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A NOVEL AUTOMATIC SYSTEM FOR ANALYZING RATS' FREEZING BEHAVIOR BASED ON VIDEO RECORDINGS

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Defensive freezing behavior is an immobile and crouching posture that animals present when facing potential threatening or dangerous situations. This response is a widely employed index of innate and conditioned fear. Freezing is commonly measured by trained human observers. The present study presents a novel computational system analysis the rat freezing behavior automatically. The system is based on a supervised learning algorithm. During the training phase, videos of the rat´s general activity are first normalized for size, blurred to reduce high-frequency spatial noise and edges are extracted using a Roberts filter. Next, sum-of-differences are calculated independently for each two sequential frames quadrant.

The resulting four features are embedded in a dissimilarity space, where each frame is represented by its Cartesian distance to all other frames, and a pseudo-Fisher discriminant is built. The classifier is trained using ground-truth freezing/activity classification as registered by trained human observers. The system was evaluated using 16 videos, totaling 73 minutes, of context conditioning and a leave-one-out procedure. Error rate, calculated comparing automatic and ground-truth freezing/activity classification frame-by-frame or in blocks of 15 seconds, was 6.4% and 4.6 %, respectively. For comparison, the error rates of a second observer were 9.7% and 8.0 %, respectively. These results indicates that the present system can reliably measure freezing behavior in rats. Indeed, error rate of this system is below the variance presented by trained human observers.

Palavras-Chave**:** Freezing; Automatic Measurements; Moviment Detection

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