

Brain Neuroactivity Project

Understanding anxiety patterns in mice behaviour

Team 4
Brain Neuroactivity

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goal

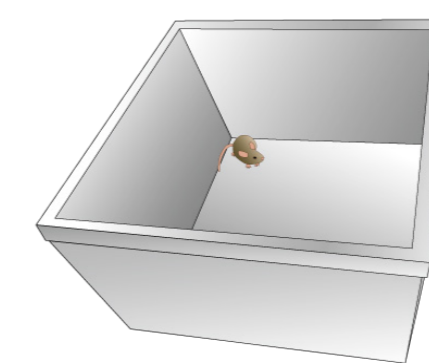
To build a tool that helps to diagnose anxiety levels in mice using machine learning methods.

prospects

Adapting the findings of the Brain Neuroactivity project on mice to the real-life situation for treating and diagnosing anxiety and depression disorders in human.

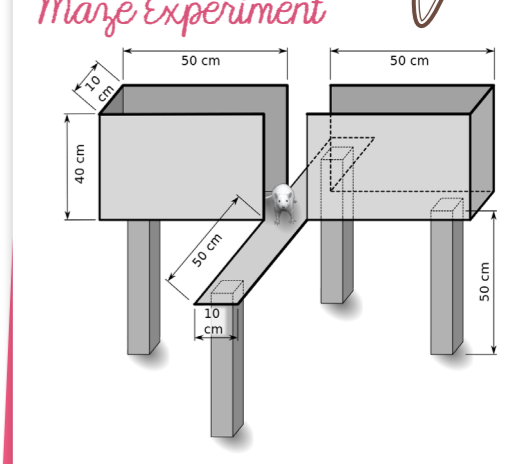
Experiments

Open Field Experiment



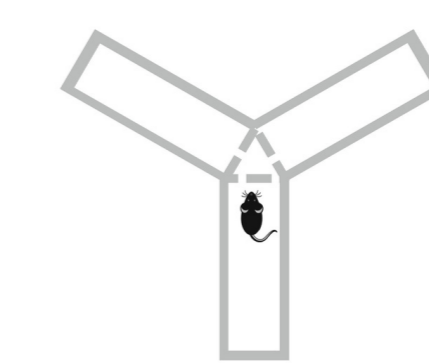
The Open Field Experiment has a setting consisting of the square 45 cm arena with high walls. The mouse is placed inside the arena and behaviors are tracked. The main features to be derived from the experiment are the time spent and the distance traveled by the target mouse in the central and in the peripheral zones of the arena.

Elevated Plus Maze Experiment



The arena is a plus shaped maze. It contains two open and two closed arms. The mouse is placed inside the center of the arena and its behavior is observed. The main features for this experiment: the time spent by the mouse exploring the open and closed arms of the maze.

Y-maze Experiment

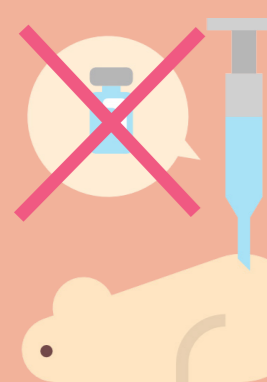


The Y-Maze Experiment has a closed Y-shaped arena. The mouse is placed inside the maze. The alternations between the arena's arms and the exploration of the maze by the mouse are the main features.

Social Interaction Experiment

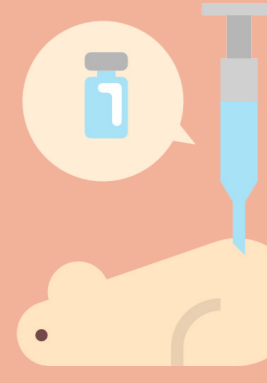


The Social Interaction Experiment is similar to the Open Field Experiment. The only difference is that the non-target mouse is also placed in the same arena. This is done to observe the interaction of the mice. Therefore the main feature for this experiment is the proximity and the interaction frequency between the mice.



control group

Control group is the group of mice that was not injected with any antidepressants (Jnk gene) during preparation for the experiment.



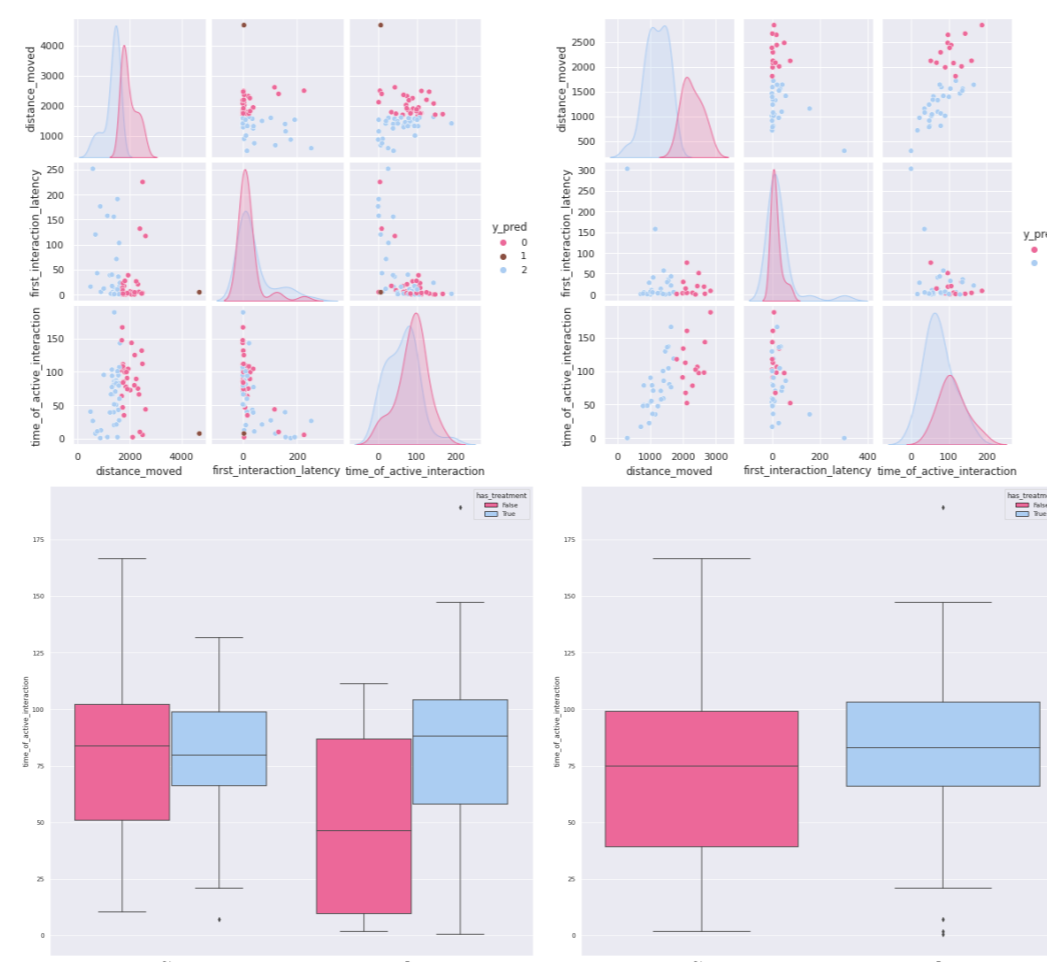
treatment group

Treatment group is the group of mice that was treated with the antidepressant during preparation for the experiment.

Is there a correlation between the behavior of the mouse and its anxiety level?

During the stressful situations mice can show different response behaviors. Those response behaviors can be active or passive.

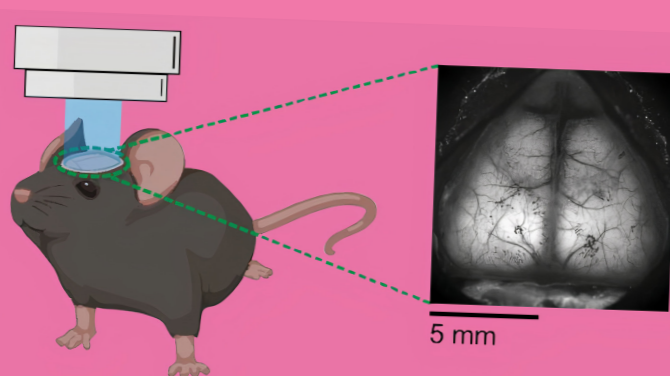
Active response: frequent rotation, avoiding interaction and open space, etc.
Passive response: stalling, showing no interest in social interaction and arena exploration, etc.



As it can be seen, the treatment type can influence the anxiety level of the mouse during stressful situations. This can be observed through the overall behavior of the mice: for example, the average time of the social interaction of the mice belonging to the control group is lower than the average time of social interaction of the mice that received the treatment.

Therefore, given the treatment has an effect on anxiety level of the mice, it can be concluded from the experiments that the change in the neurological response of the mice is observable through the deviation in their motoric behavior.

Calcium Activity Data



Data collection

Data Acquisition

Elevated Plus Maze:
110 videos
~5 mins duration

Open Field:
114 videos
~10 mins duration

Social Interaction:
114 videos
~5 mins duration

Y-maze:
64 videos
~10 mins duration

Data Pre-processing

Video file format conversion:
video provided in MPG format were converted into the MP4

Video file were renamed using common naming convention

Videos were grayscale before training a model for minimizing computation and amplifying the contrast

Large videos were cut into the smaller ones

Data Labeling

Labeling of the mice

- Head
- Body (upper, lower)
- Tail (end, middle)
- Back
- E.t.c.

Labeling of the arena

- Box shaped (Social Interaction, Open Field)
- Y-shaped maze (Y-maze)
- X-shaped maze (Elevated Plus Maze)

Feature Engineering is crucial!

The results of the pose tracking model contains coordinates of different bodyparts of the mice and the arena keypoints.

Every experiment focuses on the specific aspects of the mice behavior, they should be derived from the result of pose-tracking algorithm.

In Social Interaction Experiment the importance is imposed on the proximity of the mice.

In Open Field Experiment the velocity and the distance travelled by the mice are crucial.

In the Elevated Plus Maze Experiment, the time spent in each arm of the maze should be derived.

And in the Y-maze experiment the focus is on alternation between the arms of the maze.

Outcome: Application

