Graduate School of Science and Technology Master's Thesis Abstract

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Abstract

This study explores the use of LSTM autoencoders and neural network embeddings for the semantic analysis of long-term social behavior in genetically modified mice. Using mice with a condition associated with psychiatric disorders, we aim to assess subtle behavioral differences through advanced machine learning techniques. As the experiments observed natural, spontaneous social behavior, the analysis required long-duration videos where behavioral differences were subtle and emerged gradually. Using DeepLabCut (DLC) for pose estimation, we tracked specific body parts of experimental mice during free social interactions within a monitored space. Spatiotemporal features were extracted and tokenized into behavioral units, which were further analyzed using LSTM autoencoders. Embedding projections were generated from reconstructed k-mers to evaluate the similarity of behaviors across groups, with cosine similarity as the main metric for comparison. Results demonstrated significant variations in the embeddings of approach and investigative behaviors between heterozygous and homozygous groups, suggesting subtle differences in long-term social behavior patterns that were not grasped by classical methods. This methodology provides a sophisticated, data-driven framework for analyzing complex natural behaviors over extended periods.