ALGORITHMS AND METHODS FOR MOTION DETECTION

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The aim of this work is to develop multimedia framework to provide motion detection in continuous video stream, object recognizing and calculating their kinematic properties. Also its practical using is determined.

Introduction

Most of algorithms for motion detection in a continuous video stream are based on comparing of the current video frame with one from the previous frames or with something that is called background. Most cameras produce a noisy image, so motion will be detected in such places, where there is no motion at all. To remove random noisy pixels, we can use a Noise filter, which is default to DirectShow .NET.

Main principles and methods

Let us describe the algorithms, methods and the main principles. Most cameras produce a noisy image, so motion will be detected in such places, where there is no motion at 269 all. Assume that we have an original 24 bpp RGB image called current frame (image), a grayscale copy of it (currentFrame) and previous video frame also gray scaled (backgroundFrame).

Let's find the regions where these two frames are differing a bit. For the purpose we can use Difference filter. The purpose of this filter is to find out the value how much the selected pixel differs from other with same cords, but on the second picture. It is determined by formula

$D = P1_{x,y} – P2_{x,y}$,

Where

$P1_{x,y}$ - color vector of the pixel with coordinate (x,y) at the first picture;

$P2_{x,y}$ - color vector of the pixel with coordinate (x,y) at the second picture.

Each algorithm calculates a binary image containing difference between current frame and the background one. So, the only what is need is to just calculate the amount of white pixels on this difference image.

2. Simple Detector

This simply compares the current frame with the previous one, finding the difference between them.

Disadvantages:

- If the object is moving smoothly we'll receive small changes from frame to frame.

So, it's impossible to get the whole moving object.

- When the object is moving so slowly, the algorithm will not give any result at all.

2. Detector with background – algorithm 1

Based on comparing the current frame not with the previous one but with the first frame in the video sequence. Let's assume that we have an original 24 bpp RGB image called current frame (image), a grayscale copy of it (currentFrame) and a background frame also gray scaled (backgroundFrame). At the beginning, the first frame of the video sequence as the background frame is taken. And then it is always compared with the current.

Advantages:

- if there were no objects in the initial frame, comparison of the current frame with

the first one will give us the whole moving object independently of its motion speed

Disadvantages:

- if there were some object on the first frame and then it is gone, the algorithm we'll

always have motion detected on the place, where the object placed

3. Detector with background – algorithm 2

Based on idea of the previous detector, it moves background image towards current frame by one level per number of frames. Simply, it automatically adoptee background for the new frame, which is optionally determined.

```
len = Width * Height;
for (int i = 0; i < len; i++)
{
    int t = currentFrame[i] - backgroundFrame[i];
    if (t > 0)
        backgroundFrame[i]++;
    else if (t < 0)
        backgroundFrame[i]--;

}
```

Disadvantages:

- not perfect edges of the moving object

4. Detector for group of objects

This algorithm is more efficient in case when we have more than one moving object, its form doesn't matter, and if their count, position, width and height, velocity vector are needed Using Blob Counter method, developed by Andre LaMotte, after the difference was calculated, it is possible to get the number of objects, their position and the dimension on a binary image.

Practical achievement

Application was developed in C# under .NET Framework with using of DirectShow .NET (Part of the Managed DirectX). Application provides Click Once service, so continuous video stream input could be taken not only from local device on the current machine, but from internet too. The spheres of approaches are very wide:

- Security systems and improving of the existing security systems
- monitor a driveway and traffic
- compressing traffic in applications which use camera and internet
- monitor a parking area
- monitor a warehouse
- capture lightning during a thunderstorm
- monitor a place where wild animals might appear
- Smart games which give more freedom and fun

Conclusion

In Multimedia applications which works with video and sound (like Adobe Audition, Synopsis Wwise and etc.) to improve control and operations which provides the applications more simple. So it gives more time and possibilities for the creative process, but not on its realization

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