Automated classification of complex social behavior in mice

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Background and Motivation

Systems neuroscience has been revolutionized by genetic tools that allow for manipulation of specific neuronal subsets that produces observable changes in an animal's behavior. A systemic problem in this field is poor reproducibility of results. Traditionally, humans classify behavior by hand, introducing inconsistency andbias across experimenters. **Aiming to promote replicatability of behavioral experiments, we therefore developed an automated behavior tracking software that classifies complex behaviors in mice.**

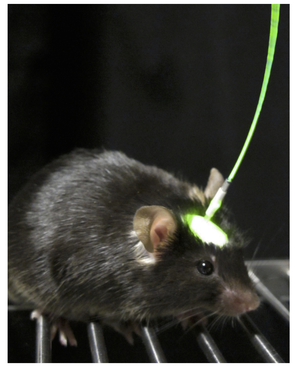
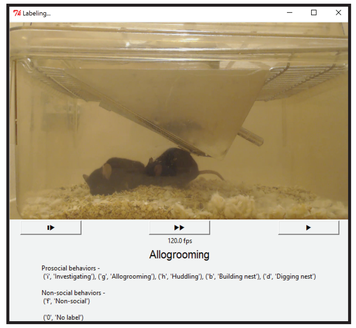
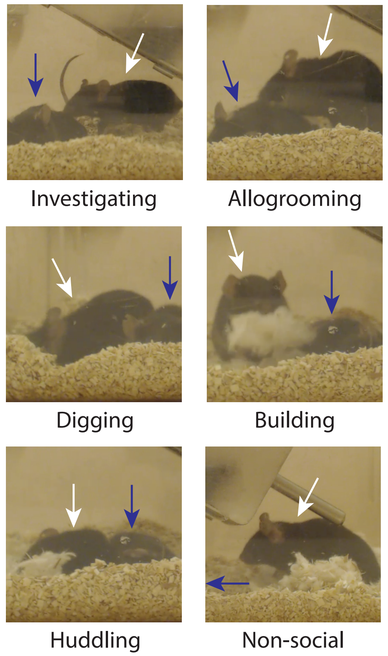


Image credit NSF, Inbal Goshen, Karl Deisseroth

Behavioral Dataset and Classification

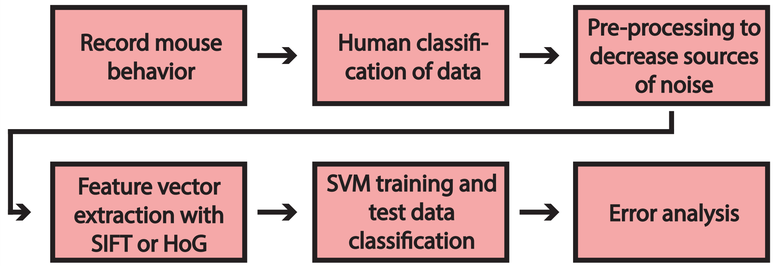




In the behavioral paradigm from which our data were collected, the subject mouse is placed into its home cage with an anesthetized cage mate. We classified the behavior of the subject mouse frame by frame with one of the following six labels: investigating, allogrooming, digging nest, building nest, huddling, or non-social.

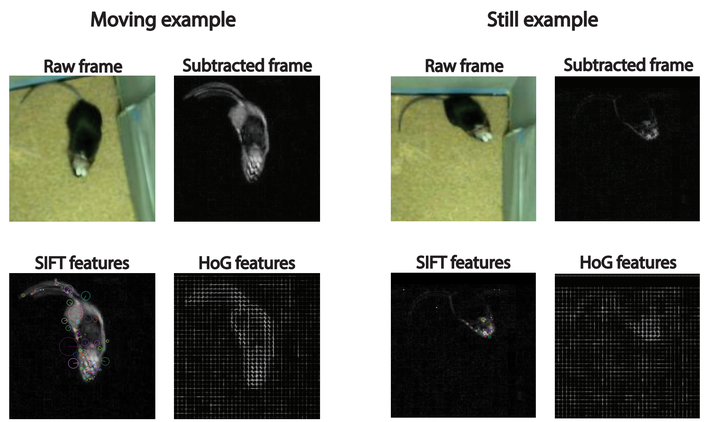
White arrows: subject
Blue arrows: anesthetized cage mate

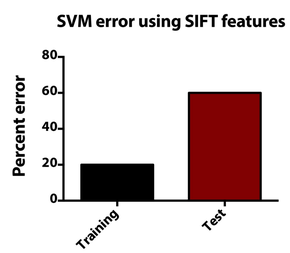
Project Outline

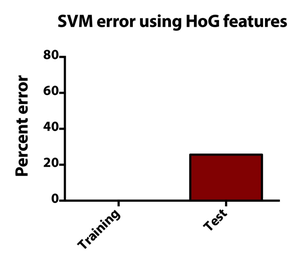


Simple behavior

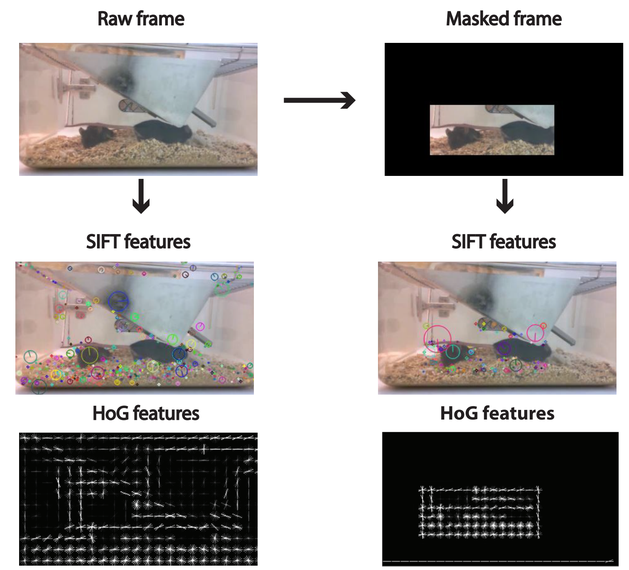
To test our methodology, we first applied our machine learning algorithms to a simple behavior: a single mouse runs around a chamber. We classified the mouse as either moving or still. We trained our learning algorithms on images generated by subtracting each frame from the average of the five previous frames.







Complex behavior



Future Directions

1. Data collection
   - -Higher resolution camera to increase signal-to-noise ratio
   - -Record behavior from multiple angles
2. Training set
   - -Classification by multiple observers on same videos
   - -Classification of more videos to increase training set size
3. Learning
   - -Try different multi-class supervised learning algorithms
   - -Deep learning

Acknowledgements

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