The adaptive intelligent information processing system

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Abstract

With the fast development of computer science and the wide application of multimedia technology, a mass of digital videos have become an indispensable part of our lives. However, it takes too much time and manpower to check the monitor. In order to solve these problems, this paper proposes the adaptive intelligent information processing system. The method extracts video abstracts from the original monitoring videos and analyzes these video abstracts one by one. So within a short period of time, users can get those video events that are interesting to them. The realization of the system can help users find the monitoring information quickly and efficiently. This system can be used in public places such as airports and stations, where traffic accidents are most likely to happen.

Keywords: video abstract, key frame extracting, intelligent processing, intelligent recognition

1 Introduction

In recent years, with rapid development of our society and enhancement of national strength, requirements of safety protection and record alarm systems in bank, electric power, transportation, security and military facilities as well as other fields are steadily on the increase, and the demands are more and more exigent, so video surveillance are widely used in almost all aspects of social life and production [1-3].

However, the actual monitoring still needs quite a lot of manpower, and the existing video surveillance system can only record video images and does not explain the information. So it can only be used in obtaining evidence afterwards, and cannot perform real-time and initiative functions. In order to analysis, track and discriminately monitor objects and provide information for government departments and security areas in time, "intelligent" video surveillance seems particularly important.

Intelligent video surveillance uses computer vision technology to process, analyze and understand video signal [4, 5]. It can make an alarm or provide useful information when abnormal condition happens without human intervention by automatically analyzing the sequential images, analyzing and judging the behaviour of the target based on locating, identifying and tracking. Consequently, it will assist the security staff to deal with the crisis effectively and reduce false positives and negatives phenomenon maximally.

Nowadays, the popular software of intelligent video processing is as follow:

1) Object recognition: it can distinguish a moving object like a car, a motorcycle, a person, or a plane and so on, which is the basis of other recognitions.

2) Cross-border recognition: by drawing a line or curve on the video screen, software can recognize the behaviour of objects across the boundary.

3) The trajectory tracking: after distinguishing a moving object, software can draw the motion trajectory.

4) Left or lost object recognition: Devices can identify objects in the scene view, be it a lost one or an extra one, which is suitable for the warehouse, station, exhibition hall, security and other places.

5) License plate recognition: the device can automatically identify the number when the license plate area appearing in the video and remind the users by word.

6) Traffic statistics: intelligent devices can identify passing pedestrians and vehicles and count the number.

7) Reverse alarm: in places where traffic flow is in single direction in single-way streets, or the exit and entry of stations and airports, if someone is retrograde, the system will automatically identify and make an alarm.

Besides, some software is used in dealing with speed measurement, perverse behaviours like graffiti and fighting. The mentioned intelligent recognition software only deals with the events or objects with certain characteristics like colour, shape, etc. [6, 7].

They still have problems as follows:

1) Monitoring time is long, normally dozens of hours.

2) Too many surveillance cameras, and it is difficult to assign more people monitoring large video resources.

3) Wasting human as well as time resources. If we don't know the specific characteristics of the objects, we shall have to watch the whole video.

Therefore, it will save lots of human and time resources if we use video monitoring to extract specific parts of the video and recognize the types of video events automatically, the efficiency of monitoring and safety protection will be greatly improved. The adaptive intelligent information processing proposed by this paper refers to a method of extracting specific parts of the video and analyzing what type they belong to through video extract technology, so as to achieve the result of monitoring videos automatically, quickly and effectively.

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2 Video abstract extraction

Video abstract event refers to an event of some moving object. We should detect and track it, record its information such as size, location and movement trajectory, and then extract it from the video.

The advantage of extracting video abstract lies in that we don't need to enter the specific characteristics of the event like colour or shape, but extract all the event abstracts indistinguishably and then make them into a whole video. Thus, users can finish scanning several hours of surveillance video abstracts in one minute.

All the abstracts should be numbered, so users, while watching, can find the video abstract that interests them according to its number, and play the specific one to get more details.

After the video was extracted, all the video abstract information will be stored in a database in certain format. It would help users to find the video next time.

The precondition of video abstract extraction is to detect and track the moving objects. Figure 1 shows the flow chart of the video abstract extractions.

3 The realization of the video intelligent information processing system

This system will solve out the following problems:

1) It should be accurate when detecting and tracking the moving objects by frame difference method, which means the size of the detected object should not be bigger or smaller than the moving object itself. What's more, frame difference method is easily affected by overlapping moving object, that is, it might recognize two overlapping moving objects as one, affecting the accuracy of the extraction.

2) It will take up a lot of memory resources when handling multiple moving objects, which will lead to memory overflowing. This is the technical bottleneck of video abstracting technique, resulting from the large number of temporary images produced when integrating multiple moving objects. So we should improve integration algorithm, reduce memory usage as much as possible to avoid memory overflowing. Otherwise, the technology would fail.

3) Improving the recognition rate of the event. Owing to the open air condition, ray strength, reflection and shadow, the system's judgment of colour and shape of the target will deviate. For example, photographed objects will deviate in significant colour and shape because of the dark light or shadow, and the high-speed movement in the lens will also bring the deformation of the objects. So in these complex cases, the validated and false identifying rate are generally higher, and the colour, texture, motion characteristics that the lens used will be used in the final retrieval.

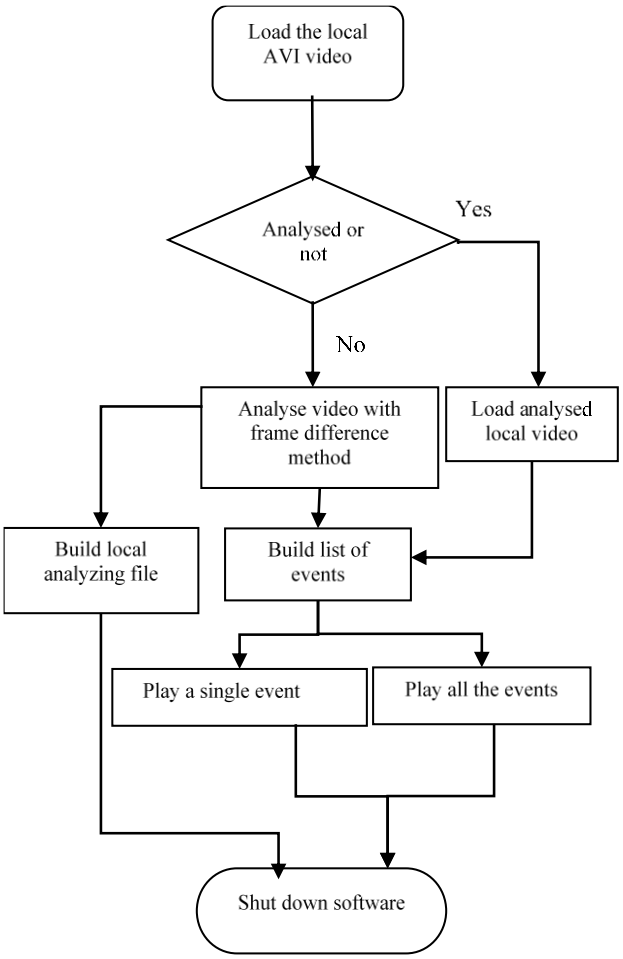


FIGURE 1 Flow chart of the system video abstract extraction

4) Improve the speed of video processing, so as to realize the flexibility and stability of a large amount of video. This is a technical bottleneck of a lot of current similar techniques, and the reason is that the way of video information search is mainly linear frame by frame matching.

This system solves the key algorithm of fireworks, banners, pornographic images identification, and sensitive information detection etc.

3.1 THE FIREWORKS RECOGNITION METHOD

Among domestic and foreign products, technology products for fire alarm based on video monitoring are very rare, and the products applied in production and life directly are scarcer. The relevant literature at home and abroad is mostly based on the method and principle of image processing and pattern recognition. And these designs are basically aimed at the outdoor forest fire. Now the main products include the 361 guardian of the forest, and the fire monitoring system in various tourist attractions and forests. The system's hardware requirements is demanding (some require the detection of infrared camera), but it is able to accurately locate the position of

the fire. And our products can return fire appearance in the video time in addition to identifying the fire alarm signal.

The recognition of fireworks is mainly based on the basic characteristics of smoke and flame image. Fire as a disaster refers to burning out of control. At the initial stage, its smoke and flame are unsteady. And at the different stages, the flame shape, area and the radiation intensity will change, and so will the smoke. These characteristics of fire flame and smoke can provide good references for the firework identification.

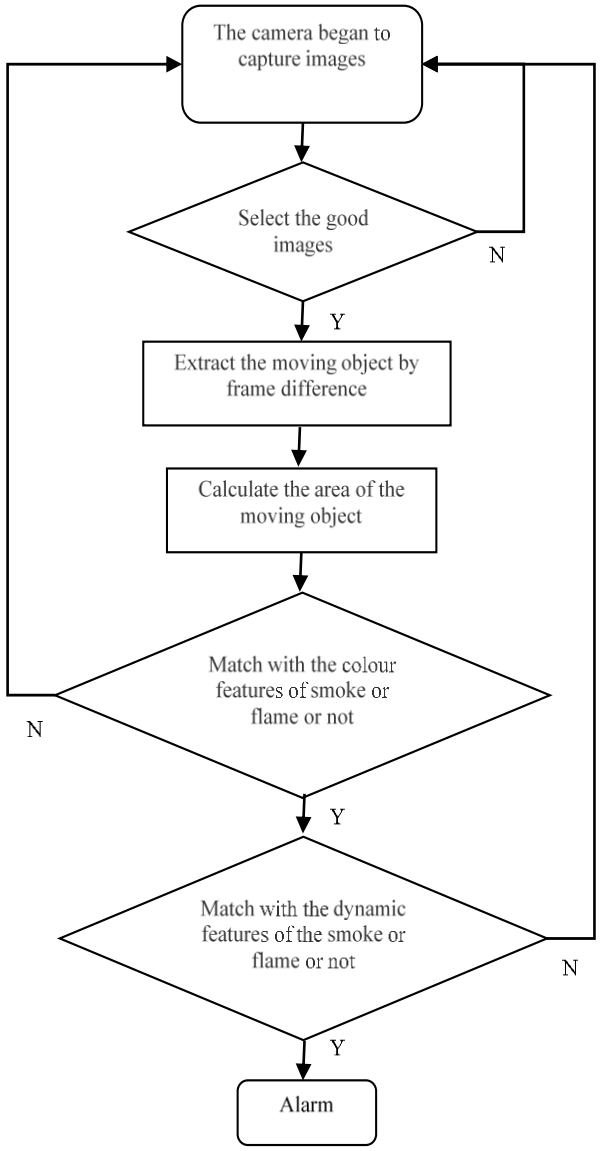


FIGURE 2 Flow chart of smoke and fire detection

The basic characteristics of smoke image are mainly manifested in the following aspects:

1) There has smoke or not. In the early detection, the smoke can be identified from video image.

2) Dynamics of the smoke. Dynamic smoke results from irregular diffusion. It consists of irregular shape and diffusion. We detect the smoke by putting the irregularity and diffusion together. The extracted smoke should be detected by its colour and then, we can judge whether it is irregular and diffuse. This can filter the false smoke area (it has the colour of smoke, but it is not smoke). Detection of dynamic characteristics will greatly improve the accuracy of alarm rate.

3) The smoke has its own change range in colour. The colour of smoke changes within a certain range, and we can judge whether it is smoke colour or not according to smoke range in the RGB colour space.

At the same time, the basic characteristics of flame image are mainly manifested as follows:

1) The changes of flame area. After a fire breaks out, the flame will enhance as the fire increases. Therefore, the flame image characteristics will have a continuously expanding tendency.

2) The changes of flame edges. The edge of flame is changeable. The changes of edge of fire flame are different from changes of stable flame edges of high-temperature objects as well as lights. You can distinguish fire by its changing flame edge. The jitter of the flame edge is the characteristics of fire flame. And edges of high-temperature objects, light and stable flame are more stable.

3) Characteristics of fire flames. The flame colour changes in a certain range, and we can judge whether it is the flame colour or not according to flame range in the RGB colour space.

Figure 2 is a flow chart of smoke and fire detection.

Fireworks recognition subsystem prototype interface is as shown in Figure 3.

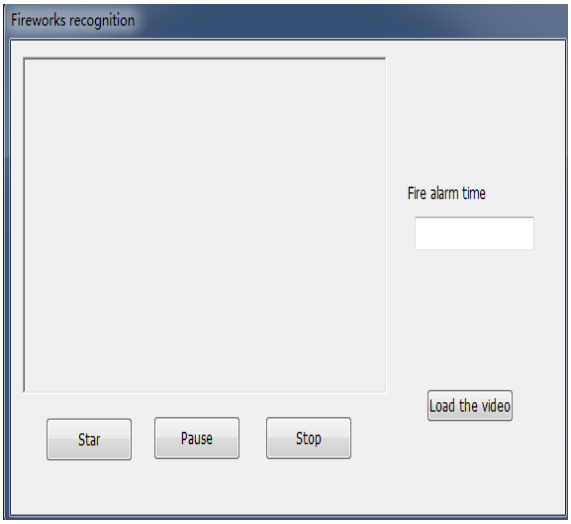


FIGURE 3 Fireworks recognition subsystem

3.2 THE BANNER RECOGNITION METHOD

Comparison between similar technological products at home and abroad:

There is no intelligent banner recognition technique around the world at present.

The method adopted by the project.

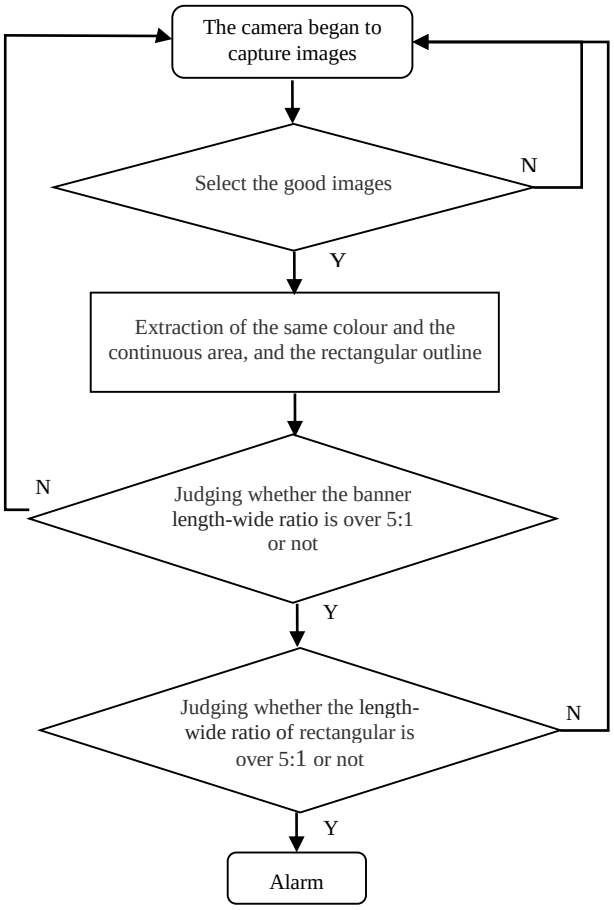


FIGURE 4 Flow chart of banner detection

The banner has the following characteristics:

1) The pure background (pure red, pure white, pure yellow, etc.). On the banner there are slogans or field, and we can extract the contour of entire banner according to its background colour.

2) The overall contour of the banner is a rectangular or similar rectangular outline, and its length-width ratio is disparate, which can be compared after the extraction of the rectangular profile banner. If the ratio surpasses 5: 1, it can be identified as a banner.

3) For a banner, only the background colour is pure, and the whole banner is not. Since the text on the banner has different colour, we can filter out some pseudo-banner (all pseudo-banners have the same colours).

3.3 THE WAY OF IDENTIFYING THE EROTIC IMAGES

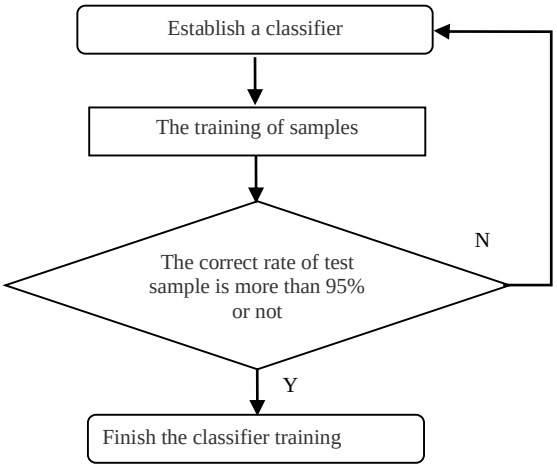
Comparison between similar products and technologies at home and abroad:

The results are shown in the Table 1. The letter 'a' represents the project products. The letter 'b' represents the Green Dam-youth Escort and the letter 'c' represents the Microsoft Photo DNA.

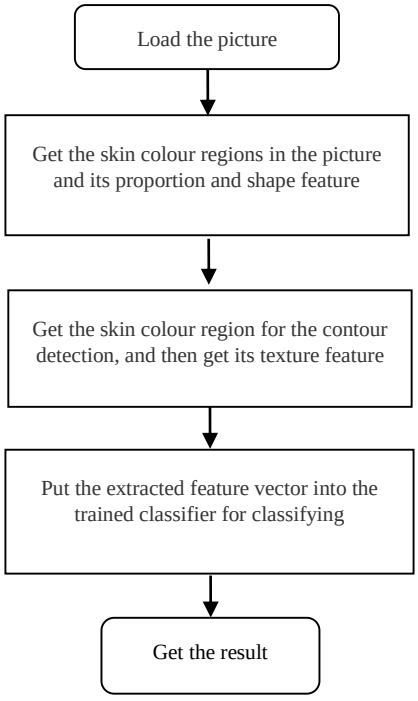
TABLE 1 The compare results of similar products.

Functional	**a**	**b**	**c**
Image recognition	Yes	Yes	Yes
Video recognition	Yes	Yes	No
New image recognition	Yes	Yes	No
Misjudgement rate	Lower	Moderate	Higher

The method adopted by the project.



a) Classifier training



b) Picture classifying

FIGURE 5 Flow chart of identifying the erotic images

The erotic images have the following characteristics:

1) As for the colour, in the erotic images, the area of exposed skin of human body will be very large, and we can identify the erotic images based on the percentage the human skin colour, its shape and so on;

2) The shape and the texture feature of human sensitive areas. To judge whether an image is an erotic image or not,

the key is to see whether the human sensitive areas are exposed or not. On the basis of detection of skin, we can go a step further to identify an erotic image by detecting contour of this areas and capturing the texture feature.

We can use the SVM classifier to identify the erotic images. First, extract enough samples of colour, shape, texture features, and then repeated extracting these samples to draw a reasonable SVM classifier. After that, use the trained classifier to classify the other pictures, separating erotic pictures from the normal picture.

Figure 5 is a flow chart of erotic image recognition.

3.4 THE METHOD OF DETECTING THE SENSITIVE INFORMATION

Compare the present similar technological products at home and abroad:

The products of science and technology: the technology of searching video content is rare, and it is rarer to use it directly in production and life products (Picasa has some, but they are mainly empirical), and they search mainly by the image (Google image search) and text (Google and Baidu).

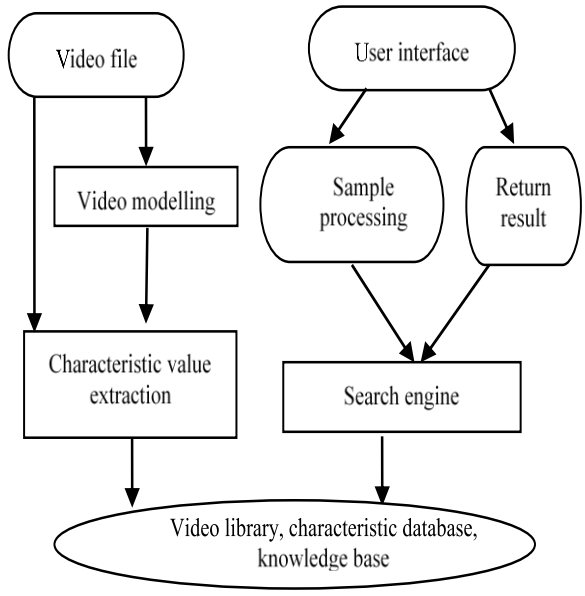


FIGURE 6 Flow chart of processing the video information

Patent technology: they are mostly realized by the image processing and key frame-based searching. A large number of frames of video search will encounter serious time bottleneck, and also have certain requirements of image quality; the content of the search video is coarse, because it is difficult to meet the requirement of many fine granular video content, and all the information of the image is not used well.

The requirements and implementation of performance and function:

Function:

Analysis and management of intelligent and sensitive information;

Search fine grained and massive video;

Edit suspicious videos;

Process a lot of non real-time information;

The advantage and disadvantage of performance:

The stability of the system;

The development of the system;

The processing speed of the system;

Method adopted by the project:

Aimed to solve the key technical problems mentioned above, this module is expected to adopt the following technical route:

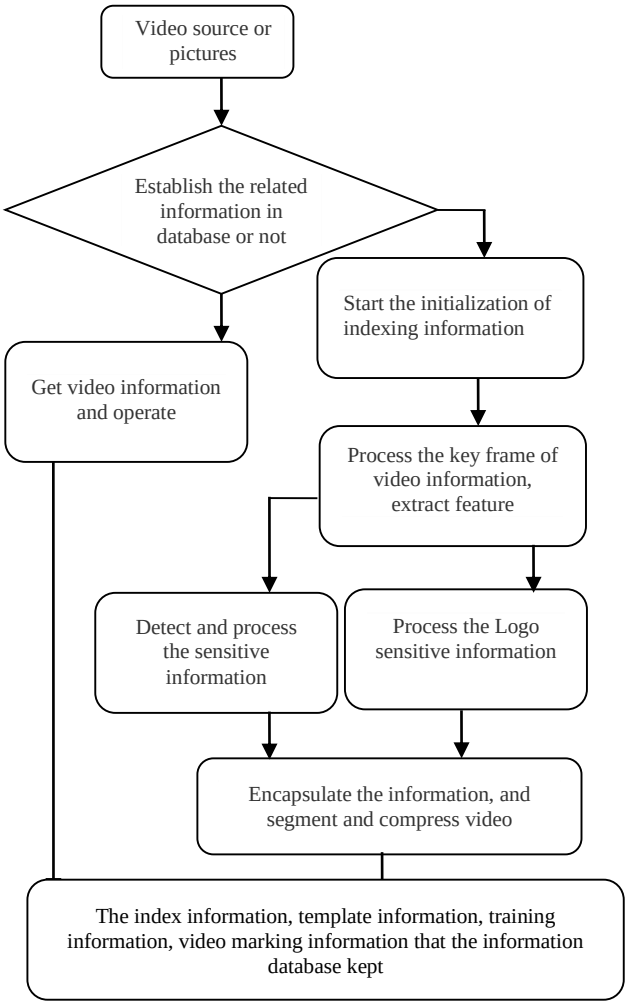


FIGURE 7 Video information analyses and processing

1) Establish the overall structure, namely, store the classified information, input the information, store the information template and sensitive information associated video information etc. Use database (MySQL /SQLserver) to save the data permanently.

2) While detecting the logo carrying sensitive information, we need to process, store the template logo and build its index firstly. So whether in video processing stage or searching a target from videos, it all needs some processing, such as extracting the histogram of colour,

computing its moment, getting the template contours and some other image features.

3) The data flow chart of video processing is showed in Figure 7. First of all, a large number of videos or photos taken by camera will be put into the system, or direct contact with external video source will be established, and the related information will be stored in the database. The system will analyze videos through the fine-grained decomposition software that the system writes, and extract the traffic characteristic value of the content of the video through the Open CV image processing library. Then it will create a copy of the multimedia, and segment and compress the copy of the multimedia according to the extracted features. The operation will improve the search speed. At the same time, the machine will store, classify, preserve and manage the original multimedia and processed multimedia and build their indexes according to certain rules. When the users submit search requests, they can access the information through the saved information database.

The above is part of the operation of logo in order to obtain the characteristics of the logo or the original image, and then perform some operation treatment.

UI renderings

You can add the new sensitive information by yourself.

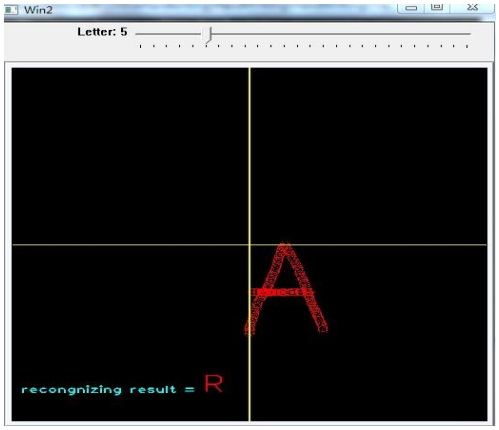


FIGURE 8 Chart of adding new sensitive information manually

Part of program interface as shown in Figure 9.

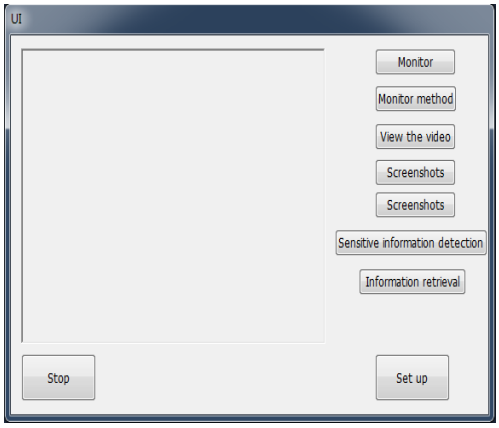


FIGURE 9 UI program interface diagram

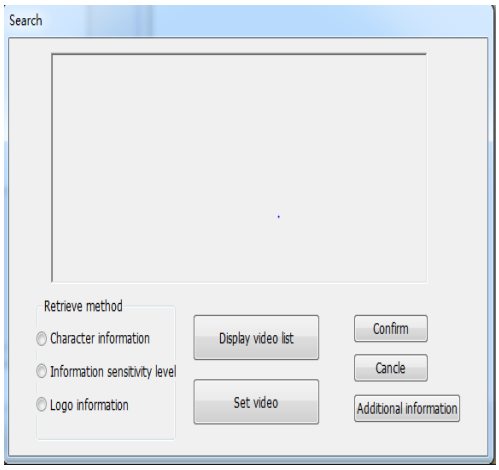


FIGURE 10 The search interface

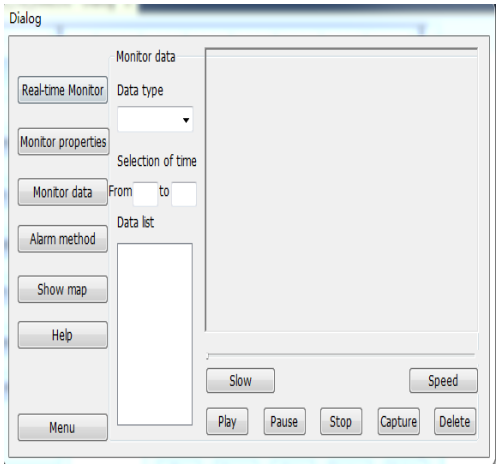


FIGURE 11 The monitoring data interface diagram

4 Conclusion

This study proposes the adaptive intelligent information processing system which can be used to solve the problems in time and manpower consuming monitoring. The method extracts the video abstracts from the original monitoring videos and analyzes each of the video abstract events. Users can get their interested video abstract events within a short period of time. The realization of the system can be used for fireworks recognition, banners recognition, pornographic images recognition, sensitive information retrieval and so on.

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References

[1] Kia S M, Rahmani H, Mortezaei R, et al. 2014 A Novel Scheme for Intelligent Recognition of Pornographic Images *arXiv preprint arXiv:1402.5792*
[2] Wang W Z, Liu B H 2014 An Intelligent Recognition Algorithm on Traffic Safety States *Applied Mechanics and Materials* 433 1388-91
[3] Li Y 2001 An Over View of Video Abstraction Techniques. Image Systems Laboratory *HP Laboratory Palo Alto*, *HPL-2001* 191.
[4] OuY J, Li J, Zhang Y 3006 Survey on video abstraction technolgy *Computer Engineering* **30**(10) 7-9
[5] Wang C, Liu G, Lao S, et al 2005 Eventoriented Film Abstract *Journal of Image and Graphics* **10**(5) 642-9
[6] Liu G, Li J, Xiao P, et al 2005 Video summarization based on the "Entities-Description-Utilities" Model *Computer Engineering & Science* **27**(10) 31-4
[7] Guo W, Guo B 2009 Design and realization of video processing system based on DM642 *Electronic Design Engineering* **17**(1) 79-81

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