先端科学技術研究科 修士論文要旨

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要旨

Cats exhibit highly flexible and liquid-like body motions, which make accurate pose tracking particularly challenging in video-based behavioral analysis. Conventional markerless pose estimation methods, such as DeepLabCut (DLC), achieve high accuracy for standard postures but often fail under extreme body deformations and self-occlusions, resulting in missing or unstable keypoints that degrade pose tracking continuity and reliability. We propose a pose tracking framework that integrates DLC, Tracking Any Point with per-frame Initialization and temporal Refinement (TAPIR), and the Segment Anything Model (SAM), to improve tracking accuracy for highly flexible cat postures. Initial keypoints estimated by DLC are temporally refined using TAPIR, while SAM segmentation is employed to filter out invalid keypoints located outside the cat region. Final keypoint positions are determined by combining DLC likelihoods and TAPIR confidence scores. The proposed method was evaluated on 20 cat videos recorded in both web and clinical environments, including standard walking motions and highly flexible or abnormal postures. In videos with dynamic motions, the proposed method achieved higher F1 scores for visual evaluation than DLC-only, with improvements of approximately from 0.08 to 0.13. These results indicate that the proposed method is effective for tracking complex cat poses in natural environments and has potential applications in animal behavior analysis and biological research.