

Algorithmic block for behavioral tests in the BIOHLIT information system for radiobiological studies



The **BIOHLIT** information system (IS) for analyzing behavioral and pathomorphological changes in the central nervous system when studying the effect of ionizing radiation on laboratory animals. Information system is being jointly developed by specialists from MLIT and LRB JINR.

The IS is necessary for storing data in a single information space, enhancing the detection of laboratory animals in the behavioral tests (Open Field, T-maze, etc.) arena, calculating individual behavioral patterns, as well as for reducing time and energy costs, minimizing the human factor when dealing with histological slides. This will allow processing experimental data in no time and defining qualitative and quantitative changes in the central nervous system after exposing to ionizing radiation. For these purposes, on the basis of modern technologies of computer vision and machine learning, an algorithm was developed; it enables to automate the analysis of the behavioral reactions of experimental animals through video files.

To solve this problem, it was necessary to develop several subgroups of the field of experimental setups, algorithms for tracking the animal's position in experimental setups of different types and algorithms for evaluating the animal's behavioral patterns that characterize its emotional status and orienting-exploratory reactions. As a result of the operation of this algorithm, the information obtained is stored in different forms: a visualized track of the laboratory animal's position, a heat map by sectors and a JSON file that stores all the information obtained from the video file for subsequent statistical analysis. The JSON file contains information on automated marking by the sectors and boundaries of the experimental setup, a track of the animal's movement by frame coordinates, the characteristics of the original video file (frame size, number of frames per second). These data are required for additional analysis (statistical, etc.).

Simplified DB Scheme

groupID INT(255

group

objCreator VARCHAR(255)

objCreationDate DATETIME

<u>BIOHLIT</u> it's a joint project of MLIT and LRB: aims at establishing an information system (IS) for analyzing behavioral and pathomorphological changes in the central nervous system when studying the effects of ionizing radiation and other factors on biological objects.

Conceptual scheme of the service



IN.

Information system is based on:

- computer vision algorithms based on machine and deep learning technologies;
- modern IT solutions for data storage, processing and visualization. IT system will help to:
- Speed up and simplify work on experimental data for different groups of researchers;
- Simplify and accelerate the diagnosis of CNS pathologies, in a particular case to use effective methods of prevention and protection from ionizing radiation.

Hierarchical data structure of IS

Experiment is the major IS element inside of which all the contents of the experiment will be stored. It has a standard set of attributes: title, creator's name, creation date, description.

Supercomputer "Govorun"



Webapp

Group

Experiment

Group is an auxiliary IS object related to a specific experiment, inside of which data on "objects" of research (experimental animals) will be stored.

Object (experimental animals) Object is an auxiliary IS object related to a specific group; metadata of "objects" of the experiment will be stored inside.

ML\DL\HPC ecosystem



Circle search result: clustering results for marking lines and circles





PROCESSING

