Motion-Attentive Network for Detecting Abnormal Situations in Surveillance Video

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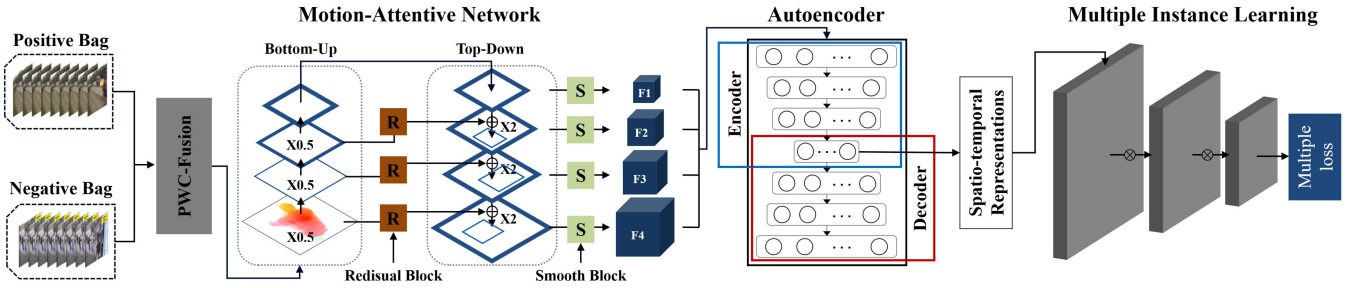

Figure 1: The flow diagram of the proposed motion-attentive network

ABSTRACT

Recently, numerous studies have utilized deep-learning-based approaches to detect anomalies in surveillance cameras. However, while several of these studies used motion features to detect abnormal situations, detection problems can arise due to the sparse information and irregular patterns in certain abnormal situations. We propose a means of preserving motion patterns in abnormal situations through a network called MA-Net, which solves representation problems caused by a loss of sparse information and irregular patterns. We show through experiments that the proposed method is superior to state-of-the-art methods.

CCS CONCEPTS

• **Social and professional topics** → **Surveillance**.

KEYWORDS

surveillance video, motion-attentive network, anomaly detection

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1 INTRODUCTION

Surveillance cameras are used to detect abnormal situations though such detections are labor-intensive tasks. On the other hand, we can also consider such tasks as an anomaly detection problem, referring to the process of automatically identifying unexpected patterns from surveillance video. Existing approaches to detect abnormal situations use hand-crafted features [Hasan et al. 2016; Lu et al. 2013] or deep-learned features [Sultani et al. 2018; Zhu and Newsam 2019]. Hand-crafted feature-based approaches [Hasan et al. 2016; Lu et al. 2013] statistically extract appearance and motion patterns representing normal and abnormal situations from video frames and then classify abnormal situations through a deep-learning network. However, with hand-crafted features, it is difficult to detect abnormal situations, which typically present irregular patterns, even if they are of the same type. Deep-learned feature-based approaches [Sultani et al. 2018; Zhu and Newsam 2019] robustly classify abnormal situations by extracting spatiotemporal representations from irregular motion patterns using a deep learning network. Although the anomaly detection performance has dramatically improved with deep-learned feature-based approaches, it still requires further improvement. In particular, during the extraction of deep-learned features, relatively sparse information, which can be meaningful information to determine an abnormal situation, is lost. That is, a typical motion pattern for an abnormal situation may not always represent an abnormal situation, which leads to an abnormal detection failure.

To address this issue, we propose a motion-attentive network called MA-Net (see Figure 1). MA-Net learns enhanced deep-learned features that preserve significant portion of motion information related to abnormal situations in video frames. These enhanced deep-learned features solve the problem of failing to detect anomalies due to the loss of sparse information. We show through experiments that MA-Net outperforms state-of-the-art methods.