Big Data Analytics as a Healthcare Digital Transformation Tool

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Abstract.

Over the past thirty years, medical and health-care has led to a growing trend towards the increasing use of information technology there has been and growing trends in medicine and health care, both in the practices of physicians and in ensuring optimal health management at all levels, i.e. the creation of a digital health system. This has led to a transition from a "disease treatment" model to a "savings and health promotion" model, and a shift in the delivery of health services to the concept of 4P medicine. These models, for their part, required the use of new methods of rapid processing of ever-increasing arrays of diverse medical information. The lack of the necessary legislative framework and a certain conservatism of doctors held back this innovative process. That all changed when humanity decided to global respond to the COVID-19 pandemic, which in a short period affected millions of people and required entirely new methods of responding to disease, both in a patient and in order to ensure the effectiveness of health systems. The proposed work describes the first results of building a special medical integration platform to solve these problems.

Keywords.

Digitalization of medicine and health care, technologies, methods and tools of artificial intelligence for medicine and health care, analytics of large amounts of medical and management data, special medical integration platform, cloud technologies, medical solutions support systems, medical imaging methods.
Health care, along with the food industry, is the mass-service system with the largest number of human services. All people, without exception, necessarily get sick and eat. From the point of view of health, this leads to large amounts of medical information that need to be collected, preserved, systematized, analyzed and based on which decisions are literally vital, both for each individual and for humanity as a whole.

Analysis of global trends in the development of healthcare and medicine reveals the following main trends:

- Transition from a "disease treatment" model to a "saving and health promotion" model.
- Transition in the provision of medical services to the implementation of the concept of 4P-medicine (predictive, preventive, personalised and participatory).
- Transition from local systems to global, cross-border health care systems, international projects to eliminate epidemics and pandemics of the most dangerous infectious and non-communicable diseases.
- The use of information and telemedicine systems to ensure accessibility and a single high standard of quality of care to the population.
- Development of new highly informative medical diagnostic and treatment techniques.
- Creating new forms of drugs.

The bulk of medical data is collected and stored in patient records. At the same time, the largest volume of these data are medical diagnostic images, the analysis of which requires a highly qualified doctor. The human factor makes a significant contribution to diagnostic errors.

The medical platform being developed is focused on creating a system to support the decision-making in personalized medicine on the most critical nosology based on the analysis of big data obtained through the use of cloud and telemedicine technologies for the automated diagnosis of medical diagnostic images.

The project takes into account the trends of Russian and world medicine mentioned above. The project’s resulting and subsequent medical data mining products for physician decision support systems operate on large medical data arrays, providing, among other things: improving the effectiveness of treatment, including life-threatening diseases, which will improve the quality of life and increase the active longevity of people, increase in the productivity of medical personnel, optimization of health care costs. The application of the methods and software tools developed in the project provides a significant reduction in the time of diagnosis and choice of individual treatment strategy, reduces the number of errors in the initial diagnosis, as well as, in particularly difficult cases, receiving advice from leading specialists. All of this is currently being done in the case of the fight against COVID-19.

As a pilot area, the analytics of digital X-ray images of the chest of COVID-19 patients has been implemented. The program processes digital medical images and for each image gives a binary type conclusion, assuming the presence or absence of pathology in the analyzed image. In addition, if the program assumes the presence of pathology, it localizes the area of the alleged pathology in the picture, highlighting pathology of a colored contour.

This program is selected and successfully participated in the Moscow Government's Experiment on the use of innovative computer vision technologies for medical images analysis, which takes place at the Clinical Diagnostics and Telemedicine Research Center of the Moscow Department of Health. To date, more than 1,000,000 digital X-ray images have been processed.

The application of the methods and software tools developed in the project will significantly reduce the time of diagnosis and selection of individual treatment strategies, reduce the number of errors in the initial diagnosis, and, in particularly difficult cases, receive advice from leading specialists.
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