VIRTUAL REALITY VIDEO IMAGE BASED FIRE DETECTION RECOGNITION SYSTEM

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***Abstract*: Fire detection technology based on video images can avoid many flaws in conventional methods and detect fires. To achieve this, the support vector machine (SVM) method in machine learning theory has unique advantages, while rough set (RS) theory and SVM complement each other in application. Thus, a new classifier could be created by organically combining these methods to identify fires and provide fire warnings, yielding excellent noise suppression and promotion. Therefore, in this study, an RS is used as the front-end system for the SVM method, yielding improved performance than only SVM. Recognition time is reduced, and recognition efficiency is improved. Experiments show that the RS-SVM classifier model based on parameter optimization proposed in this paper mitigates deficiencies in overfitting and determining local extremum with excellent reliability and stability, and enhances the forecast accuracy of fires.**

***Keywords*: SVM algorithm, Machine learning**

INTRODUCTION

Accidental fire is a natural disaster that seriously threatens public safety. In recent years, accidental fire has frequently occurred in many places, including superstores, communities and forests, yielding huge losses to production and human life. After several decades of development, virtual reality technology has matured quickly and has changed people's lifestyles by being widely applied in many fields [1]. For example, VR technology has been used to manage accidental fire in industry, agriculture, hospitals, aviation, aerospace, and firefighting.

Thus, virtual fire environment technology has become integral to future fire protection. Due to their detection principles or system structures, traditional fire detectors, which include temperature detectors, smog detectors and optical detectors, usually have inherent defects or application restrictions. Because flames and smog have specific colors, textures, shapes and other image features, people have begun to consider using computer visual features to improve the efficiency of fire detection (e.g., video flame detection technology based on image processing). In most

The associate editor coordinating the review of this manuscript and approving it for publication was Zhihan Lv. fire scenes, flames and smog exist [2], [3]. Fire detection technology based on video images recognizes flames or smog in video images and then implements real time monitoring of fire scenes. This noncontact technique requires a computer to process imagery and discriminates suspicious targets that appear in the video images by studying and extracting visual features of flames or smog [4]. A support vector machine that uses the principle of structural risk minimization can solve problems that have a small sample, a high dimensionality, and a local extremum perfectly while avoiding over fitting, over dimensionality and other problems of conventional neural networks. SVM is an effective tool for classification and recognition. Many successful applications in classification, recognition, and regression prediction are based on SVM [5], [6]. To enhance the reliability and stability of a fire detection system, SVM has been studied and developed for the field of fire detection.

SVM is built upon statistical learning theory and has a strong learning ability, adaptability, and a high classification accuracy [7]. Rough set theory approximately describes uncertain and inaccurate knowledge compared to known knowledge within a database, works well in processing large amounts of data, and removes redundant information. Therefore, this study investigates an image processing technology that uses both SVM and RS, and develops a fire flame image recognition method based on the RS-SVM classifier model.

1 Literature Survey

1. T. Celik and Hasan Demirel et al. further enhance system that uses a statistical color model with Fuzzy logic for fire pixel classification. The proposed system develop two models; one based on luminance and second based on chrominance.

Fuzzy logic uses the YCbCr color space for the separation of luminance from chrominance instead of using color spaces such as RGB.

Existing historic rules are replaced with the Fuzzy logic to make the classification more robust and effective. This model achieves up to 99.00% correct fire detection rate with a 9.50% false alarm rate.

2. R. Gonzalez-Gonzalez et al. proposed a method to detect fire by smoke detection based on wavelet.

In this smoke detection method, image processing on video signals is proposed. The SWT transform is used for the area detection of ROI's. This method comprises of three steps.

In the first step, preprocessing is performed and the image is resized and transformed to grayscale image. Finally indexed the image using indexation.

The second step involves high frequencies of an image is eliminated using SWT and reconstruct the image by inverse SWT. In order to group the intensity colors that are closed to each other is the main purpose of image indexation.

Histogram analysis is used to determine the indexation levels. After that compare the image with a non-smoke frame and selecting those pixels that are change from one scene to another.

The final stage consists of smoke verification algorithm in order to determine whether ROI is increasing its area and to reduce the generation of false alarm. These three steps are combined together to form the final result.

2 Problem Statement

Fire detection technology based on video images can avoid many flaws in conventional methods and detect fires. To achieve this, the support vector machine (SVM) method in machine learning.

3 Existing System

The main part of previous system is the flow that will be used to estimate the amount of motion undergone by an object while moving from one frame to another.

4 Proposed System

In this proposed system we are analyzing characteristics parameters of fire i.e color, area, motion, smoke individually, all the parameters are examined simultaneously to reduce the false alarm rates which was present in a previous detection systems.

System Architecture

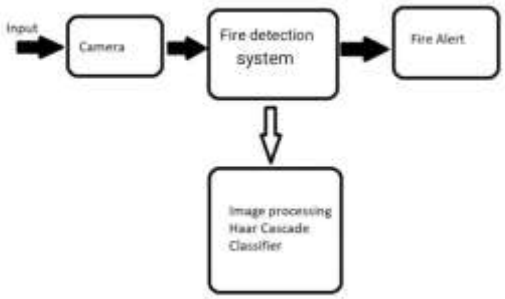

Fig. System Design

5 System Requirements

1 Hardware Requirements

1) 4 GB RAM
2) 120 GB Hard Disk
3) Camera
4) Dual core

2 Software Requirements

1) Web browser
2) Xamp server
3) Visual Studio Code
4) Operating System: Windows 10.

6 Advantages and Limitations

Advantages

1) Decrease risk of fire damage.
2) Detecting potential fires early
3) More robust to fast expanding flames with dynamic colors

Limitations

1) Need of sufficient and specific conditions
2) Variability of Shape, Motion, Colors and Patterns of fire and smoke
3) Less accuracy visual information
4) It is possible for a false detection if only color characteristics have been used.

Conclusion

With the recent rapid development of computer graphics and hardware, VR technology has entered a relatively mature application state and has been widely applied in fire detection. Image-type fire flame recognition methods are unconventional for early fire flame recognition. This study has investigated image-type fire flame recognition using a support vector machine and rough set theory. In practical applications, the RS method is sensitive to noise and poor in fault tolerance and generalization, while SVM has strong anti-noise capability and generalization performance. This paper has presented an RS-SVM fire flame recognition algorithm and designed a classifier of fire flame image recognition. By building a model with SVM, the parameters of which have been optimized, this study used more feature variables as criteria, represented the static and dynamic features of flames, selected and extracted the most effective feature subsets, fused the features of fire flame images extracted, and reduced required training to recognize and extract flame regions. The experimental results show that the proposed fire flame recognition strategy yields a high recognition rate, a fast recognition speed, excellent robustness, and a wide range of application.

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