

Still observing behaviour manually? There **is** a better way.



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Unsupervised Machine Learning of kinematic and postural data **is all you need**

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Key Findings

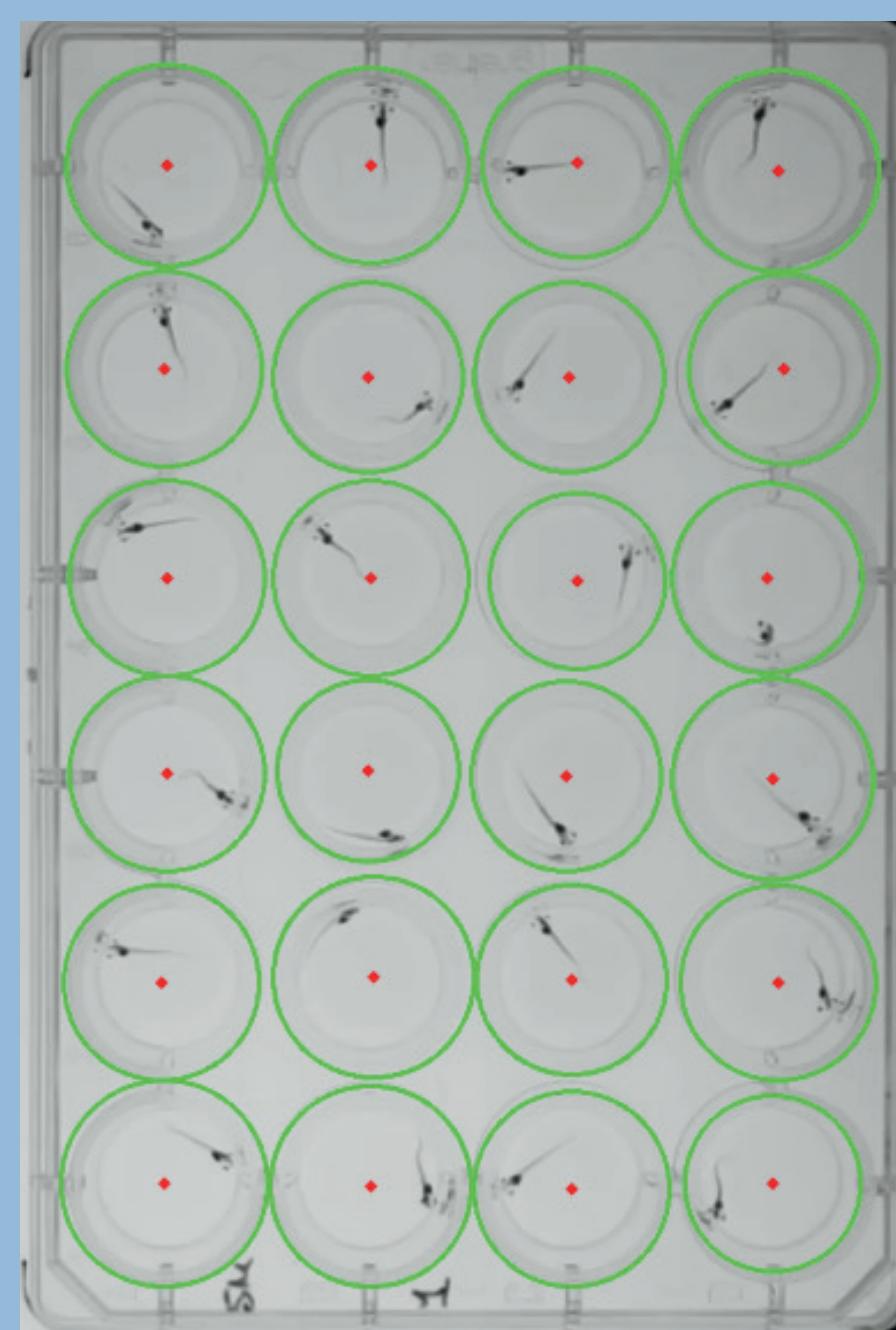
Kinematic and Postural clustering offers:

- Behavioral categories free of human bias
- 10x more behaviors than other methods
- Detection of rare important behaviors

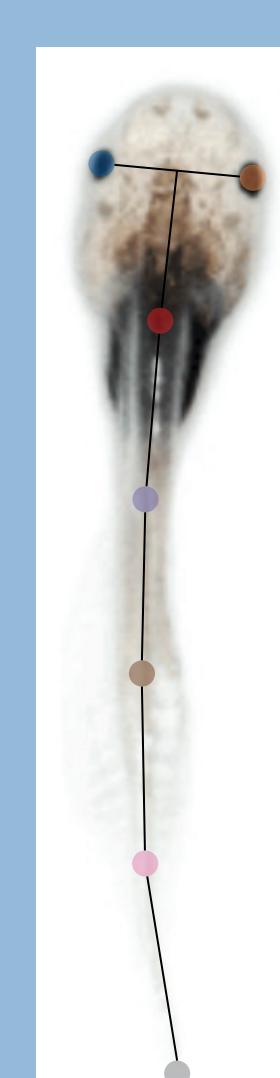
Aim

To Identify and validate behavioral prototypes using machine learning in a seizure model

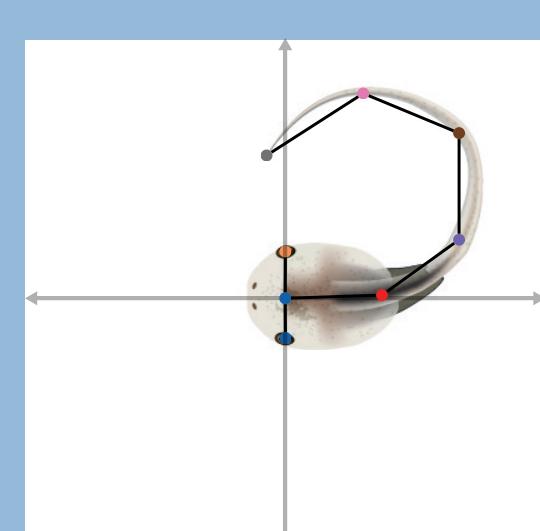
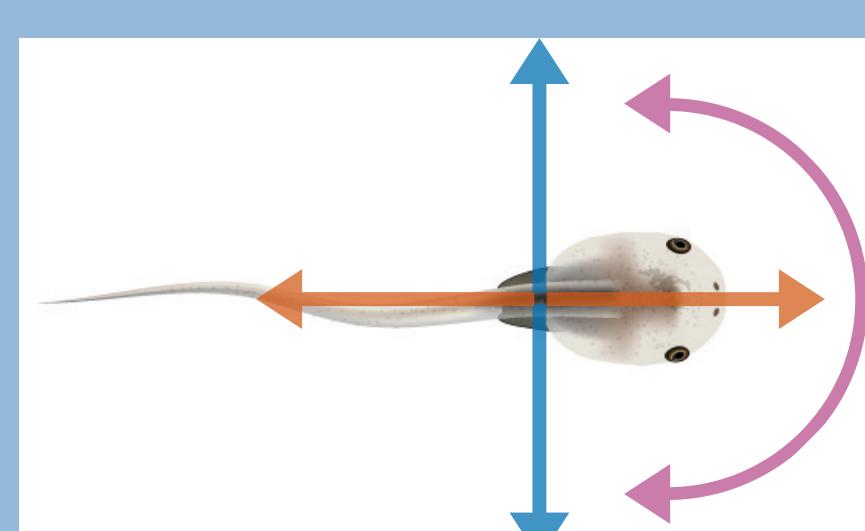
Pose Estimation



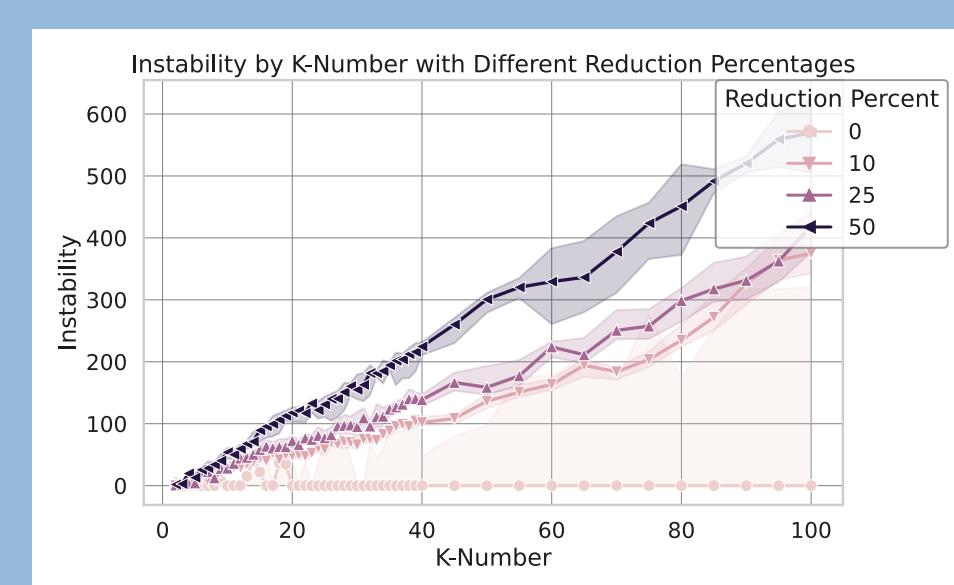
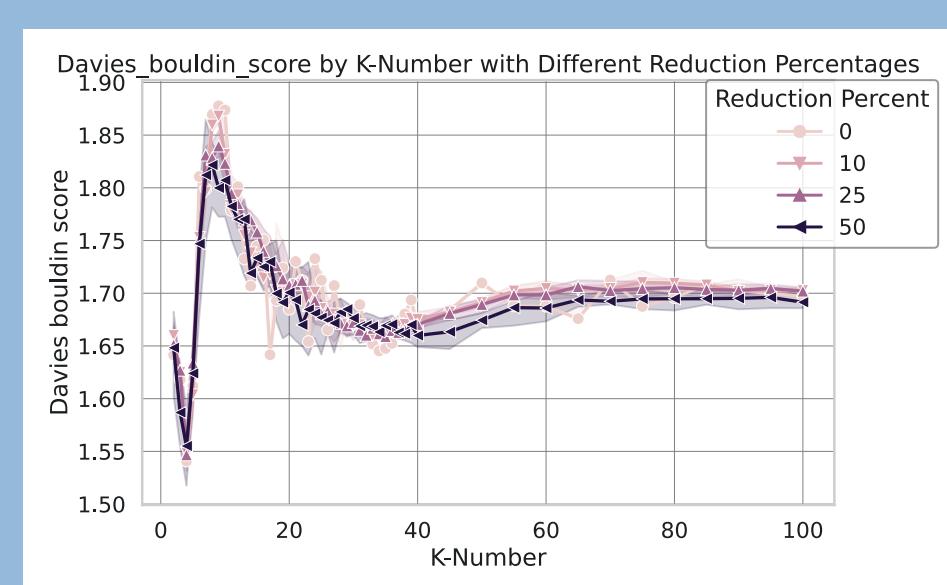
DeepLabCut:
a software package for
animal pose estimation



Extraction of Kinematic and Postural data

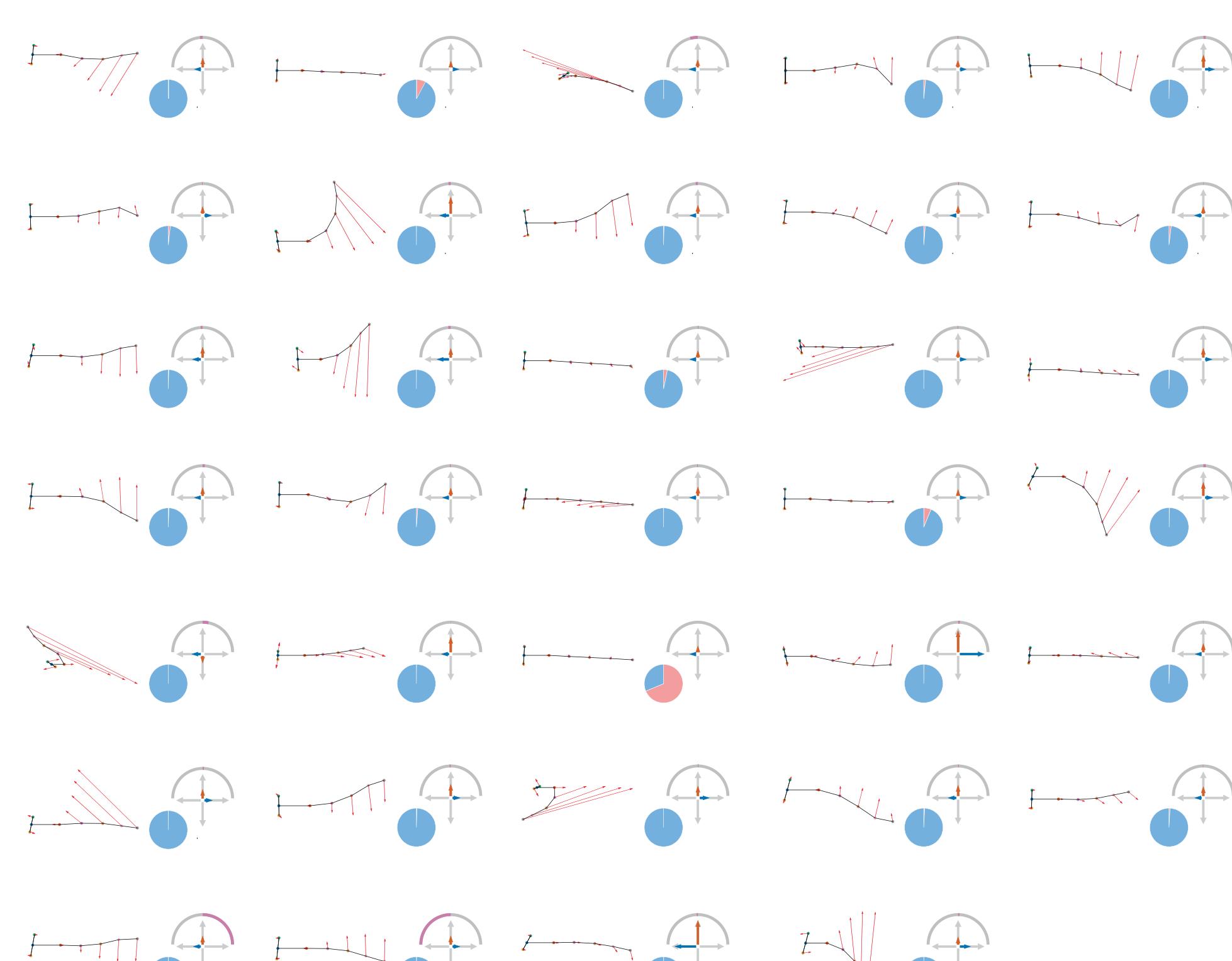


Cluster Number Selection

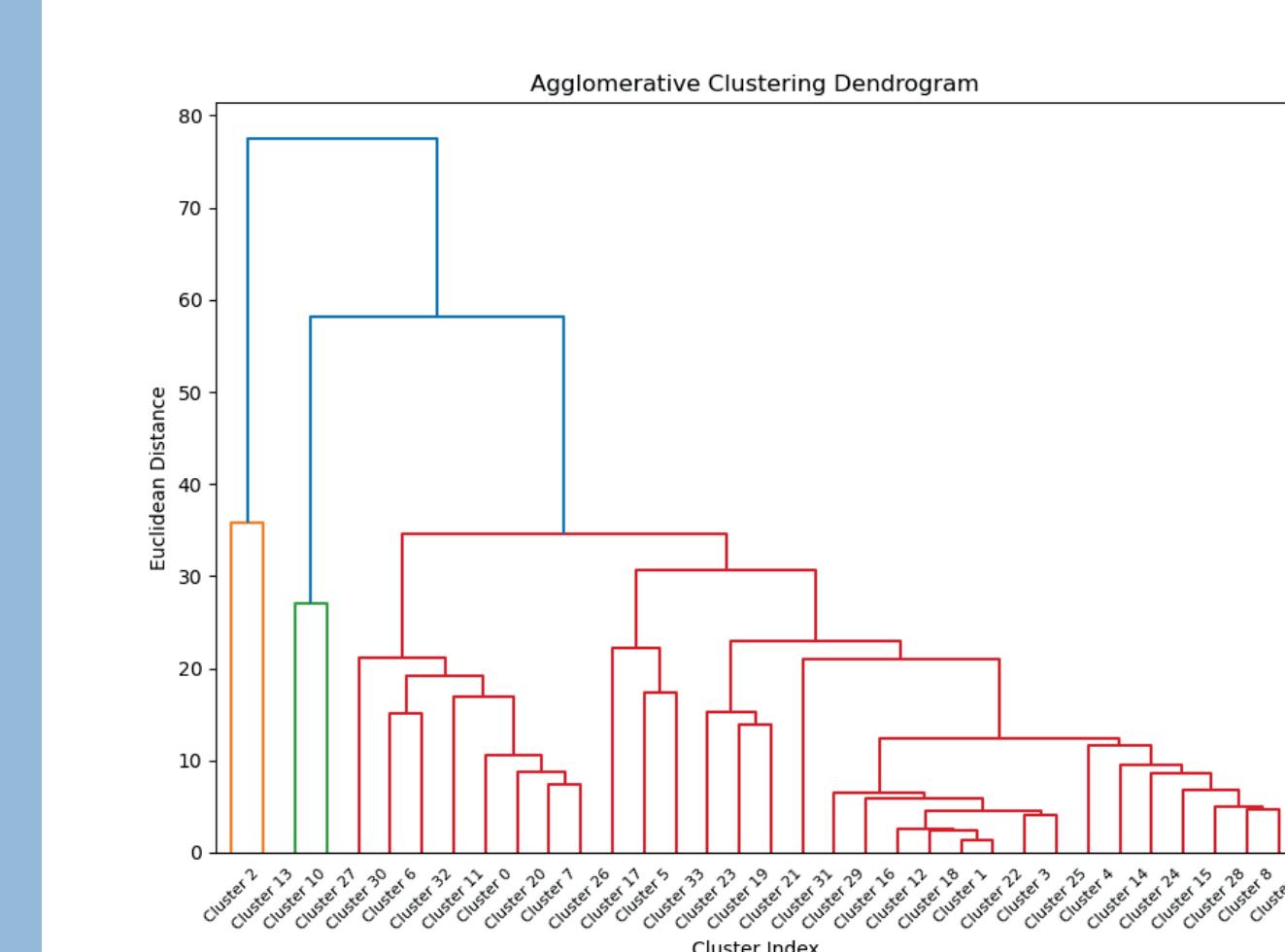


34 clusters was the minimum number needed to achieve stable and high-quality postures, as indicated by the Davies-Bouldin score.

Cluster Centroids

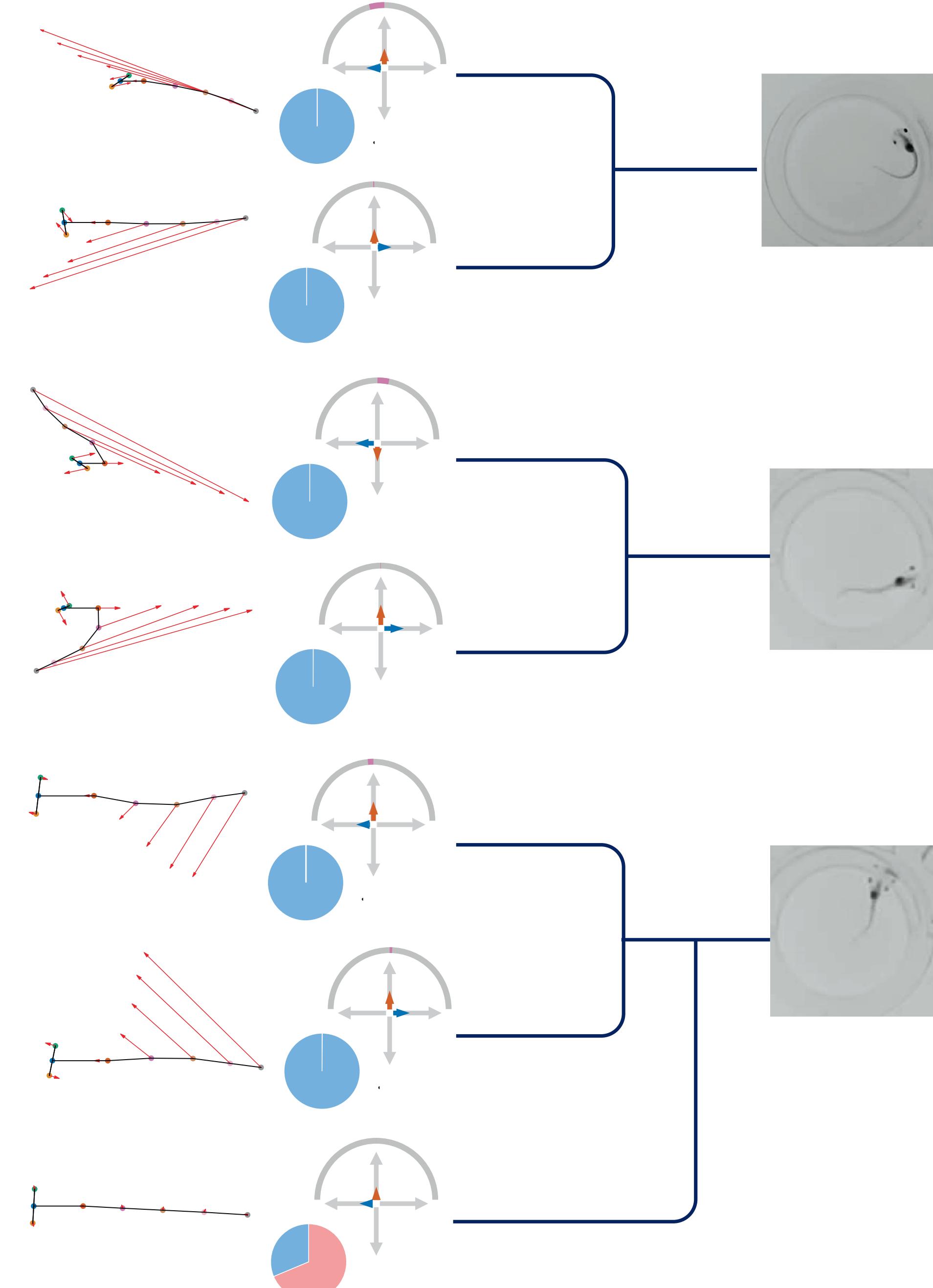


Super-clustering



Agglomerative clustering grouped 34 clusters into 7 and 3 super-clusters, revealing rare and biologically relevant C-start and swimming behaviors.

7-Supercluster

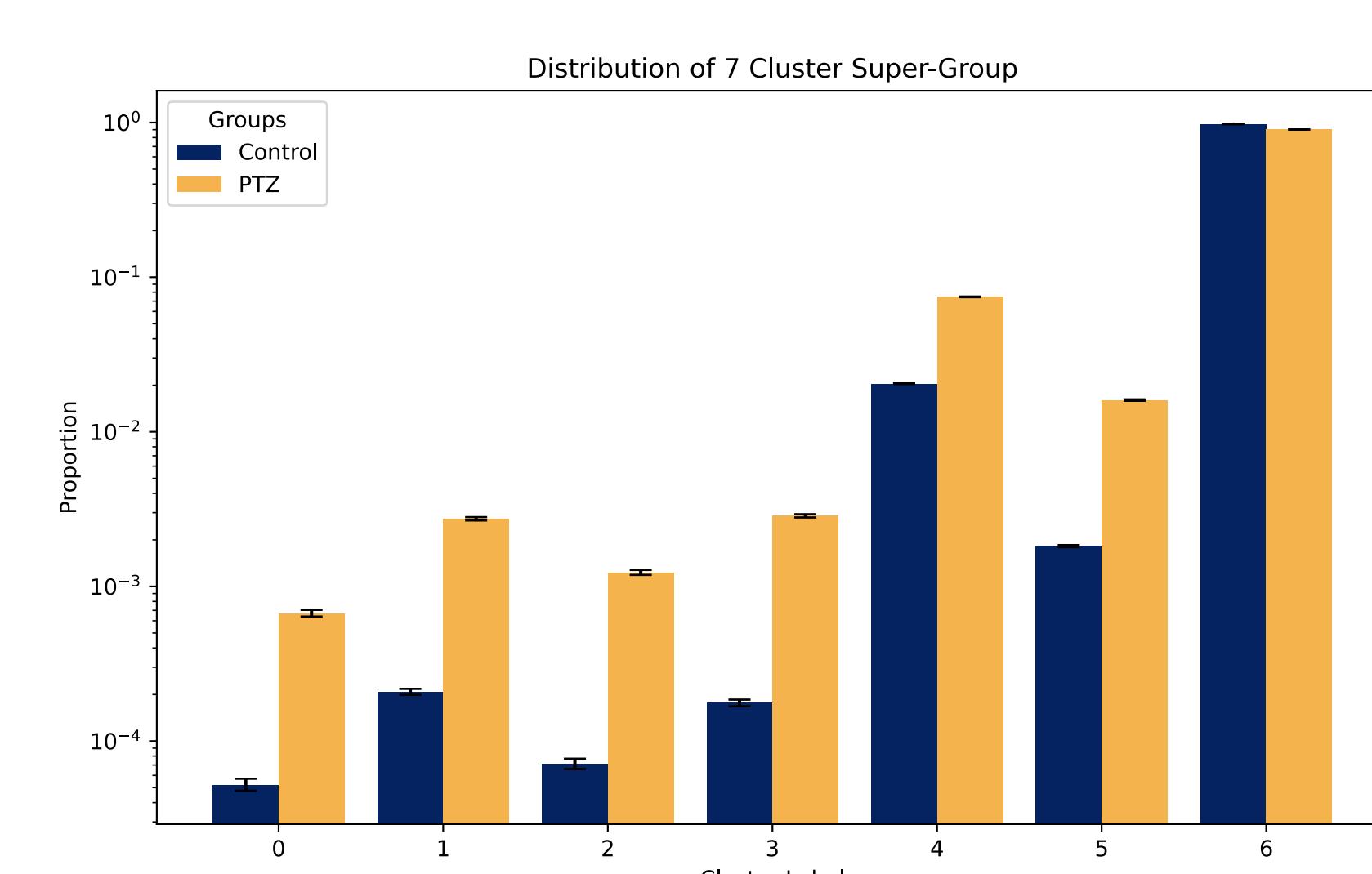
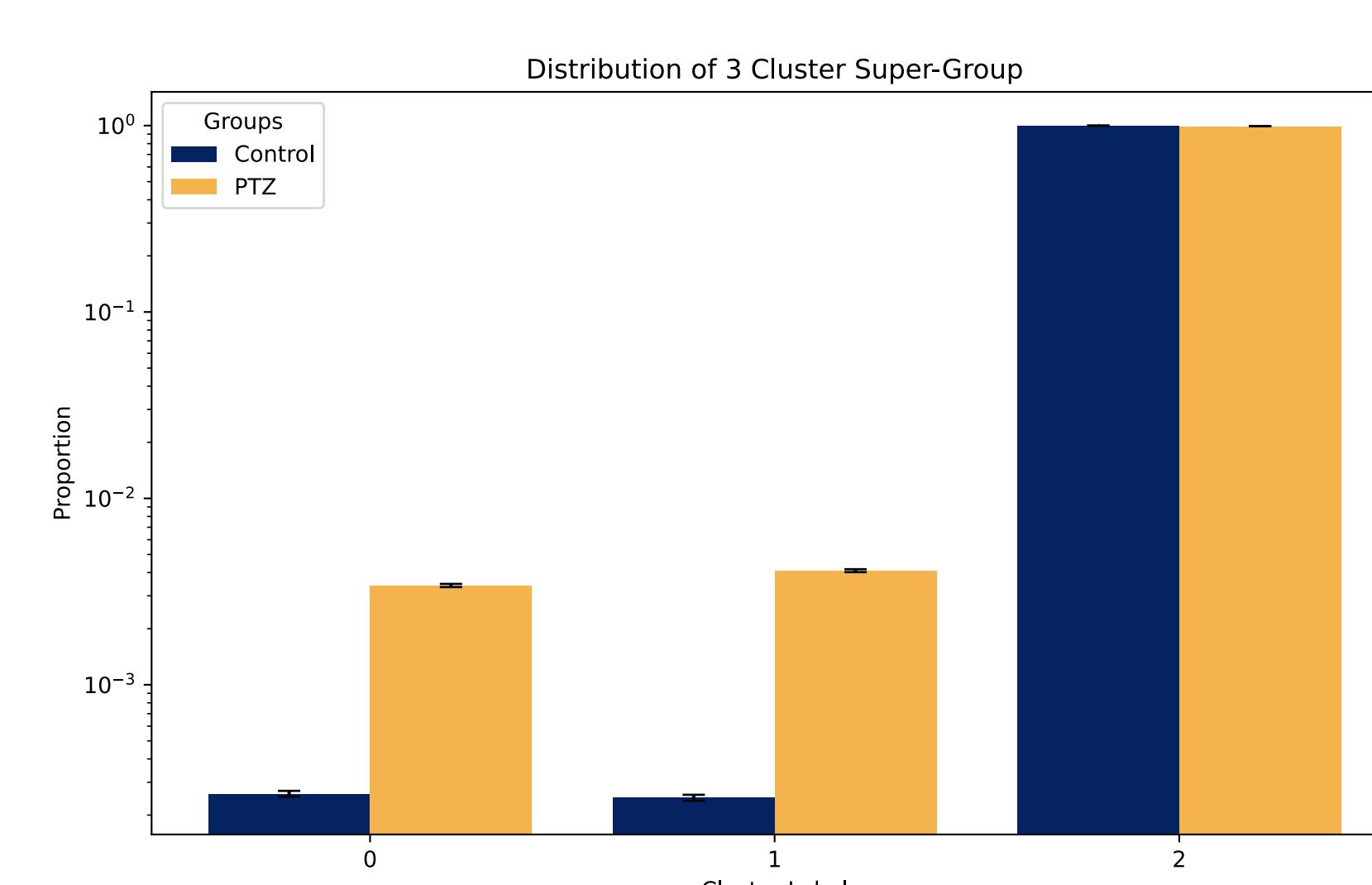


3-Supercluster

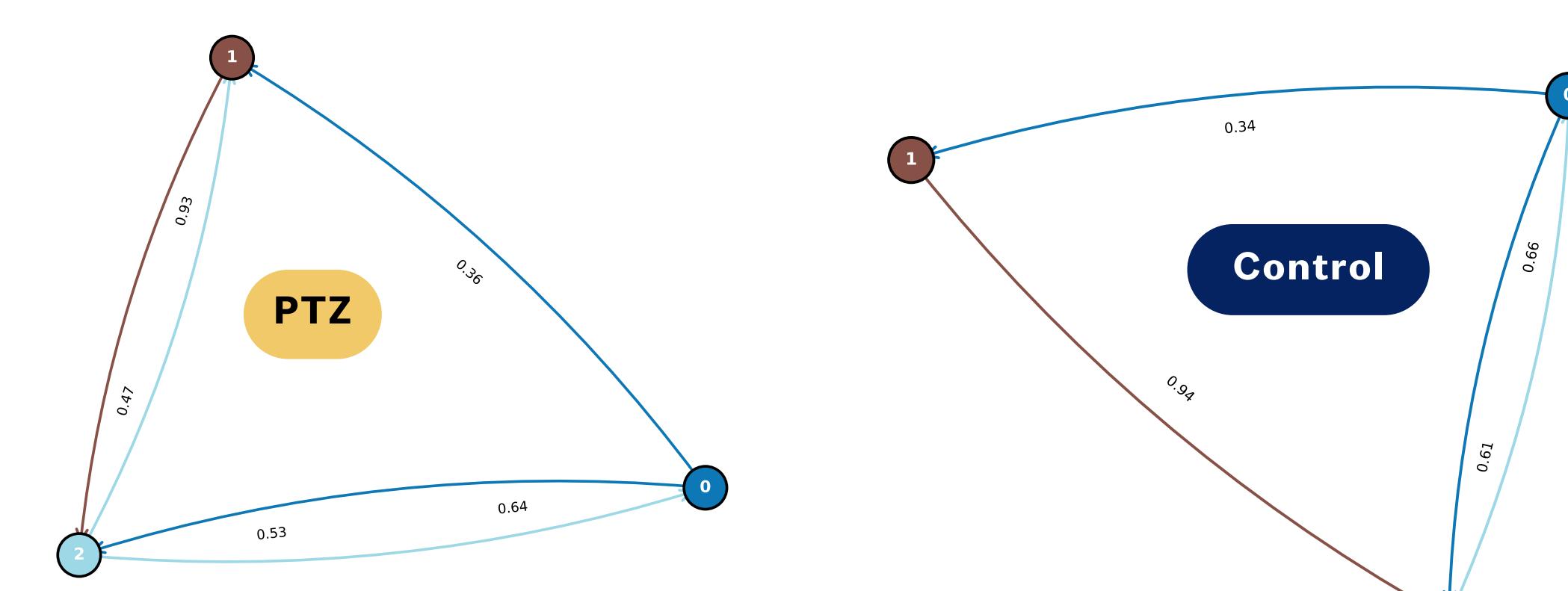
Analysis Overview

Animals 456
Frames 6×10^6
Data Points 1×10^7
Manual time saved (2 sec/frame) 130 days

Using Clustering to Quantify Seizure Behaviour in a Tadpole Model of Developmental and Epileptic Encephalopathies



Hidden Markov Models for Significant Cluster Transitions



Conclusions

- Tadpoles exposed to the seizure agent PTZ showed significant differences in all clustered behaviors.
- Seizure responses are more complex than can be quantified manually.
- Behavioral clustering is crucial to fully capture seizure phenotypes.