WEAKLY AND SELF-SUPERVISED CLASS-AGNOSTIC MOTION PREDICTION FOR AUTONOMOUS DRIVING

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Abstract

Autonomous driving systems require accurate and robust motion prediction to anticipate the future trajectories of surrounding agents in complex and dynamic environments. Traditional trajectory forecasting approaches often rely on fully supervised learning with dense annotations and class-specific modeling (e.g., separate models for vehicles, pedestrians, or cyclists). However, collecting large-scale, high-quality labeled trajectory data is costly and time-consuming, and class-dependent models may struggle to generalize to unseen agent types. To address these limitations, this work proposes a Weakly and Self-Supervised Class-Agnostic Motion Prediction framework that learns motion representations without requiring explicit class labels or exhaustive ground-truth supervision.The proposed framework integrates self-supervised representation learning with weak supervision signals derived from heuristic pseudo-labels. In the self-supervised stage, past trajectories are augmented through geometric transformations, temporal masking, and noise injection to create multiple views of the same motion sequence. A contrastive learning objective encourages the encoder to learn invariant and discriminative motion embeddings, enabling robust modeling of temporal dynamics without manual annotations. In parallel, weak supervision is introduced through automatically generated pseudo-labels based on trajectory smoothness, jerk, and kinematic consistency, allowing the system to distinguish plausible motion patterns from corrupted or unrealistic ones.