International Journal of Digital Crime and Forensics
Volume 15 • Issue 1

Abnormality Retrieval Method of Laboratory Surveillance Video Based on Deep Automatic Encoder

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ABSTRACT

Aiming at the problem that abnormal behavior is difficult to distinguish from normal behavior, a retrieval method for abnormal behavior of laboratory security surveillance video based on deep automatic encoder is proposed. Firstly, the fuzzy median filtering algorithm is used to reduce the noise of the collected laboratory security surveillance video, and then the YUV spatial chromaticity difference method is used to divide the foreground and background of the video, and the illumination degree in the video is determined. The diagonal model and codebook clustering idea are used to compensate for global and local lighting mutations. Finally, the preprocessed video is input into the mixture model, which is based on the deep automatic encoder and combined with the Gaussian mixture model, and the abnormal behavior retrieval results are output. The experimental results show that the proposed method has good security surveillance video preprocessing effect, large AUC, small error rate of abnormal behavior retrieval, and high operation efficiency.

KEYWORDS

Abnormal Behavior Retrieval, Deep Automatic Encoder, Gaussian Mixture Model, Laboratory Safety Surveillance Video, Light Mutation Compensation

INTRODUCTION

A large number of expensive instruments and equipment are stored in the laboratory. If theft, fire and environmental parameters exceed the normal storage range of instruments and equipment occur, it will cause huge economic losses and even casualties. With the continuous development of science and technology and national economy, laboratories have put forward higher requirements for safety monitoring technology (Tang et al., 2022). The laboratory video monitoring system is gradually moving towards automation, intelligence, low power consumption and practicality (Liu, 2021). Therefore, it is very important to establish a scientific and reasonable video abnormal behavior retrieval method to ensure the safety of the laboratory.

DOI: 10.4018/IJDCF.325224 *Corresponding Author

Z. Wang et al. (2022) took the convolutional fusion strategy and temporal segmentation and deep residual network as the basic reference, collected the temporal behavior and motion information therein, optimized the network performance, and further enhanced the motion information modeling performance. A segmented network is established to extract time series features, and high-dimensional spatiotemporal features are fused to retrieve abnormal behavior of laboratory security surveillance videos.

J. Gu et al. (2022) integrated learning and deep neural network integration to generate countermeasures network for laboratory security monitoring video abnormal behavior retrieval. At the same time, a group of generators and a group of discriminators are trained to enable the generator to obtain the discriminant results of multiple discriminators, so as to improve the performance of traditional generation countermeasures network and realize the retrieval of abnormal behavior of laboratory security monitoring video. P. Gu et al. (2022) and others conducted data analysis through the feature pyramid network to collect the abnormal behavior in the video image, and calculated the optical flow diagram of the two adjacent frames on this basis to obtain the external features and motion features. The spatial context is constructed and the external features and motion features are recoded. The spatiotemporal dual-stream network is used to reconstruct the two, and the abnormal behavior retrieval of laboratory security monitoring video is realized based on the reconstruction error. The above methods did not compensate for video illumination mutation before retrieving video abnormal behavior, resulting in poor security monitoring video preprocessing effect, small AUC and high error rate.

In order to optimize the effect of abnormal behavior retrieval of surveillance video, a method of abnormal behavior retrieval of laboratory security surveillance video based on deep automatic encoder is proposed. On the basis of preprocessing the laboratory security surveillance video, a deep automatic coding Gaussian mixture model is established by the deep automatic encoder method to optimize the performance of abnormal behavior retrieval.

Laboratory Security Monitoring Video Preprocessing

In order to ensure the retrieval effect of abnormal behavior of the final laboratory safety surveillance video, the laboratory safety surveillance video is preprocessed before retrieval. The preprocessing steps mainly include two parts: noise reduction of laboratory safety surveillance video and sudden change compensation of laboratory safety surveillance video, and the specific process is as follows.

Laboratory Security Surveillance Video Noise Reduction

The proposed method uses the fuzzy median filtering algorithm as the noise reduction algorithm for laboratory safety monitoring video (Tan et al., 2021; Huang et al., 2021). The core of this algorithm is the acquisition of fuzzy membership coefficient. $h\left(x,y\right)$ is used to represent the gray value at pixel (x, y) in the K frame image of the laboratory safety surveillance video, T1 and T2 represent the preset threshold, and the fuzzy membership coefficient $f_{x,y}$ is expressed as:

$$f_{x,y}=\begin{cases}0, h\left(x,y\right)<T_1\\ \dfrac{h\left(x,y\right)-T_1}{T_2-T_1}, T_1\le h\left(x,y\right)\le T_2\\ 1, h\left(x,y\right)>T_2\end{cases} \tag{1}$$

However, the fuzzy membership coefficient calculation method of the above equation has the following two defects: