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IASET

DEVELOPMENT OF MOTION DETECTION ALGORITHMS FOR USE WITH IP CAMERA SYSTEMS

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ABSTRACT

The time detection of moving objects is a very important area for many applications in security cameras. A motion detection algorithm for use as IP camera network it needs to work for detecting the displacement measurement and analysing images to improve the motion by identifying how many image pixels move between adjacent images to obtain a successful motion detection in the presence of camera motion or background changing. Digital image correlation applied to recorded images containing measurement data is used to analyse the digital image and extract this data echanising the whole process for application in this sector.

KEYWORDS: Digital Image Correlation Applied, Send Images and Video in Two Ways Communication Easily, Computer Vision

INTRODUCTION

The last decade has seen a shift in the way that large camera networks, such as those used for security, acquire and process images. The cameras have become digital and the data is transferred between the cameras and a central hub using internet protocols,

IP Network Cameras are designed to work in a Local Area over the Interne that allow for motoring local to the computer network to which the cameras are attached to. With additional configuration of your computer network you have the ability to be monitored not only locally but remotely from any location as well having the ability to send images and video in two ways communication easily [1, 2].

Moreover, digital video can allow to progressive scanning and better quality images extracted especially for moving targets. However the time detection of moving objects is very important area for video surveillance still in its early development stage which needs to improve its weakness. Several techniques for moving object detection have been proposed [7,8].

There are two approaches temporal differencing and optical flow, one temporal differencing is used to detect motion areas for the optical flow calculation to achieve real-time and accurate object motion detection and optical flow is an approximation of the local image motion and specifies how much each image pixel moves between adjacent images to obtain successful of motion detection in the presence of camera motion or background changing [3,5].

The first problem for moving object detection involves foreground-background separation by subtracting the background from each frame of the video sequence. This difference shows the moving objects for example a moving man or a moving car in the scene and is known as foreground detection. Secondly, the problem complexity in extracting the moving objects in a dynamic scene, however, increases with the increasing presence of motion due to various other phenomena such as a change in illumination, variation of sunlight as the day progresses, change of appearance of colour due to white or colour in the colour of digital camera itself, change of pixel value which create false motions in the dynamic scene [7].

This project will investigate a motion detection algorithm suitable for use on an IP camera network will be developed and tested using webcam that installed together with a digital video recorder DVR or a network video Recorder (NVR) to form a video surveillance system

MOTION DETECTION ALGORITHM

There are several algorithms of motion detection describe the motion in a successive image. One approach that detects the motion is called temporal differencing based on frame difference, which attempts to detect moving regions by using the difference of two or three frames pixel by pixel in an image sequence to remove moving positions, the principle of this method used a model of the background and compare the current image with a reference. In this way the foreground objects present in the scene are detected. This way is adaptive to dynamic location however generating holes inside the moving objects [8,9].

Other, optical detection method for calculation two image frames which are taken at interval *t* at every pixel position by transforming one image into the next image in sequence. Approximating this method is useful in array recognition, computer vision, and other image processing applications [14, 15].

DIGITAL IMAGE CORRELATION

Digital image correlation refers to the class of non-contacting methods that acquire images of an object, store images in digital form and perform image analysis to extract full-field shape, deformation and/or motion measurements. Digital image included lines, grids, dots and random arrays. One of the most approaches employs random patterns and compares sub-regions throughout the image to obtain a full-field of measurements.

The first wok of image correlation became available in the 1960s-1970s and began to develop vision-based algorithms in the research with the applications for microscopy, medicine and radiology, photogrammetry, and character recognition for the shape deformation measurements such as laser speckle and holograph interfereometry [18, 19 and 20].

THE METHODS OF DIGITAL IMAGE CORRELATION

The methods of digital image correlation analysis have been an active area of researches and development with different applications for image processing methods in digital imaging technology:

- Methods for digitally recording images containing measurement data.
- Algorithms to analyze the digital images and extract the measurement data.
- Approaches for programing all process.

In many cases, the characteristic design used to compare subsets and extract full-field information was obtained by either coherent light illumination or through application of a high contrast pattern with incoherent illumination, resulting in a full-field, random pattern, or white light speckle pattern. There are three methods of image digital correlation:

- Two-Dimensional Measurements.
- Three-Dimensional Digital Image Correlation Measurement.
- Volumetric Digital Image Correlation (VDICs).

PROPOSED PROJECT AND RELATED WORK

A series of experiments applied in the late 1980s- 1990s for this method to quantify deformation measurements correlation application in 2D digital image correlation for scanning tunneling microscopy [22,23] & [24,25]. Other researchers have presented modifications to various aspects of the 2D-DIC combined analytical models with 2D-DIC measurements for high magnification [26, 27]. In this work we use the first methods of image digital correlation with two dimensional measurements This approach refers to the comparison of the digital images for various small regions known as subsets throughout the images before and after deformation, locating the positions of each of these subsets after deformation through digital image analysis today known as 2D Digital Image Correlation used optically recorded images to perform motion measurements using algorithms to demonstrate planar translation and rotations through 2D image matching [21]. This way can modify the images by applied motion detection algorithm through 2D data measurement for obtaining high resolution and accuracy in digital image application for use with IP camera system. The research approach of experimental investigation of different images as well as analysis of the investigation carried out give an insight view of the behavior of spatial resolution and accuracy schemes and their performance in digital imaging technology to develop methods and applied this algorithm as driver for digitally recording images containing measurement data and extract the requirements data for programming all process in this sector.

DATA MEASUREMENT AND RESULTS

Digital image processing deals with digital image that consists of matrix of pixels representing intensities of various positions for example, images produced by a video camera. The image has been digitized; it can operate upon by various image processing operations to develop the data for automatic images perception. The extraction of image into subset with the 2D-DIC measurement combined analytical model for high accuracy of the matching process, resulting in image for both the x and y directions operate to obtain useful information from the image. Firstly, starting with the input image is tested at each pixel position such as *t0 and t1*.The fast Fourier transform (FFT) which first published in 1965 by J.W. Cooley**[28],** is a fast DFT calculation technique. The basic algorithm, many versions of which can found, calculates a number of points N, equal to a power of 2, and the time saved compared with a direct calculation is : Gain = N / log2(N)

For N = 1,024, the fast Fourier transformer(FFT) is about 100 times faster than the direct calculation based on the definition of the discrete Fourier transformer (DFT). The correlation in mathematical analysis shows that the result of Fourier transform of *t0, t1 ar*e multiplied in frequency domain point by point and then transform this product into spatial domain via the inverse of Fourier transform.

As a result the cross correlation can be measured during the detection process shows in figure 1, by using 2D-Fast Fourier Transformer which determined three situation for normalized cross- correlation, the first condition indicated image is in good identical condition :ncc=1

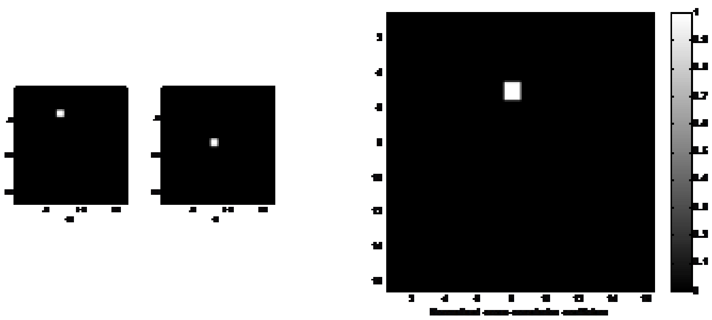

Figure 1: Normalized Cross-Correlation of Sub-im

The extraction of the image into subset as result each one has size of (m×n) which represented the extraction in the x- direction and y- direction of the image which can be tested and has the same size of data t0,t1 could be represented as $m \times n$ matrix. Then the output image be can calculated and analyzing in order to measure x displacement, y displacement and Normalized Cross Correlation (NCC).

The automatic perception is achieved by a number of steps. The initial step is divided the image into subimage region. The input image should be multiplied in the frequency domain. Therefore, a number of complex computation steps should be added. When analyzing a region in an image it is dynamic that distinguishes between the object of the original and shift image, resulting is indicated in Figure 2, the measurement of the maximum values of x-displacement, y-displacement and NCC as shown in figures 3 and 4. In figure 3 a areas of the image that were affected by changes as those caused by the movement of objects can be identified by low cross correlation values (in blue), in the proposed example the whole picture has been shifted with the result that the areas with a higher cross correlation (i.e. more similar) are those occupied by subjects occupying a space bigger than the length of the shift since they are less affected by the shift.

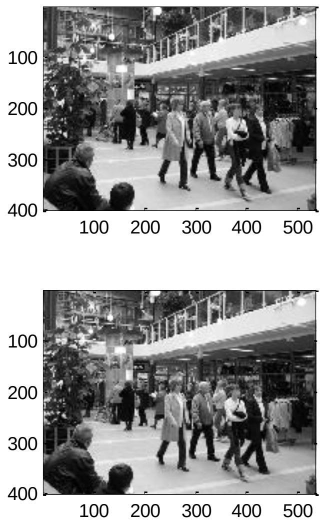

Figure 2: Original Test Image

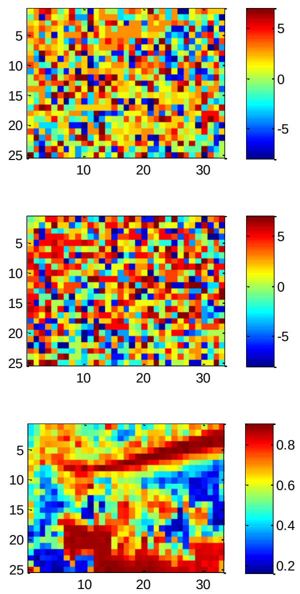

Figure 3: Shift in the x and y Directions and Normalized Cross Correlation for Each Sub Image

Figure 3 shows the displacement vectors in the x and y directions for each pixel obtained after applying the Normalized Cross Correlation algorithm.

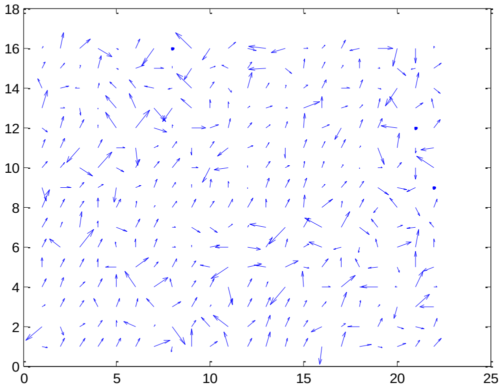

Figure 4: Figure Quiver (MAXX, MAXY)

The important part in this work of research we will show how to measure the accuracy of the displacement measurement. The observed signal will be analyzed with the FFT for evaluating different images such as "plain" and "detailed". The observation of the graphs including noise shows that the accuracy depends on the difference between plain images with the desired signal-to-noise ratio as shown in figures 4 and 5 that the input image is characterised by fine detail the accuracy is more affected by noise because there are less oscillations around the accuracy.

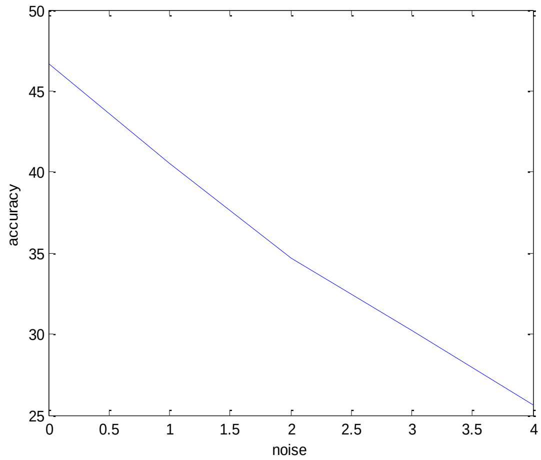

Figure 5: Plotting Accuracy of the Signal vs Noise

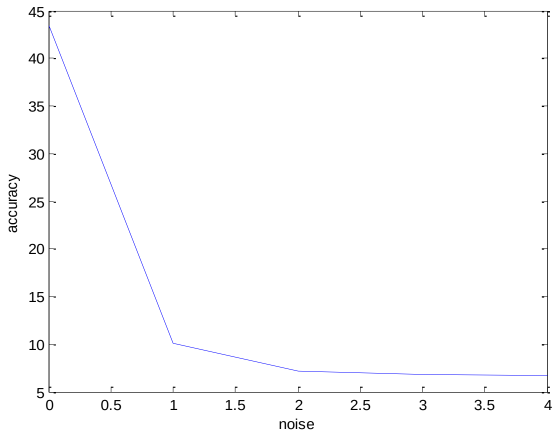

Figure 6: Plotting Accuracy of the Signal vs Noise

And when compare this result to the detailed images which have more detail they show that there are significantly higher variation around the accuracy as shown in figures 5 and 6 for different detailed images.

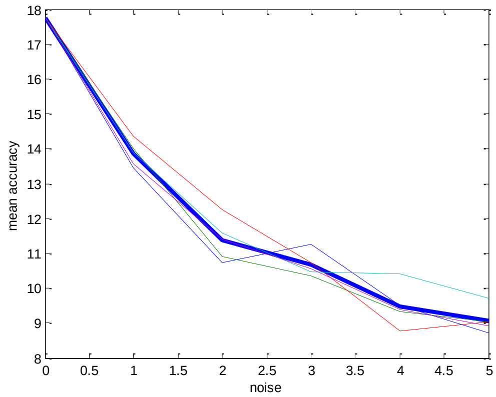

Figure 7: Averaging Accuracy for Detailed Image

To improve the accuracy of the displacement measurement we tried to increase the size of the sub image from 16 to 24 pixels, the results of this simulations are presented and developed for many purpose in the field of digital imaging.

CONCLUSIONS

We have developed an algorithm to improve the performance of motion recognition systems. This can find applications in the field of digital imaging in the consumer or scientific sectors whenever the detection of movement is necessary. In this work of resarach we first described single pixel objects moving in a two dimensional plane. This helped us to develop a much more complex algorithm which included an adjustable number of sub images. The tradeoff between the resolution of the reconstructed image and the achieved accuracy was analysed. It has to be taken into serious account due to the influence of these parameters on the computational time required and degree of detail required in practical implementations. Post processing offers the possibility to elaborate the data after it was acquired. An algorithm based on the digital image correlation of multiple acquisitions provides improvements in the recognition of displaced objects when the right combination of resolution and noise levels to achieve higher accuracy in the reconstruction moving object.

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