A computer model has learned to detect prostate cancer

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Scientists at the TSU Laboratory of Biophotonics, working with Tomsk National Research Medical Center (TNIMC) oncologists, have developed a new approach to the diagnosis of adenocarcinoma, a

malignant tumor of the prostate gland, that uses artificial intelligence to identify oncopathology and determine the stage of the disease. Using machine learning, a computer model was taught to distinguish between healthy tissues and pathology with 100 percent accuracy.

The gold standard for the diagnosis of cancer is histology, during which tissue from a patient is examined for malignant changes. So that the samples can be stored for a long time, they are dehydrated and packed in paraffin. Then experts make thin sections and examine these slides under a microscope.

"Usually, several people work with prostate biopsy samples, and after studying the sections, they make a collegial decision," says Yuri Kistenev, executive director of the TSU Institute of Biomedicine. "The human factor has not been eliminated, therefore, due to subjective assessment, there are erroneous conclusions. We tried to solve this problem using IT technologies—we developed a computer model and, through machine learning, taught it how to detect abnormal areas using a tool such as terahertz spectroscopy."

According to Yuri Kistenev, in the analysis, artificial intelligence not only detects the presence of cancer cells, but also evaluates the tumor according to the Gleason score, which is traditionally used in the diagnosis of prostate cancer to determine the degree of malignancy (indicators from 1 to 10), which is important in terms of predicting the course of the disease.

"Terahertz spectroscopy visualizes the sample very well because a laser reads from 2500 to 4000 points in a small area," says Anastasia Knyazkova, TSU graduate student, one of the project managers. "A computer model was trained on samples of healthy and diseased tissue, which were provided by the Research Institute of Oncology, TNIMC. Thus, artificial intelligence learned to separate the norm and pathology.

A test of its ability to verify adenocarcinoma was carried out on the part of the samples that were not used in training. Assessment of the malignancy was carried out for samples with a ranking of 4 and 8 on the Gleason scale. The accuracy of the differential diagnosis was 100 percent."

According to the staff of the Laboratory of Biophotonics, as the data accumulate, the model will be able to evaluate the tumor on the entire Gleason scale, after which the new tool can be introduced into clinical practice. As Yuri Kistenev noted, the approach is universal. It has already been tested for diagnosing melanoma. If there is a sufficient amount of training material (samples with norm and pathology), the model can be trained in the diagnosis of other cancers.

More information: Yury V. Kistenev et al. Application of multiphoton imaging and machine learning to lymphedema tissue analysis, *Biomedical Optics Express* (2019). DOI: 10.1364/BOE.10.003353

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