UDC 616-073.75.616.831

THE USE OF NEURAL NETWORKS AND MACHINE LEARNING FOR ANALYSIS AND PROCESSING OF TOMOGRAPHY RESULTS

Student gr. PB-82 Yukhymenko Y. A.
PhD, Assoc. Prof. Stelmakh N. V.
National Technical University of Ukraine
«Igor Sikorsky Kyiv Polytechnic Institute»

One of the main tasks in the post-processing of MR scans of the brain is the segmentation of cortical and subcortical structures, which provides the necessary data for both structural and functional studies. There are many automatic and semi-automatic methods for segmenting brain tissue, but most of them still involve direct human intervention. But manual segmentation is very laborious and takes a long time.

Therefore, to automate the segmentation process, the use of artificially trained neural networks was proposed. Like the real doctors, neural networks need to be trained to identify abnormalities in MRI scans. To do this, doctors study pictures of healthy patients in order to further see the differences between healthy and infected tissues. The neural network is trained in exactly the same way: a database with brain images of healthy patients is downloaded into it, the neural network studies them and indexes them as "healthy". Due to machine learning, it combines the similarities of all healthy MRI scans and in the future will be able to detect anomalies in patients.

The training of the neural network for segmentation of MRI scans of the brain works in the same way: the already manually segmented images are loaded into it and, with the help of machine learning, the neural network recognizes them, compares them and learns to segment "clean" images. The resulting average coefficient after analysis and comparison of automatically segmented images with manually segmented images taken from publicly available datasets available through the MICCAI grand challenge (MRBrainS13), accounted for 84.78 %, 88.47 %, 82.76 %, 95.37 % and 97.73 % for gray matter (GM), white matter (WM), cerebrospinal fluid (CSF), brain (WM + GM) and intracranial volume respectively. Compared with other proven methods for the same data set, the proposed method achieved competitive results with a relatively shorter training period of time [1].

References

1. Mahbod A. et al. Automatic brain segmentation using artificial neural networks with shape context // Pattern Recognition Letters. – 2018. – T. 101. – C. 74–79.