finance it further with our own funds. We have already started looking for investors among venture funds in the USA and Europe. I am personally very impressed with how this ecosystem works. I have already held a number of negotiations with funds and have begun to understand how the search for strategic investors works.

Plans for development

The product prototype is ready. It's being tested in my clinics.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Example of an investigation record

In the spring, the first iteration of the project will be ready, at a stage close to completion. As I said before, Diagnocat is conceived as a large-scale project. We will release it in stages. And the first will be no later than March 2019. I am convinced that even then it will be useful in practice.