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ЗАСТОСУВАННЯ УКРАЇНСЬКОЇ ҐРІД-ІНФРАСТРУКТУРИ ДЛЯ АНАЛІЗУ ЕЛЕКТРОЕНЦЕФАЛОГРАМ ТА УЛЬТРАЗВУКОВИХ ДІАГНОСТИЧНИХ ЗОБРАЖЕНЬ

Р. В. Бивалькевич, В. О. Гайдар, С. П. Радченко, О. О. Судаков
Київський національний університет імені Тараса Шевченка

APPLICATION OF UKRAINIAN GRID INFRASTRUCTURE FOR ELECTROENCEPHALOGRAM AND ULTRASONIK DIAGNOSTIC IMAGES ANALYSIS

R. V. Byvalkevych, V. O. Haidar, S. P. Radchenko, O. O. Sudakov
Taras Shevchenko National University of Kyiv

Introduction. Ultrasonic introscopic imaging (USI) and electroencephalography (EEG) are powerful tools for diagnostics of different pathologies. In the same time USI and EEG equipment is available in almost all clinical and even in many educational institutions. Development of ultrasonic images and EEG data processing algorithms providing physicians with additional specific clinical parameters is a popular current research subject. Successful operation of these algorithms needs fast procession of large information volumes. These algorithms are based on an analysis of large databases with information about the patients. Grid infrastructures can provide distributed data archiving, procession and access facilities for such databases.

Results. In this work we created the medical database in Ukrainian Grid infrastructure suitable for different types of medical data. Database was populated with about 500 EEG studies. Resource consuming algorithms were applied for removal of miogram and oculogram artefacts from these data. Now we are working on application of this database for archiving and procession of ultrasound images. We obtained the first results of Kohonen neural network application for USI images classification. System testing was performed by classification of ultrasonic images with 9 diagnoses (normal, hypothyroidism, cancer, nodes, thyrotoxicosis, goiter, diffuse goiter, and samples with unknown and multiple diagnoses simultaneously). Results of classification effectiveness are compared with diagnoses based on results of biochemical assay of thyroid gland hormones concentration and physician-expert evaluation. Trying to achieve better results in true positive rate (TPR) and false negative rate (FNR) of prediction we applied some modifications of the basic algorithm (Fig. 1).

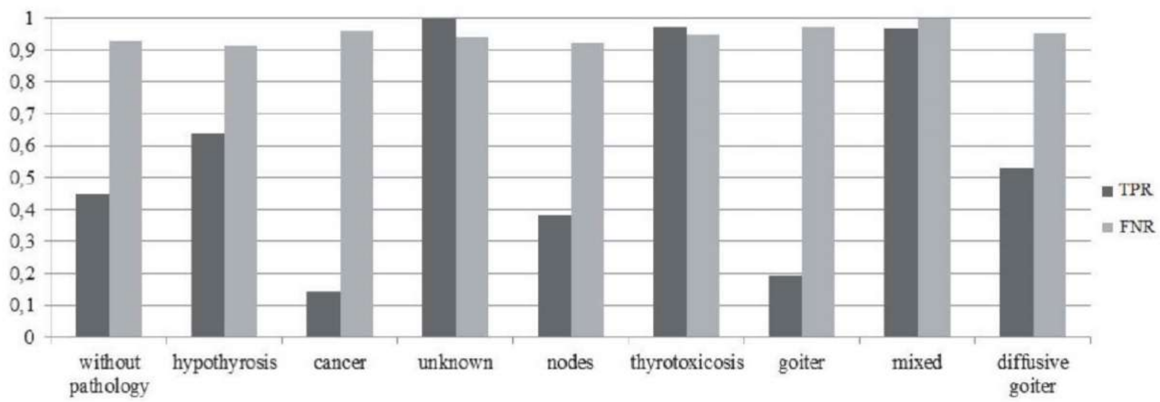

Figure 1. The result of ultrasonic images prediction.

One can see the probability to identify the true negative diagnoses exceeds 91 %. Also, we can see that system identifies the true positive diagnosis of thyrotoxicosis with probability about 95 %.

Proposed algorithm also provides determination of the most informative features for diagnosis prediction. Different diagnoses are characterized by different sets of features that have the strongest influence on their aggregation into one class. For example, the volume of the left thyroid gland projection and the results of hormonal analysis are the most influential features for thyrotoxicosis.

Proposed algorithm may be efficiently applied in distributed environment. Each copy of program can process small part of data stored on different components of distributed storage.

After that results of classification are collected in centralized storage. Centralized storage contains information about power coefficients and neurons' vectors. When new data arrives its classification is performed on the nearest computing element. Classification requires read-only access to centralized storage.

Conclusions. Proposed medical data classification system is now under development in Ukrainian National Grid infrastructure.