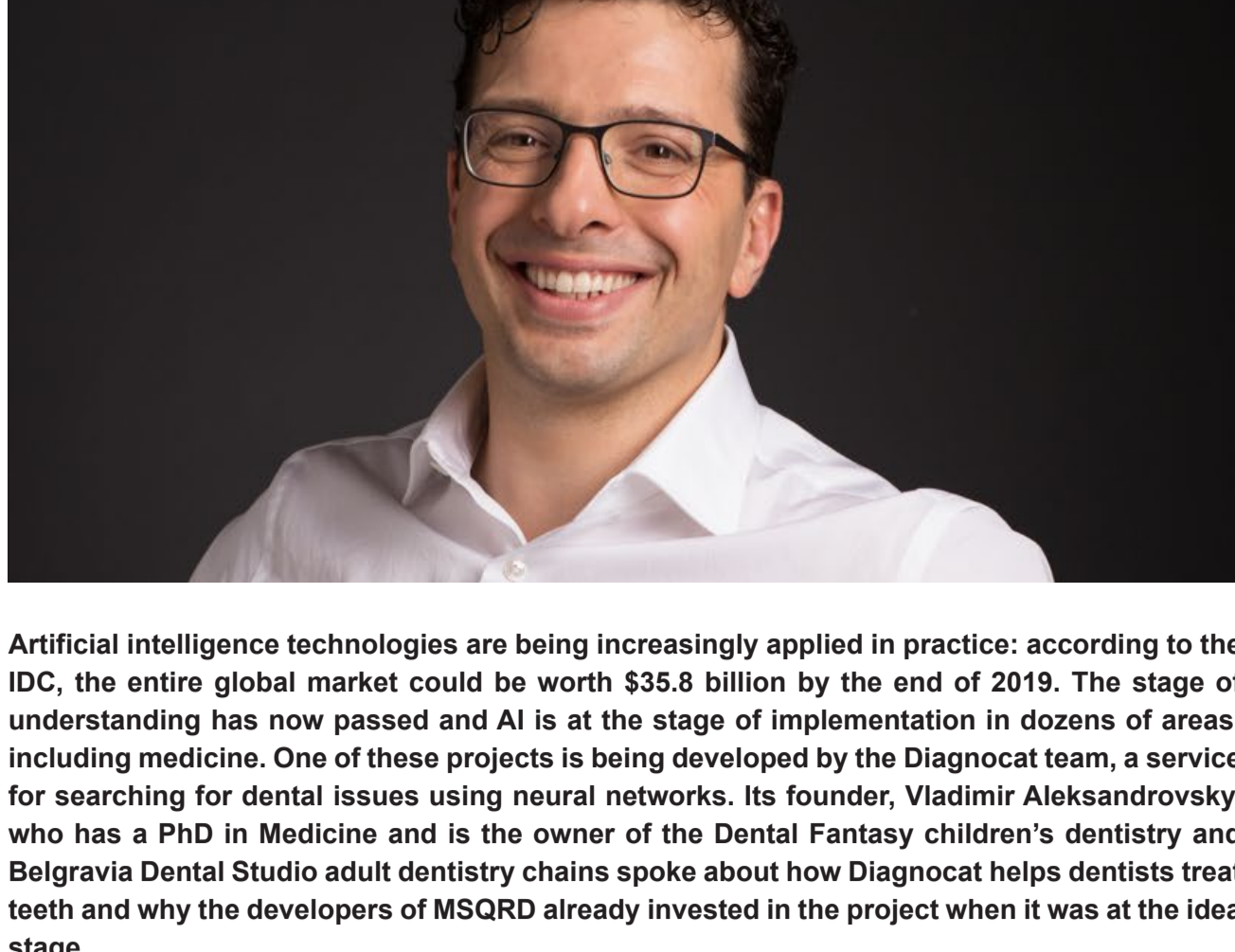


«Artificial intelligence is changing everything now—even human health»

The Founder of Diagnocat on the capabilities of computer vision and error-free dentistry



Artificial intelligence technologies are being increasingly applied in practice: according to the IDC, the entire global market could be worth \$35.8 billion by the end of 2019. The stage of understanding has now passed and AI is at the stage of implementation in dozens of areas, including medicine. One of these projects is being developed by the Diagnocat team, a service for searching for dental issues using neural networks. Its founder, Vladimir Aleksandrovsky, who has a PhD in Medicine and is the owner of the Dental Fantasy children's dentistry and Belgravia Dental Studio adult dentistry chains spoke about how Diagnocat helps dentists treat teeth and why the developers of MSQRD already invested in the project when it was at the idea stage.

— It was you who came up with the idea of a project that can determine the condition and diseases of the teeth without human involvement. When and how did this happen?

— The idea grew out of an awareness of a practical need. In modern dentistry, it is impossible to correctly diagnose and plan treatment without looking and understanding what is «inside the tooth». The doctor must take a picture—either a regular 2D (X-ray) or a more modern 3D computed tomography (CT) scan.

And that's where the main problem with analyzing the images arises. The number of issues which are misinterpreted or even missed by dentists is very significant***. Why? First of all, dentists have a different level of training and experience, while working with a CT requires additional professional retraining, which is not available to all dentists. Second, mistakes happen simply due to the human factor: the doctor may be tired, they may not have enough time and other issues of this kind. That means that many conditions may be overlooked. As a result, patients lose their health and money, as delayed treatment leads to complications, while the dental clinic loses both money and reputation as a business.

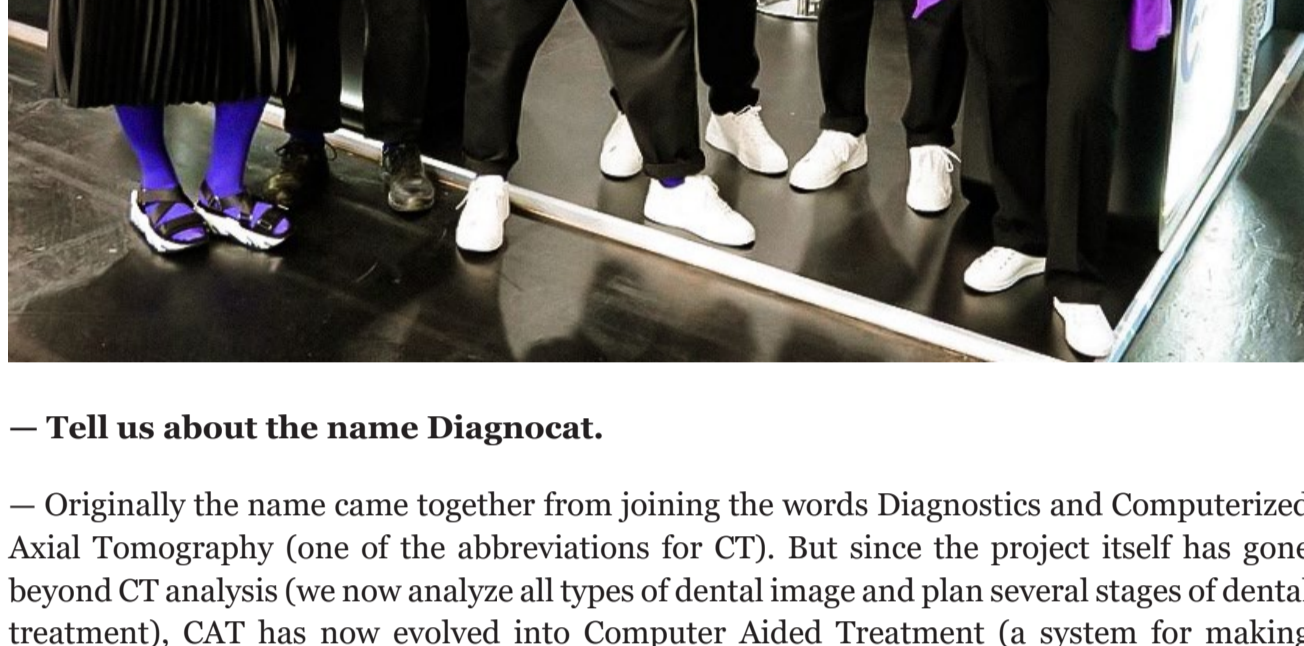
So, our Diagnocat project is conceived as an aid for the dentist, as a means of effective transparent communication with patients as well as an additional business management tool.

— So there was an acute shortage of a way to quickly and accurately analyze images in dentistry, and you decided to develop it yourself?

I began looking for a solution, and I realized that neither training nor management tools could improve the situation with the quality of diagnostics. I began to study what is happening in other branches of medicine and found out that computer vision technologies are used to recognize lung or brain conditions. Artificial intelligence is changing everything now—even human health. The answer lay on the surface: if computer vision can recognize your face, then let these technologies recognize caries on a tooth! I looked to see if there is anything similar on the market. It turned out that there wasn't, so we had a good opportunity to create a unique startup. That was two years ago.

— You gathered a stellar team in this startup. In addition to renowned radiologists and experienced managers, you have other trump cards. The co-investors include the developers of the sensational MSQRD application, which was bought by Facebook (we are talking about Evgeny Nevgen and Sergey Gonchar). How did you manage to involve them in the project?

— Two years ago, my venture capitalist friends who I told about my idea introduced me to Eugene and Sergey. I explained what we wanted to do on the phone to them and they were very inspired by this idea and became co-investors at an early stage. Of course, since they were working for Facebook at the time after the takeover of MSQRD, they couldn't work for our startup. But they became angel investors and advisers at the same time and helped me a lot. I am a professional healthcare manager, I can treat people and organize medical care, but I had no knowledge about creating IT startups. This is, of course, a separate field of expertise. Largely thanks to these guys, I learned about this field of activity and got a unique and incredibly interesting experience. As a result, I retired from operational management in my clinics at the end of 2017 and became a full-time founder and head of the Diagnocat startup.



— Tell us about the name Diagnocat.

— Originally the name came together from joining the words Diagnostics and Computerized Axial Tomography (one of the abbreviations for CT). But since the project itself has gone beyond CT analysis (we now analyze all types of dental image and plan several stages of dental treatment), CAT has now evolved into Computer Aided Treatment (a system for making medical decisions using computer technology). Many in the team call our project «the CAT» and we use this homonym in the branding.

— How do you train the neural networks? How does Diagnocat work?

— We assembled a group of annotators (experienced dentists and radiologists) who have «marked» more than 500,000 teeth on dental images. By means of special software, annotators scrupulously examined, outlined and captioned everything they found on the image. After that our data scientist engineers trained the artificial intelligence with the data so that it could detect such conditions automatically. The heart of Diagnocat is a highly sophisticated algorithm consisting of 20 neural networks.

The dentist interacts with it using a user-friendly interface. For example, a dentist takes a shot of his patient, uploads it to the Diagnocat cloud service and receives a report describing each tooth and its conditions within a couple of minutes. The Artificial intelligence tells the doctor what to treat and how to treat it. And this is not even something that will happen in the near future. This is happening now.

— What percentage of accuracy in determining a particular issue does it have?

— Accuracy is different for different conditions. The less frequent the condition, the lower the accuracy, but it is over 90% for the majority of the most common conditions.

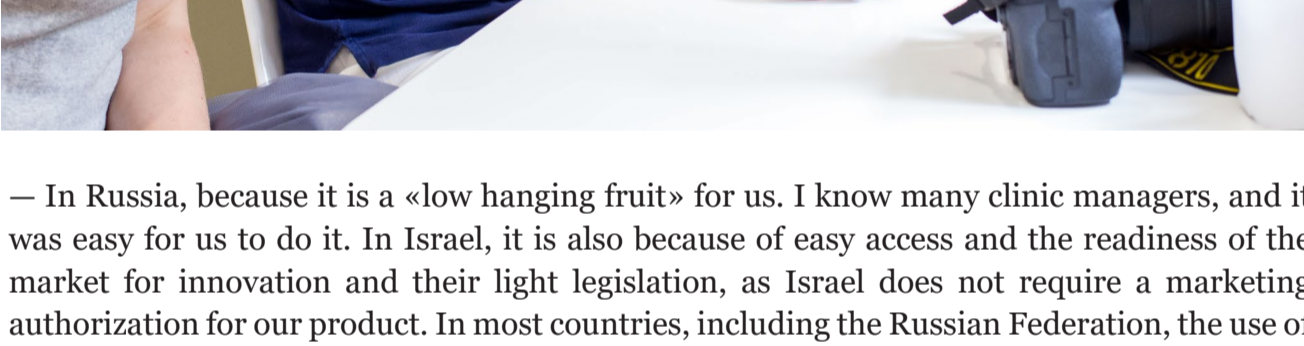
— And how many conditions are generally distinguished in dentistry?

— Diagnocat can identify about 50 conditions and these are 95% of the most common dental problems in a doctor's daily practice. We don't diagnose oncological diseases of the maxillofacial region or certain rare diseases yet. But it's a matter of time as the data collection is underway.

— Dental clinics are your target audience. Is the product already available commercially?

— Yes, we have launched test sales in Israel, Russia, Brazil and China.

— Why there?



— In Russia, because it is a «low hanging fruit» for us. I know many clinic managers, and it was easy for us to do it. In Israel, it is also because of easy access and the readiness of the market for innovation and their light legislation, as Israel does not require a marketing authorization for our product. In most countries, including the Russian Federation, the use of medical software must receive a special authorization from government agencies similar to our Rospotrebnadzor (Federal Service for Surveillance on Consumer Rights Protection and Human Wellbeing). In Israel, however, there is no such requirement, so we have a green light for our sales.

In Russia, we are currently going through the process of obtaining a marketing authorization, so we recommend that users employ Diagnocat as an auxiliary tool to assist in diagnostics and as a quality control tool for clinic managers. Use of this kind is legal. We have very good reviews and more than 100 clinics have connected to the service in 4 months from the start of sales.

We are interested in the USA and China as focus markets.

— Why?

— Due to the size in the first place. For example, the US dental market is \$130 billion annually, with very high purchasing power, a large middle class, 200 thousand dentists, and a serious trend towards market consolidation. The American dental industry used to be a «one-donor practice», but now private equity funds are buying up small clinics and, through economies of scale, turning them into multi-million corporations. According to our estimates, 10% of dentistry is run by very large chains such as Heartland Dental and Aspen Dental in the USA and they include dozens and even hundreds of clinics.

The Chinese market is also very promising. The Chinese model of providing dental care is similar to the Russian one. Dentists of all specialties work in large clinics there, from hygienist and therapist to maxillofacial surgeon, providing a comprehensive solution to the patient's medical issues in one place, where the volume of services provided is enormous. It is considered normal for a Chinese dental surgeon to work on 6 thousand implants per year.

— Russia is only dreaming of this, I suppose?

— From the point of view of organization of dental care, Russia is at a very high level. Although, if we compare it to the scale of China, we consider someone a successful surgeon if they work on 100 implants a year.

In fact, there are clinics in Russia that will outmatch any advanced western clinic in terms of their organization and business efficiency. Russian dentistry is something we can be proud of. But of course, effective demand is much lower in Russia, while financial instruments are far less available.

— How did the pandemic affect your business?

— The sales were negatively affected of course, because our dental clinic clients were closed in April and May all around the world. This led to our profits falling by half. But I know from the experience of 1998, 2008, 2014 that the dental industry recovers from crises very well. We always grew during a crisis, because people who were in a difficult situation preferred to invest money in their own health instead of spending it on travel and entertainment. Even during this crisis, we used the fact that doctors had a lot of free time for the benefit of Diagnocat. We involved them in marking photos of teeth. As a result, we managed to create a unique data set for the development of a new Diagnocat module that will diagnose teeth based on photos in the shortest possible time.

— What sales model do you use for Diagnocat?

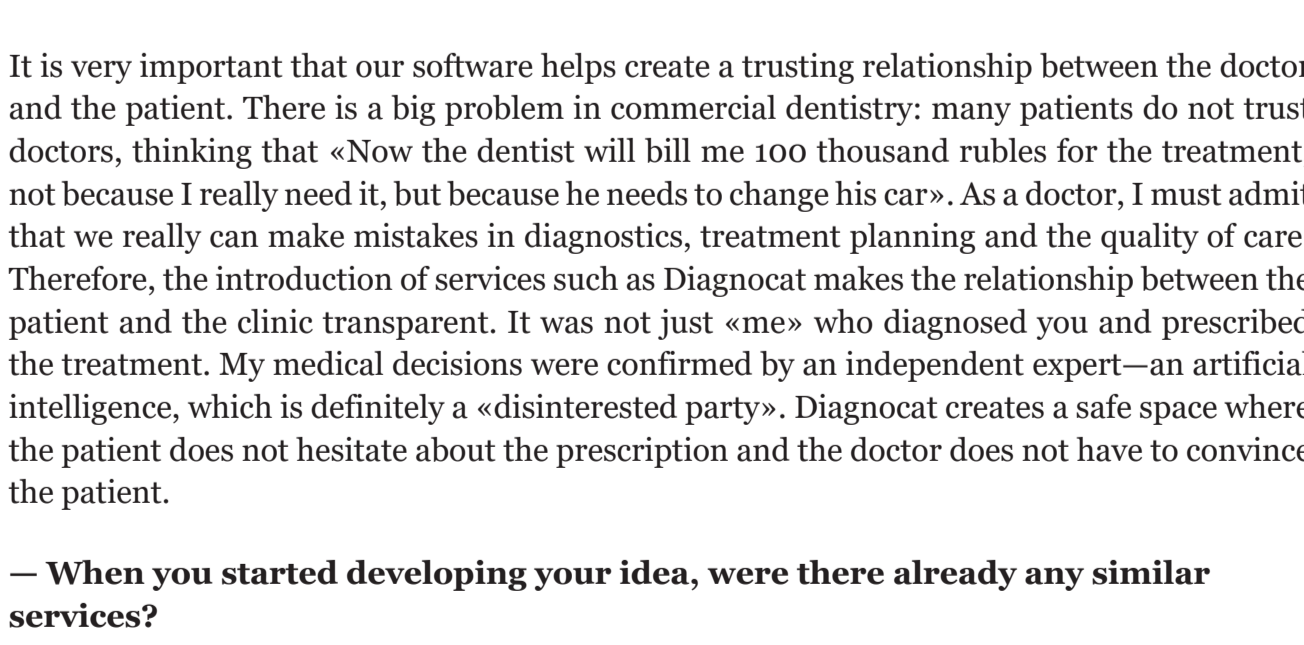
— We started selling with the pay by click model: payment for uploading and image analysis. It was an easy entry to the market for us, and it was a cheap way to integrate the service into their own practice for the client. It is currently a combination of pay by click and subscription. In general, SaaS pricing is a very interesting and complex topic. You need to deeply understand the needs of your customers, be able to divide them into groups and offer them a different set of functions at different prices. There are very few SaaS pricing specialists both in Russia and abroad, so we don't have anyone to consult with and have to experiment.

— How much does it cost to use the Diagnocat service?

— We are trying to make the service very accessible to dentists so that Diagnocat would become an industry standard and appear on every dentist's computer. For example, the cost of one analysis of a computed tomogram is 300 rubles, which is accessible for any dental clinic.

— How do the doctors react when you introduce them to your invention? Do they welcome technology or are they wary of it?

— Most dentists love innovation and understand the benefits that Diagnocat can bring and how much it can improve the quality of diagnosis and treatment. Although there were isolated opinions that artificial intelligence encroaches on the «doctor's daily bread».



It is very important that our software helps create a trusting relationship between the doctor and the patient. There is a big problem in commercial dentistry: many patients do not trust doctors, thinking that «Now the dentist will bill me 100 thousand rubles for the treatment, not because I really need it, but because he needs to change his car». As a doctor, I must admit that we really can make mistakes in diagnostics, treatment planning and the quality of care. Therefore, the introduction of services such as Diagnocat makes the relationship between the patient and the clinic transparent. It was not just «me» who diagnosed you and prescribed the treatment. My medical decisions were confirmed by an independent expert—an artificial intelligence, which is definitely a «disinterested party». Diagnocat creates a safe space where the patient does not hesitate about the prescription and the doctor does not have to convince the patient.

— When you started developing your idea, were there already any similar services?

— There were no services of this kind either in Russia or abroad. They have appeared in the last two years and now there are about 10 startups in Europe, USA, and Asia that are developing a similar solution. But we are convinced that we are ahead of the rest both from the technological and product point of view.

— You had a «head start».

— I think our biggest advantage is our deep knowledge of the dental business, while the founders of competing startups are engineers or businessmen. And thanks to having our own clinics, our hypothesis-test-analysis product development cycle is incredibly fast. Those who are trying to catch up with us are even stealing something, particularly the interface of our first medical application. We naturally react quickly to such things and we change quickly. I am sure that it will be very difficult to catch up with us, even for companies with good funding.

— You are a startup, which means that you are developing with the help of attracted investments. Have you already raised any funds? In what perspective will you be doing the next investment round?

— Until now, we developed the project using funds raised from business angels and funds that I invested in as a founder. I made two funding round attempts in the Silicon Valley at the end of 2018 and at the end of 2019. Both attempts were unsuccessful because we did it wrong. Like many founders, I thought that raising capital through rounds was such a fun adventure, but in fact it is hard and often very unpleasant work. In a startup, this requires first-person competence and continuous effort. Now, learning from the lumps we've taken, we are in the active phase of fundraising again and we are in touch with several funds from the Valley which are ready to act as lead investors.

— What are your future plans for the development of the project? Do you plan to expand the Diagnocat neural networks to diagnose disorders in other areas of medicine? How applicable can this be, say, in allergology, oncology or dietology, etc.?

— We have a long-term five-year strategy and we will develop products specifically for dentistry. In addition to automating diagnostics (when almost any diagnosis in the maxillofacial region will be made very accurately with the help of Diagnocat), we will build a fully-fledged medical decision management system and draw up patient treatment plans based on the diagnoses made. We have a lot of work here.

The important thing is that dentistry is a very lucrative industry, a huge market which is probably worth over \$1 trillion a year. And a significant part, almost half, of this money does not come from insurance, as it does in general practice, but from the pocket of the person who pays. This makes the market very dynamic and we are interested in doing this from a commercial point of view. I am sure that we have already managed to create a product that meets the true needs of the consumer and brings great benefits to society—this is the goal of any startup.

***Source: William C Scarfe, Maxillofacial Cone Beam Computed Tomography, 2012