Central Nervous System Recovery Evaluation through Computation With Analysis of Locomotion Kinematics

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Mouse models are commonly used in the study of central nervous system (CNS) diseases. Areas such as spinal cord injury (SCI) research often require quantification of mouse locomotion ability. The established standard for mouse recovery assessment after SCI, the Basso Mouse Scale (BMS), is limited by reliance on manual observation. Existing computational assessment solutions provide objective and sensitive quantification, but are difficult to reproduce or require expensive proprietary products. This article introduces an accessible and open-source solution for Central Nervous System Recovery Evaluation through Computational With Analysis of Locomotion Kinematics (CNSRECWALK). The pipeline utilizes DEEPLABCUT, an open-source markerless pose estimation model, to identify the position of body parts in videos of mice walking across a transparent channel. CNSRECWALK extracts and calculates 139 parameters categorized into speed, joint flexibility, coordination, stability, stepping, body weight support, and other metrics. These parameters can be aggregated to provide summary scores by category, or reduced through principal component analysis (PCA) to find overall trends or differences between experimental groups. This article describes the computational pipeline, and preliminary usage of it. It discusses the potential for this open-source method to enable reproducible comparison of condition severity and subtle behavioral differences in a variety of neurological and physiological studies.