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Vehicle Timing Motion Detection Based on Multi-Dimensional Dynamic Detection Network

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Abstract : Detecting vehicle behavior has always been the focus of intelligent transportation, but with the explosive growth of the number of vehicles and the complexity of the road environment, the vehicle behavior videos captured by traditional surveillance have been unable to satisfy the study of vehicle behavior. The traditional method of manually labeling vehicle behavior is too time-consuming and labor-intensive, but the existing object detection and tracking algorithms have poor practicability and low behavioral location detection rate. This paper proposes a vehicle behavior detection algorithm based on the dual-stream convolution network and the multi-dimensional video dynamic detection network. In the videos, the straight-line behavior of the vehicle will default to the background behavior. The Changing lanes, turning and turning around are set as target behaviors. The purpose of this model is to automatically mark the target behavior of the vehicle from the untrimmed videos. First, the target behavior proposals in the long video are extracted through the dual-stream convolution network. The model uses a dual-stream convolutional network to generate a one-dimensional action score waveform, and then extract segments with scores above a given threshold M into preliminary vehicle behavior proposals. Second, the preliminary proposals are pruned and identified using the multi-dimensional video dynamic detection network. Referring to the hierarchical reinforcement learning, the multi-dimensional network includes a Timer module and a Spacer module, where the Timer module mines time information in the video stream and the Spacer module extracts spatial information in the video frame. The Timer and Spacer module are implemented by Long Short-Term Memory (LSTM) and start from an all-zero hidden state. The Timer module uses the Transformer mechanism to extract timing information from the video stream and extract features by linear mapping and other methods. Finally, the model fuses time information and spatial information and obtains the location and category of the behavior through the softmax layer. This paper uses recall and precision to measure the performance of the model. Extensive experiments show that based on the dataset of this paper, the proposed model has obvious advantages compared with the existing state-of-the-art behavior detection algorithms. When the Time Intersection over Union (TIoU) threshold is 0.5, the Average-Precision (MP) reaches 36.3% (the MP of baselines is 21.5%). In summary, this paper proposes a vehicle behavior detection model based on multi-dimensional dynamic detection network. This paper introduces spatial information and temporal information to extract vehicle behaviors in long videos. Experiments show that the proposed algorithm is advanced and accurate in-vehicle timing behavior detection. In the future, the focus will be on simultaneously detecting the timing behavior of multiple vehicles in complex traffic scenes (such as a busy street) while ensuring accuracy.

Keywords : vehicle behavior detection, convolutional neural network, long short-term memory, deep learning
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