

Abstract

Fire monitoring and detection system is very important for a warning system to protect the loss of human life and properties. Normally, fire disaster is observed where there is no fire detection system, or there is no fire alert information at the early stage of fire. Smoke is a good indicator of fire especially at an early stage. There are various techniques that can be applied for fire monitoring and detection system such as using fire tower which can be monitored by human; using smoke or heat sensors; using heat sensor camera or even a satellite camera to monitor a wide area ; or using a CCTV or video camera with image processing techniques.

This research studies various image processing techniques for smoke and fire detection. Moreover, the research focus on the early fire stage detection or smoke monitoring and detection system according to the studied environment which is a mountain area. Detecting the smoke from a video recorded file in an open environment is quite difficult and challenging due to there are many unknown factors. It is even more difficult to create a system that can automatically detect smoke image without an error. There are many image processing approaches attempts to detect fire or smoke by using heuristic fixed threshold values or statistical values of the images. The statistical values were proved to get a better detection results and had less effect by non-fire or non-smoke variable than a fixed threshold method.

In this research, a new method for an early wildfire or smoke detection on video sequences is presented. The research applies region active contour based with Gaussian mixture model to detect the boundary of the smoke. Besides, the statistical values of the smoke region intensities and the foreground and background Probability Density Function (PDFs) are used. The smoke image can be automatically detected, and the detection results can be observed with no false positive error detection. The method has less error than combination method of background subtraction, color space evaluation or a fixed threshold value. Furthermore, the smoke boundary can be automatically detected especially when the smoke region is rapidly changed. However, future research work needs to be done on the steady spreading smoke region that could not be detected efficiently and to improve the efficiency of the fire or smoke detection in other detection environments.