

# Application of an open science analytic pipeline with a trained machine learning model to evaluate archival video of rat stereotypical behaviors

Ketamine, a non-competitive NMDA receptor antagonist, is undergoing clinical trials as a treatment for treatment-resistant clinical depression due to its rapid-amelioration effects on the disorder.

Subanesthetic doses of ketamine have been found to impair prefrontal cortex (PFC) function through the disruption of dopaminergic neurotransmission and increase of glutamatergic outflow within the PFC. The medial prefrontal cortex (mPFC) is important to sensation, perception, and emotion, and an acute dose of ketamine disrupts information in the long-distance brain networks that support and maintain these functions.

Open science involves making scientific research, data, and methods publicly and freely available. Benefits of open science are increased transparency, collaboration, and reproducibility of research. Furthermore, open science facilitates availability and dissemination of findings which then promotes knowledge-sharing for training, adaptation, & code reuse.

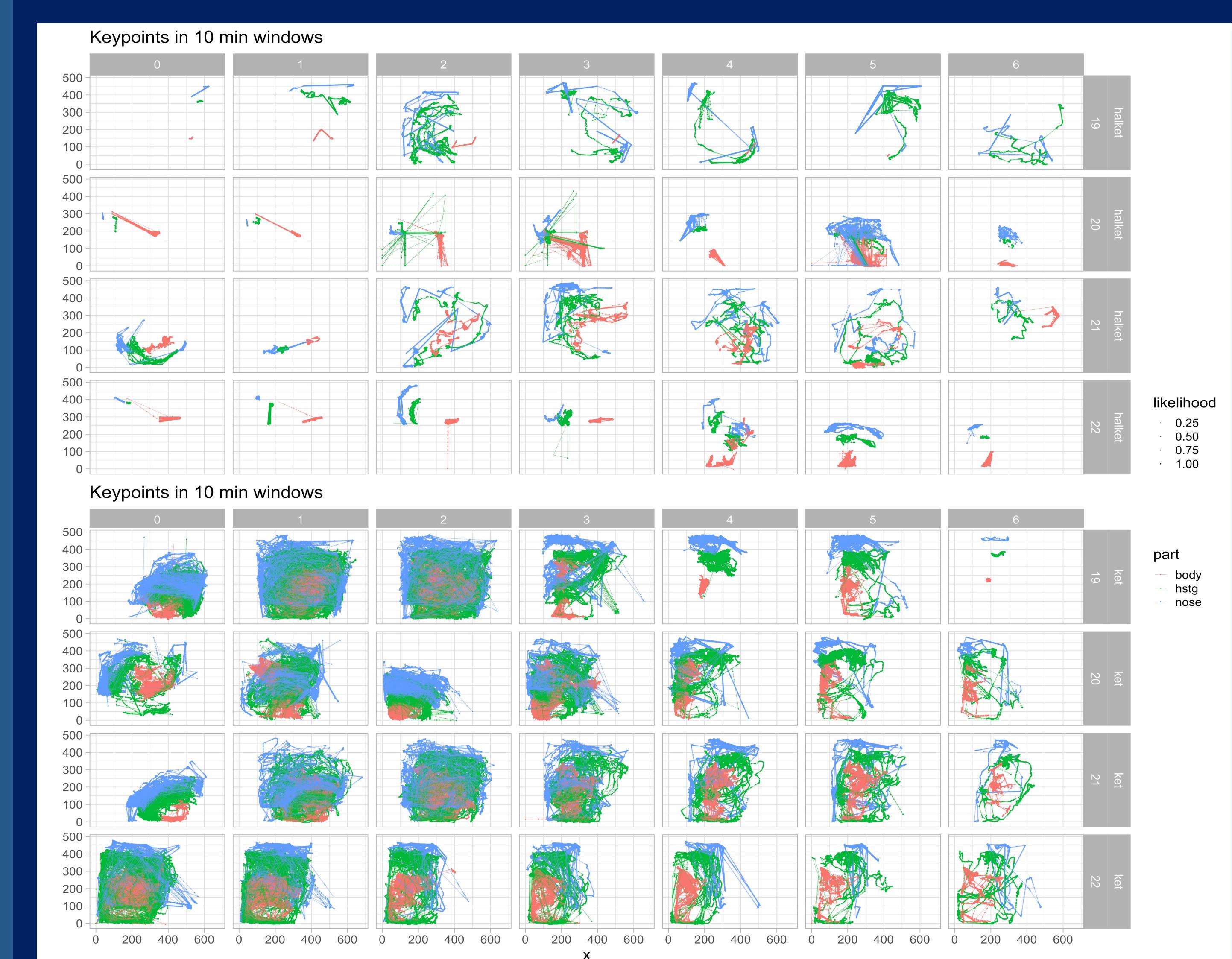
Here we analyzed output data from DeepLabCut in order to reproducibly quantify behavior from archival digitized video recordings.

## Method:

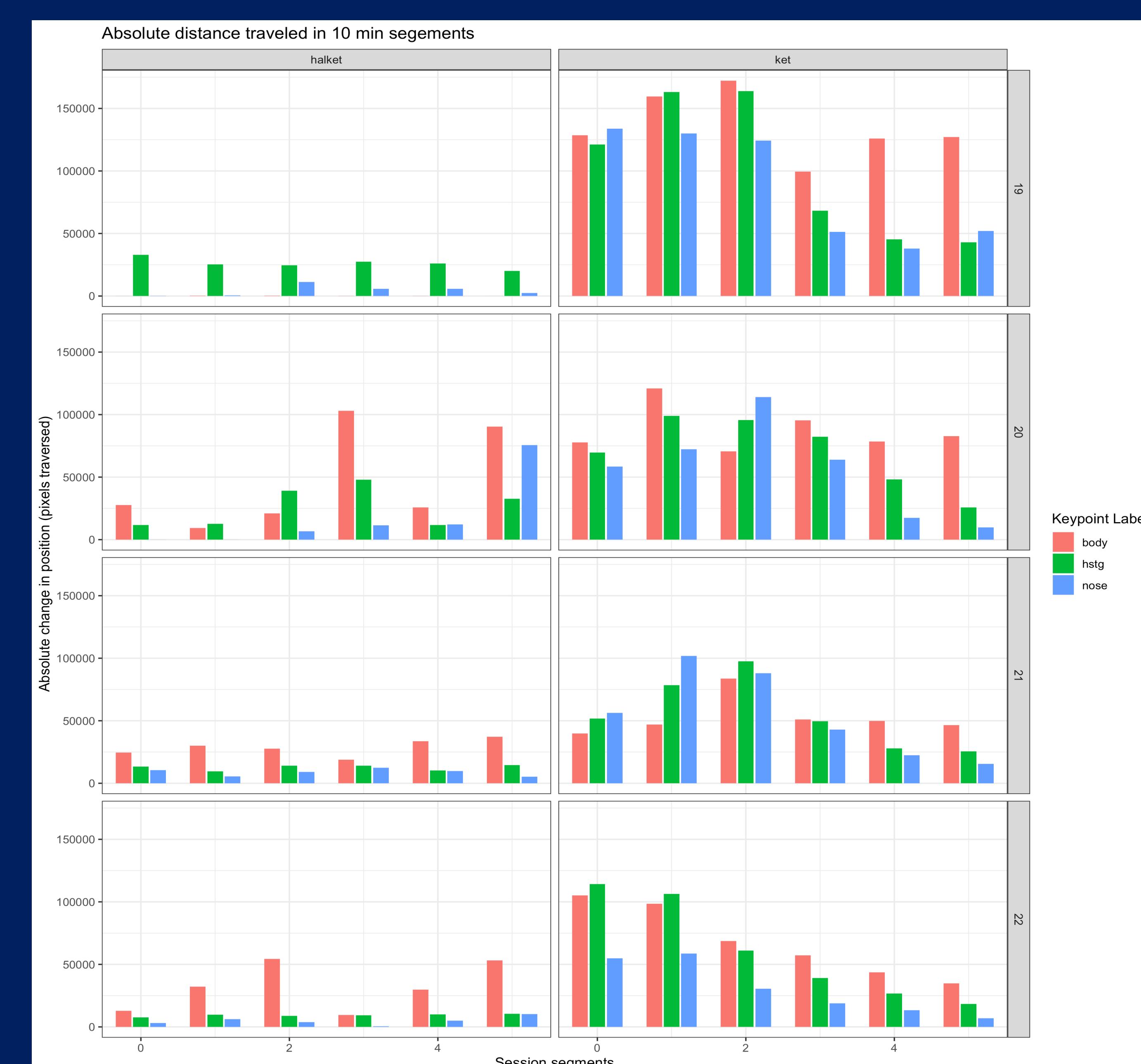
1. Rats (Sprague-Dawley subjects 19, 20, 21, and 22) were treated with sub-anesthetic dose of ketamine (20 mg/kg), and ketamine co-administered with haloperidol (1 mg/kg)
2. Utilized trained model to label novel segments from hours of archival videotaped behavior. Head, nose, and body were tracked using DeepLabCut, a python package used for animal pose-estimation for neural network training (accessed via HiPerGator).
3. Output data is quantified to assess stereotyped behavior.

## Results:

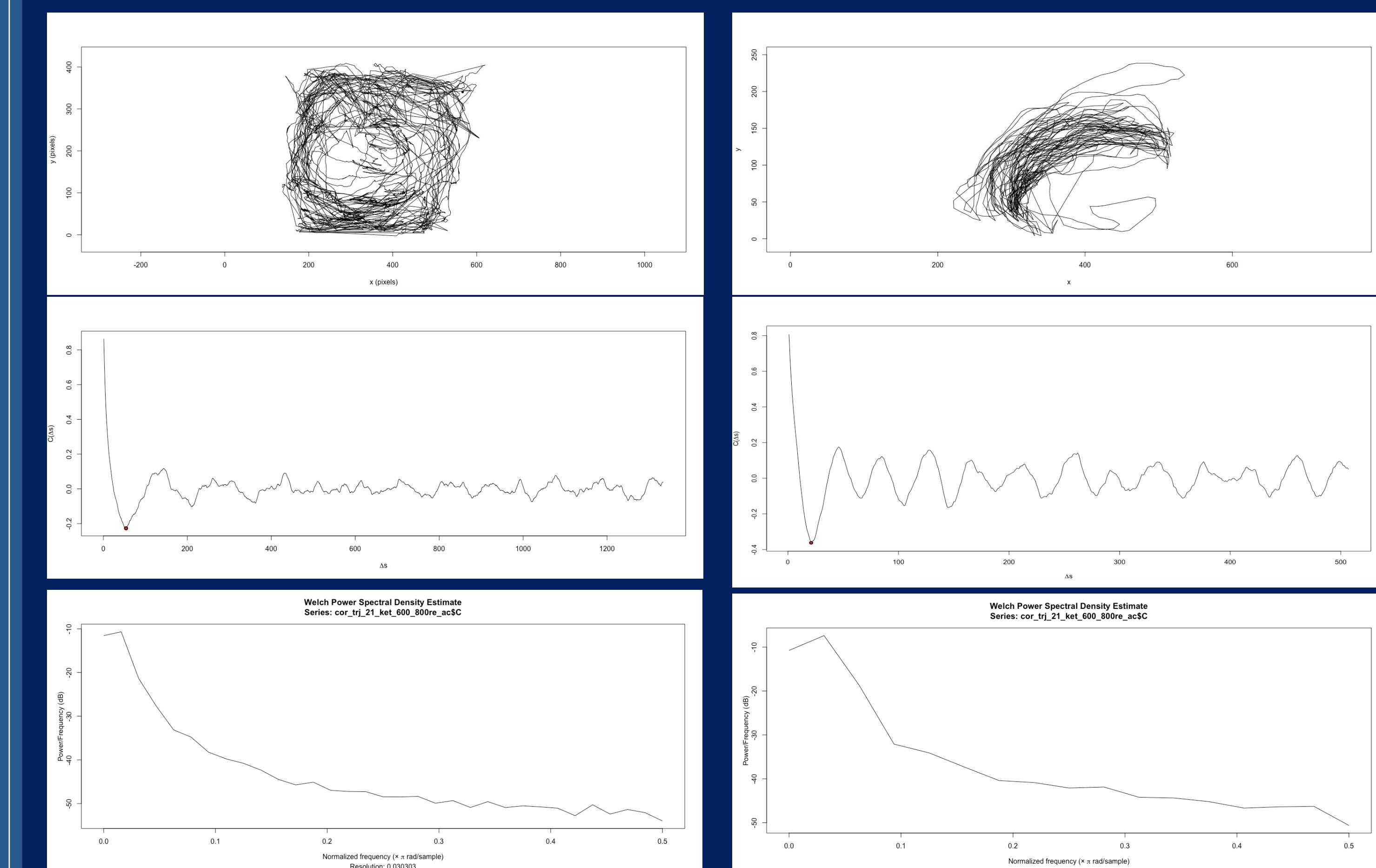
- Tracking data output taken from DeepLabCut and uploaded into R environment. Gross locomotor activity increased immediately after ketamine treatment, and this was identified as path length of center of mass body movement during the 1-hour session.
- Side-to-side head sway/wagging also increased immediately after ketamine treatment, but the distance and velocity of the movement varied over the course of the session.
- Gross locomotor activity was blocked for ketamine combined with haloperidol, and the movement characteristics of head sway were completely altered. The ketamine induced gross locomotor activity was blocked by haloperidol.



Comparison of all data from sessions demonstrates the overall difference in locomotor activity in conditions.



Cumulative path distance for each 10 minute segment of the session demonstrates that haloperidol blocks the locomotor activity that is elicited by ketamine. Locomotor activity for body and head movement is elevated 0-30min after 20 mg/kg dose of ketamine.



Rhythmicity in path distance correlation over time (middle) was examined in two case examples of a repeating pattern (i.e., rhythmic head swaying). A systematic analysis is of this rhythmic movement is apparent as a low frequency peak in power spectrum on the bottom right.

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## References:

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