

Graduate School of Science and Technology Master’s Thesis Abstract

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Thesis title	ShuttleHitFormer: A Multi-Feature Transformer Model for Shuttle Hit Detection in Badminton		
Abstract			
Accurate hit detection in badminton is a foundational task for automated sports analytics, yet it remains highly challenging due to the shuttle’s rapid motion, frequent occlusions, and the intricate spatial-temporal dynamics between players, shuttle, and court. In this thesis, we propose ShuttleHitFormer, a novel Transformer-based architecture designed to address these challenges by integrating diverse visual features from badminton video footage. Our model leverages shuttle trajectories (extracted via TrackNetV3), player keypoints (from RTMPose), and spatial cues including court lines and a newly introduced component: net keypoints. The inclusion of net keypoints offers crucial contextual information, particularly for analyzing front-court interactions—a frequently overlooked aspect in existing models. ShuttleHitFormer is formulated as a multi-class classification model that detects various types of hits within a rally. It employs a multi-stream encoder structure followed by hierarchical cross-attention and a temporal Transformer module to effectively model complex dependencies over time and space. Evaluated on the ShuttleSet22 dataset, our approach achieves state-of-the-art performance, with an accuracy of 87.5 and an F1 score of 0.866. Ablation studies confirm the effectiveness of multi-feature fusion, with the full model outperforming shuttle-only baselines by a significant margin. These results demonstrate that carefully designed Transformer architectures, when tailored to domain-specific characteristics, can substantially advance the accuracy and depth of automated sports analysis.			