Computer system for remote consultations in the diagnosis of urological malignancies

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Abstract. The complex for the decision support in diagnosis of prostate diseases with using expert knowledge and remote consultations in the process of urologic diseases diagnosis with using prostate preparation images was proposed. The complex allows to ensure consistency in the actions of doctors for remote consultation (areas of interest, marking, and search for informative objects in the preparation images) and to use experts knowledge in cases that are difficult to diagnose.

1. Introduction
Prostate cancer is a malignant tumor that originates in the prostate gland. The prostate gland is a muscular-glandular organ, it is part of the reproductive system and surrounds the urethra in the urinary system of men. Prostate cancer, like any cancer, if it progresses and is not treated in the early stages, it may eventually spread via blood and lymph to other organs [1].

The aim of this work was the creation of a complex for the decision support in diagnosis of prostate diseases with using expert knowledge and remote consultations.

2. Decision support system in the diagnosis of urological malignancies
Digital technology and in particular scanning systems for virtual preparations (slides) are widely used in medical practice [2-6]. The use of modern digital technologies in diagnosis of prostate diseases will help to improve the accuracy of diagnosis.

We propose the system decision support system based on expert knowledge and remote consultations to increase the accuracy of diagnosis. The advantage of the system is accumulation of leading experts knowledge and consultation with them in difficult diagnostic cases. This system can support doctors in remote health care facilities. The Department "Computer medical systems" of National Research Nuclear University MEPhI in collaboration with the Department of urology of A.I. Yevdokimov Moscow State University of Medicine and Dentistry of the Ministry of Healthcare of the Russian Federation developed a program that helps to diagnose prostate diseases, the training of doctors, support doctors for an accurate diagnosis.

There are two modes of operation in this program. The first mode is local. In this mode, the user works with the program without the help of any of the specialists. Three methods are realized in local...
mode. The first method provides support in diagnosis making, it includes search on histological images of prostate cancer symptoms (presence of different types of acinus and group of cells with certain shapes and sizes). The diagnosis is performed through a series of comparisons of the recorded image with the database images. Degree of overlap in the analyzed image with images in various diagnoses is estimated in result. The program provides quantification of the analyzed objects in the microscopic images of the preparation along with the application of qualitative characteristics describing the image represented by the experts [7-11].

The second method provides for the program to work with an expert for introducing new information into the knowledge base.

The third method is training.

The second mode of the program is remote consultation. An important feature is that the navigation controls in the studied microscopic images of the preparation can be performed from the workplace of the doctor via the network. It should be noted that both mode can be combined. Two users have the possibility to zoom and navigate it. They see the same picture. Remote consultant (expert) can help the doctor in difficult cases to choose informative image region and point to objects with the key features. This allows to provide remote consultations and training of doctors in remote localities.

Images of prostate preparation can have a large size: tens of thousands of pixels in width and height. The transmission of such images over the network is done by parts. The remote user will send only the parts to show on display.

The purpose of this program is to increase the efficiency of prostate cancer recognition.

Figure 1. An example of a histological image with markers, that shows the diagnostic features of the preparation.
3. Conclusion
Complex for the decision support in diagnosis of prostate diseases with using expert knowledge and remote consultations was developed. The complex operates in two basic modes – local (using a knowledge base directly at the workplace of the doctor-diagnostician) and remote consultation in difficult cases. The use of this program allows to diagnose prostate disease more accurately and to support doctors in remote health care facilities when they have difficulties in diagnosis.

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