A Novel In-Depth Analysis Method of *semaphorin1a.2* Knockdown Impacts on Negative Phonotaxis Using DeepLabCut

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Introduction

Our research centered on the behavior of Gryllus bimaculatus, a cricket species commonly used in neuroethology and behavioral physiology studies. By leveraging machine learning-assisted visual tracking through DeepLabCut, we scrutinized the insects' negative phonotactic behaviors, particularly after knocking down the gene semaphorin1a.2 (sema1a.2).

Key Findings

Our analytical pipeline, developed in R, processed data from DeepLabCut to produce more accurate measurements of the crickets' turning angles and foot-centerline distances. Our key discovery is that crickets with sema1a.2 knocked down demonstrated more irregular rhythmic patterns and intensified response patterns compared to control crickets. This indicates that sema1a.2 plays a significant role in maintaining normal phonotactic behavior.

Technical Insights and Implications

Our data analysis pipeline revealed a strong correlation between the quality of tracking and the Flying Posture Index, which measures the flight readiness of crickets. We also employed a General Additive Model (GAM) for time-series decomposition, yielding nuanced insights into the crickets' behavior. This data set is primed for future machine learning algorithms to better categorize flight postures and responses to stimuli, providing a more holistic understanding of the subject.

Future Directions

Our research opens several avenues for further investigation. For one, our findings suggest that sema1a.2 plays a role in the crickets' phonotactic behaviors, warranting additional studies to confirm and understand this connection. The data set can also be used to train machine learning algorithms to improve tracking and categorize flight postures. Lastly, improvements in the experimental setup, such as using cameras with better ISO and shutter speed, can enhance data quality for future studies.

See the final poster here: https://web.bowdoin.edu/~chan/Actual%20Poster.pdf