Using computer vision and artificial intelligence for monitoring of mice

Lundbeck v. Tina Brønnum Pedersen, CALAR and Danish Technological Institute

Is it feasible to use artificial intelligence (AI) to monitor group housed mice in their home cage?

Lundbeck is doing a pilot project using computer vision and AI. This is done in collaboration with CALAR, Danish Technological Institute and Copenhagen University (3R Center funded).

The study is a feasibility study on monitoring mice that are grouphoused under standard housing conditions which include bedding, nesting material, shelter, tunnel, shelf and gnawing sticks.

Why use AI

The welfare of the mouse is critical for the accuracy and reproducibility of experimental results.

The behaviour of the mouse is a reliable indicator for the wellbeing of the mouse.

Traditional methods for monitoring the wellbeing of the mouse may be time and resource consuming.

By internal compliance to animal ethics (and law) it is required that animals are inspected at least daily and intervene and alleviate a negative condition as fast as possible.

AI can provide detailed, accurate monitoring, and give alarms.

This picture is created using CoPilot/Bing with the query; Create a picture of a Mus musculus being monitored by computer vision and AI. The mouse must be in a cage with soft bedding.

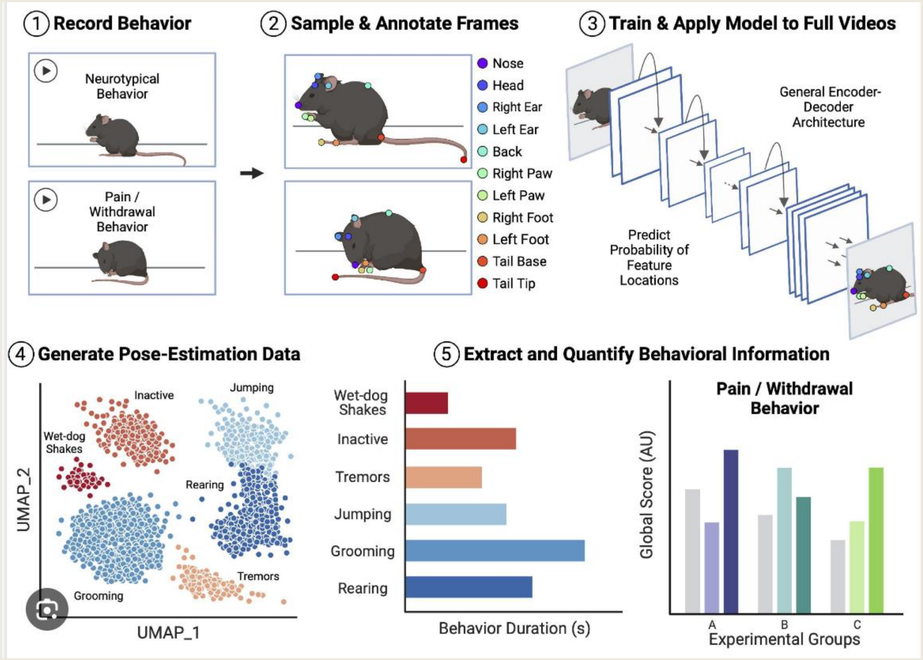
How to use computer vision and AI

Computer vision is cameras filming and creating data to capture the behaviour of the mice and changes in the behaviour that are indicative of poor animal welfare.

Data is analyzed by machine learning algorithms.

The technology can be used to monitor several mice at the same time, and provide continuous recording of the behaviour

AI process for data analysis (an example)



https://www.frontiersin.org/journals/neuroscience/articles/10.3389/fnins.2022.953182/full – *an example of a method to use artificial intelligence to evaluate the mouse behaviour*

The plan

The project is executed from June 2024 to March 2025, with the funding from Lundbeck, CALAR and the Danish 3R Center.

- The first pilot to evaluate equipment needed was performed at Copenhagen University
- The upscaled project (8 cages on a disease model) is performed at Lundbeck´s animal facility
- Teknologisk Insitut execute data capturing and analyses, in collaboration with Lundbeck's ongoing projects within the AI area

Characterization of mouse behaviour and welfare

Using AI, it's possible to increase the knowledge on the mouse behaviour when mice are in their home cage and group housed, some examples;

- The animal's circadian rhythm and possible changes
- Identify strain specific behaviors related to genetic modifications e.g. transgenic vs non-transgenic mice
- Evaluation of the animal's general condition and body weight
- Evaluation of aggression level
- Identify wounds/changed coat
- The activity of the animal (Hyper/hypo activity)
- Motor changes (Seizures, lameness, paralysis)

Potential suffering of an animal can be minimized by detecting the indicators of reduced animal welfare

Alarm parameters

Based on defined parameters, alarm settings can be developed, enabling physical or on-line inspection of the mouse/mice, making it possible to react fast on humane endpoints and/or initiate treatment for or alleviate the negative condition. Suggestions for General alarm parameters:

- Hunched posture, piloerection
- Weight loss of 10% and 20%
- Missing body parts
- Wounds (> 10% body surface ~ 1kr (Euth))
- The animal is isolating itself from cage mates (x hours per 24 hrs)
- Hyper activity/stereotypic behaviour (x hours per 24 hrs)
- Hypo activitet (> 5 hrs) or no activity

Model specific parameters:

- Seizures (Racine scala 6, or less but more frequent seizures (x minutes per 24 hrs))
- EAE severity scale (tail tonus, paralyse of tail, hind legs and front legs)
- Grimace scale (PainFace)
- …..

Which alarm parameters do you find valuable to monitor to improve the animal welfare

Use QR code and enter your input