ABSTRACT:

This project deals with a simple technique for motion detection in image sequences captured with a stationary camera where most of the pixels belong to a stationary background and relatively small moving objects pass in front of the camera. The intensity values observed at a pixel over time is a constant or slowly varying signal, except when a moving object begins to pass through that pixel, in which case the intensity of the background is replaced by the intensity of the foreground object. Thus, we can detect a moving object by looking at large gradients in the temporal evolution of the pixel values.

DESCRIPTION OF ALGORITHMS

The basic concept of motion detection algorithm is based on background change detection. In this project, the intensity values are observed at a pixel over time, the temporal change detection discerns between moving and stationary objects by comparing set of images. The temporal change detection is carried out in three steps.

1. Read in a sequence of image frames and make them grayscale.
2. The difference in frames (derivative) is computed as enough frames are available. A 1-D differential operator is applied at each pixel to compute a temporal derivative.
3. The temporal change region is identified by comparing frame difference with a threshold. The reason behind thresholding is to calculate the absolute values of the derivatives to create a 0 and 1 mask of the moving objects.

EXPERIMENTS

1. A 1-D differential operator is applied to compute a temporal derivative. For the temporal derivative filter a simple 0.5[-1, 0, 1] filter and a 1D derivative of a Gaussian with a user defined standard deviation sigma is used. The results are compared by applying Gaussian filters with different values of sigma.
2. Secondly, 2D spatial smoothing filter is applied to the frames before applying the temporal derivative filter. For the spatial smoothing 3x3, 5x5 box filters and 2D Gaussian filters with a user defined standard deviation sigma are used.
3. A strategy to select a good threshold for each image is designed. The threshold is varied to get different masks and then compared.

Sample videos EnterExitCrossingPaths2cor, RedChair and Office are used.

VALUES OF PARAMETERS USED

For the temporal derivative filter a simple 0.5[-1, 0, 1] is used. A 1D derivative of Gaussian Kernel is calculated by first calculating the Gaussian kernel with filter size as ceil(5\*(sigma)) and then calculating its gradient. The different values of sigma used are 1, 1.4, 2 and 4.

**Threshold calculation:**

The thresholds for the change detection are proportional to the noise present in the difference images.

Most pixels belonging to the background change little and thus their temporal gradients are close to zero. The noise is modelled by a normal distribution N(0, σ2) with zero mean and described by the standard deviation σ.