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Efficient abnormality detection using patch-based 3D convolution with recurrent model

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Abstract
Recent advances in the intelligence video monitoring system have received widespread attention for the detection of anoma lous human behavior in crowded scenes. Due to the varying crowd densities, low-resolution videos, inter-object occlusions and complex human crowds, the detection of abnormalities from human activities is extremely challenging. Hence, automati analysis of behavioral patterns is necessary for accurately modeling crowd behavior and alerting human operators about suspi cious activities on the scene. In response to these concerns, we propose a two-stream multi-scale patch-based pyramidal dilate 3D fully connected network (FCN) with attentive bidirectional long short-term memory (2MPD-3DFCN-AttBiDLSTM) fo detecting and locating abnormal activities in the frame. This model effectively captures the spatial–temporal features wit a dilated convolution network, and thus the motion and optical flow information features are exploited from the continuou frame, which improves the detection accuracy. Also, we introduce a parallel weighted skip connection into the residual learn ing framework that preserves the rich characteristics of the input data to be learned without the loss of effective features Based on the attentive mechanism in the bidirectional LSTM model, two directions of temporal and global representation are extracted that enhance the classification of unusual and normal activity in the visual sequences. Experimental analysi is performed with the two publicly available datasets and evaluated in terms of the equal error rate, precision–recall curve receiver operating characteristic curve, and area under the curve metrics measures. The result shows that the proposed mode outperforms the existing model and achieves high detection results in the video surveillance monitoring system.

Keywords Abnormal human behavior detection · Abnormal behavior · Anomalous detection · Dilated convolution network LSTM · Crowded scene · Video surveillance

1 Introduction

In recent years, abnormal behavioral analysis has received greater attention in the detection of unusual activity in crowded scenes [1]. Abnormal activities, such as sudden vio lence and individual deviations from usual events, greatly affect public safety and raise serious issues for social gov ernance. Traditional detection models employ manpower t detect anomalies by analyzing video continuously, leading t inefficiency and low accuracy. Therefore, automatic identifi cation is needed for research in visual surveillance to analyz group activity and ensure security in crowded environments Video monitoring is installed in several places, including air ports, educational institutions, hospitals, commercial firms residential areas, and smart cities [2].

In the healthcare sector, surveillance provides an intelli gent and inexpensive way to monitor the daily events of olde people, as well as patients suffering from physical disorder requiring long-term assessment [3]. If suspicious movemen is detected, an alert message or alarm is raised and sent t the security personnel in the monitoring system. A visua monitoring system is applied mainly for object detection

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