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INDEPENDENT COMPONENT ANALYSIS BASED FOREGROUND DETECTION FOR INDOOR SURVEILLANCE

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In video surveillance, detection of the moving objects from an image sequence is very important for the success of object tracking, activity recognition, and behavior understanding. Foreground detection (also known as background subtraction) is one of the major tasks in the field of Computer Vision of which the aim is to detect changes in image sequences. Many applications do not need to know everything about the evolution of movement in a video sequence, but only require the information of changes in the scene. There exists a set of techniques that typically analyze the video sequences recorded with a stationary camera. Most background subtraction methods adopt the strategy of updating background model to overcome the environmental changes, such as illumination variations. However, these kinds of methods are always computationally expensive.

In this paper, we propose a simple but powerful adaptive approach for foreground detection using Independent Component Analysis (ICA) based on Kurtosis. The foreground detection technique that we propose, particularly aims at indoor surveillance for possible applications in home-care and health-care monitoring, where moving and motionless persons must be reliably detected. Since it is already established that the spatial ICA (sICA) reliably estimates the spatial difference between the frames of a video, here we have used that famous sICA technique for foreground detection where the adaptation is performed based on the Kurtosis and its gradient. If we consider a frame of a video, it can be modeled as a linear combination of the background and the foreground assuming that they are independent. For two adjacent frames, background and foreground of each frame can be considered as identical provided that the back ground is stationary and the object is moving slowly or motionless. By un-wrapping the intensities of each pixel of an image into a row vector, whole image becomes a sensor measurement. Thus two adjacent image frames provide two sensor measurements which can be taken as a two dimensional mixture required for ICA. Now the detection of foreground means just running the ICA algorithm for each and every adjacent video frames. This simple concept reliably estimates the foreground of a spatial dynamic image sequence. The viability of the proposed method is verified through a manually generated spatial dynamic image sequence and some recorded video sequences under various background conditions.