Smoke detection for outdoor environment based on image processing

Giao N Pham

Department of Computing Fundamentals, FPT University, Hanoi, Vietnam

Corresponding Author: **Giao N Pham**

Abstract

At this point, the conventional smoke detection often requires many smoke sensors but they have weakness in wide coverage area and low response time. In order to overcome these shortcomings, this paper presents a method based on image processing techniques, capable to detect the smoke from video taken from camera. The proposed detection method consists of the following steps: slow motion detection, smoke color detection, inverse edge detection, AND operator and then classification phase. This will provide early warnings such as fire, thus reducing economic losses and casualties. In addition, it will help to improve the rate of smoke detection, as well as reducing the false detection rate of other suspected object.

Keywords: smoke detection, moving region detection, smoke features

1. Introduction

Fire smoke accidents frequently put in danger our life at the same time causing economic and ecological damages and the scarcity of automatic fire detection systems continues to be a problem that really needs a serious attention to save human lives by preventing injuries and/or deaths. To avoid the smoke disasters, many early smoke detection techniques have been explored and most of them are based on particle sampling, temperature sampling, relative humidity sampling, and air transparency testing, in addition to the traditional ultraviolet and smoke sensors [1]. Thus, they are not always reliable because energy emission of non-smokes or by products of combustion, which can be yielded in other ways, may be detected by misadventure. This usually results in false alarms. To provide more reliable information about fires, stereo vision based approach is becoming more and more helpful. The newest innovations are continuing to use cameras and computer algorithms to analyze the visible effects of smoke and its motion in their applications [2]. As their approaches present some drawbacks when working in spatial domain, the main difficulty is still to identify objects if they do not occur at the expected position. In this paper, we propose the new algorithm for early smoke detection for outdoor environment such as forest or street based on smoke features slow motion, growth and color information [3].

The block diagram of proposed algorithm is described as figure 1. The input data is sequence frame. These frames are used to detect slow motion, inverse edge and smoke candidate regions as figure 1. Output of blocks are binary images, and continuously they are performed by AND operator to find remain regions of AND operation. Finally, we remove noise by median filtering and verify detected regions to detect smoke objects.

2. Experimental results

We implement the proposed algorithm by using Visual Studio C++ and image processing library Open CV 2.4.9. We used smoke video with outdoor environment street and foresr [4-5] as input to experiment our system and evaluate accuracy. Experimental results show by figure 2, and accuracy get to over 90%.
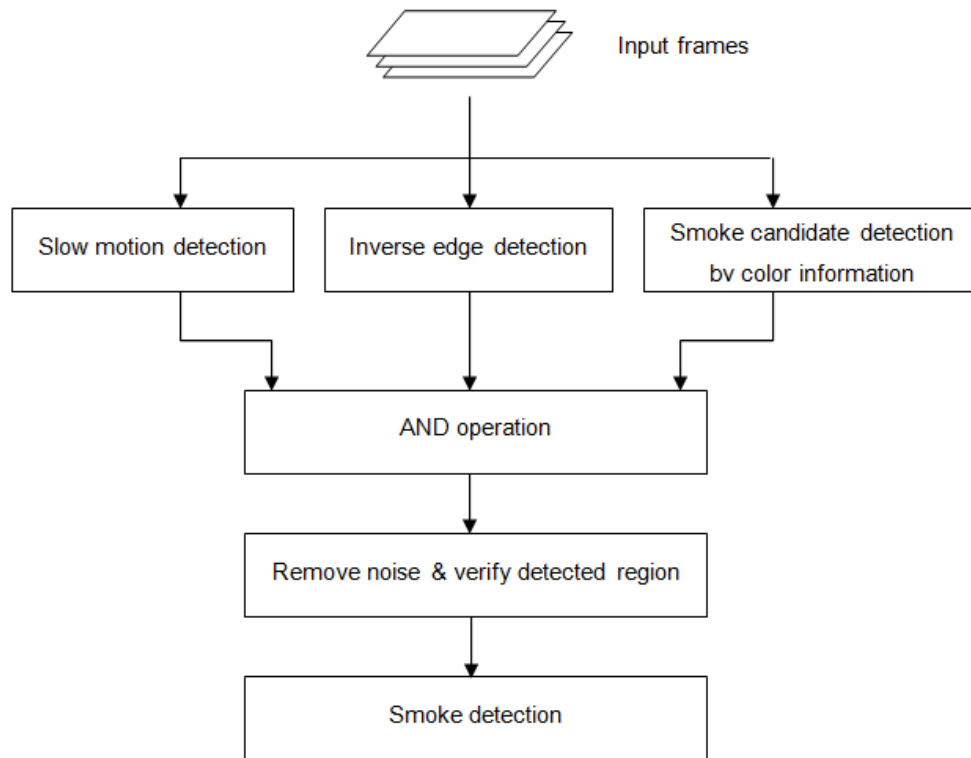
3. Design the proposed algorithm

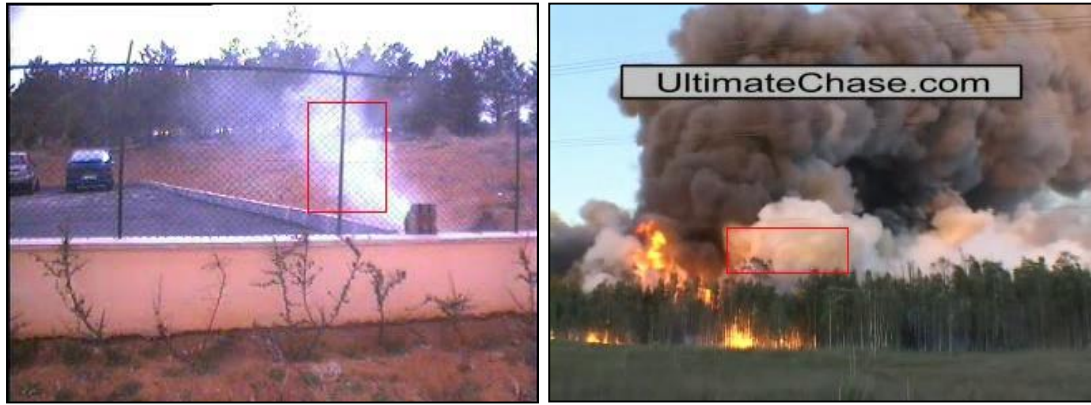**Fig 1:** The block diagram of proposed algorithm

(a)

(b)

(c)

(d)

Fig 2: Experimental results; (a) smoke occurs on street and have person, (b) smoke occur at outside, (c) and (d) smoke occurs at forest

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