Behavioral & histological parts of radiobiological research and some approaches for quantification biological data for future proper automatization

Description:

The experiments conducted at the JINR LRB by a group of physiologists are aimed at studying the radiobiological effects of various types of ionizing radiation on the central nervous system. The analysis of a large number of videos&images obtained as a result of biomedical research is an essential task, primarily associated with computer diagnostics. The procedure for automatic counting of behavioral patterns and brain cells is a key step in the systems of behavioral analysis of videos and microscopic analysis of medical images of histological slides. In this regard, the main goal of the work is to develop effective methods for the automatic determination and quantification of behavioral patterns as well as brain cells based on modern methods of video/ image pre-processing, processing, computer view and modern approaches of artificial neural network.

One of the reasons for this is the difficulty in analyzing experimental heterogeneous data, which includes: morphological data (images of sections of various biological tissues), behavioral data (video data of experimental animals), etc., obtained by various groups of researchers. A complete understanding of the impact process and a qualitative picture of the effects of ionizing radiation on biosystems require the systematization and simultaneous processing of a significant amount of these data relating to various aspects of the demonstration of the exposure. The use the methods of programming, machine&deep learning and neural network approaches seems promising. The study includes a set of methods for behavioral tests, histological analysis, systematizing and analyzing experimental data, presenting data in a form convenient for complex statistical analysis. In addition, some tasks could be about ROC curve analysis or principal component analysis. The outcome of the study is learning the basics of behavioral testing as well as histological technique and analysis, mark-up the dataset (videos/images), the systematization of the accumulated results, the identification of hidden patterns in the biological systems manifested in the response to the effects of damaging factors like ionizing radiation. During the study, you may figure out normal distribution, its cumulative distribution, and why error function is called that way and you may learn about multivariate Normal distributions, singular value decomposition of arbitrary matrix, and the concept of dynamical/topological constants. This kind of work is quite interdisciplinary.