Performance Evaluation of Monitoring System Using IP Camera Networks

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Abstract

Today, a security camera is very important for consumption to distinguish, cars and persons at the entrance of construction such as university campsites and military buildings. This can apply by using an algorithm for the extraction importance differencing which is necessity to analysis and explanation. In this paper, we have developed algorithm methods for moving object detection to minimize the classification error and reduce the problem of images segmentation for use in IP camera networks that was tested using outdoor cameras to process it by MAT-LAB computing program. Also, this work is not limited to the above aim only but, it can be modified to process image or (video) of a goal sent images from the central security office and give information to a robot automatically to detect its motion and catch it , the result of the study is that we achieve images with higher accuracy .

Keywords: *FFT: NCC: Accuracy: Digital Image: wire and wireless communications: IP camera systems.*

1. Introduction

Image processing is a method to convert an image into digital form and perform some operation on it to remote data acquisition, .the input of image processing with the test image [1].Pictures, and output may be image or characteristics associated with the images. The history of digital image processing traced back to the 1920s when digital image transferred between London and New York. However, in the past, the cost of processing was very high because of the imaging sensor and computational equipment was very expensive and had only limited functions. Digital image processing deals with images that consist of a matrix of pixel representing the intensities of various position as one of the most widely used methods for continuous video streams, which is useful in computer vision and image processing applications [2].

There are two principle methods area refer to the comparison of the digital image for various small regions known as subsets and extract full field information. Firstly, being the improvement of pictorial information for human clarification. Secondly, being the processing of data for other machine of controlling offices [3].

This study isbased on a digital camera installed at the electronic gate of building for tracking and detection motion of persons and cars for security purpose to process the images by using developed algorithm. This system is very useful for security issue to help us by processing any image that has been stored; the next step is the suitable action, which must be done a according to processed image.

2. Methods and Data Description

2.1 Data Description:

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 [4- 5]. There are two approaches of image digital correlationto analyze the digital images and extract the measurements:

1- Methods for digitally recording images containing measurement. The acquisition process modeled considering additive Gaussian noise which was added to each image pixel.
2- Approaches for programming all process. The characteristic design 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 [6] .

2.1Two-Dimensional Measurements

We apply the algorithm (**2D-DIC)** to define the size of the image. Firstly, the input image changed into gray scale image and divided into subsets. The processer treated with the shifting of the x and y directions of the pixels at the test image and applying the Normalized Cross Correlation at each sub image and the DC component removed.

Secondly, we vary the number of sub-image by dividing the size of image into departments; depend on the number of the rows and the number of the columns. Thus can use when needed to extra any losses part in the test image. Then uses FFT algorithm (Fast Fourier Transformers) and transfer again into time domain (inverse of Fourier transformers) to increase the size of the pixel of image and we get a more accurate picture and clarity by using MATLAB program computing. These equations below used to solve and analyses the plain and detailed images:

Fast Fourier Transform (FFT)(2-D Discrete F.T);

Array : M X N,

$$F(u,v) = \frac{1}{MN}\sum_{X=0}^{M-1}\sum_{Y=0}^{N-1} F(x,y)\, e^{-j2\pi\left(\frac{ux}{N}+\frac{vy}{M}\right)} \quad (1)$$

U = 0, 1, 2, …..M-1
V = 0, 1, 2, ….N-1

$$F(x,y) = \sum_{u=0}^{M-1}\sum_{v=0}^{N-1} F(u,v)\, e^{j2\pi\left(\frac{ux}{M}+\frac{vy}{N}\right)} \quad (2)$$

Where, X =0, 1, 2, ….M-1

And Y = 0, 1, 2, …N-1

If M = N

$$F(u,v) = \frac{1}{N}\sum_{X=0}^{N-1}\sum_{Y=0}^{N-1} F(x,y)\, e^{-j\frac{2\pi}{N}(ux+uy)} \quad (3)$$

$$F(x,y) = \frac{1}{N}\sum_{u=0}^{N-1}\sum_{v-0}^{N-1} F(u,v)\, e^{j\frac{2\pi}{N}(ux+vy)} \quad (4)$$

Then we apply Properties of F.T:

1. Separate

$$\boldsymbol{F(u,v)= \frac{1}{N}\sum_{x=0}^{N-1}\sum_{y=0}^{N-1} F(x,y)\, e^{-j\frac{2\pi}{N}(ux+vy)}} \quad (5)$$

$$= \frac{1}{N}\sum_{x=0}^{N-1} e^{-j\frac{2\pi}{N}ux} . N\frac{1}{N} . \sum_{y=0}^{N-1} F(x,y)\, e^{-j\frac{2\pi}{N}vy}$$

$$=\frac{1}{N}\sum_{x=0}^{N-1} e^{-j\frac{2\pi}{N}ux}.N.F(x,v)$$

$$=\frac{1}{N}\sum F(x,v)\, e^{-j\frac{2\pi}{N}ux}$$

2. Inverse F.T

$$F(x,y)=\frac{1}{N}\sum_{u=0}^{N-1}\sum_{v=0}^{N-1} F(u,v)\, e^{j\frac{2\pi}{N}(ux+vy)} \quad (6)$$

$$=\frac{1}{N}\sum_{u=0}^{N-1} e^{j\frac{2\pi}{N}ux}.N.\frac{1}{N}.\sum_{v=0}^{N-1} F(u,v)\, e^{j\frac{2\pi}{N}vy} \quad Idet.along\ Row$$

$$=\frac{1}{N}\sum_{u=0}^{N-1} N.F(u,y) \quad Idet.along\ vevtor$$

$$=\frac{1}{N}\sum_{u=0}^{N-1} F(u,y)\, e^{j\frac{2\pi}{N}ux}$$

Finally, using this plan in main door of the gate of the building for security monitoring system using **IP CAMERA** networks as shown below figure (1), the location of the control room and the location of cameras at the gate .

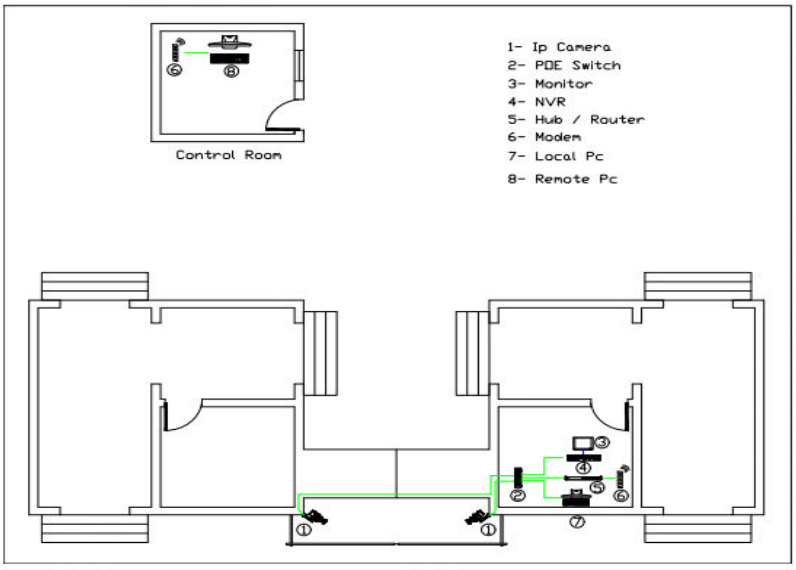

Figure1. Location of cameras at Electronic gate

The type of camera as (outdoor camera-(1322332036943#, M4boczog715g- VOAASW .this can be captured for detention the cars and people and apply imaging processing on the images trough algorithm as illustrated above

3. Result and Discussion

The extraction of the image into subset each one has size of m x n which represented the extraction in the x- direction and y- direction of the image which can be tested. Then the output image calculated and analyzed to measure x- displacement, y-displacement and Normalized Cross Correlation (NCC).

A number of steps achieves the automatic perception. The initial step is to divide the image into sub-image regions. The input image should be multiplied in the frequency domain.

Figure (2) the original image and the shift image

Therefore, a number of complex computation steps should be add. When analyzing a region in an image it is dynamic that separatesbetween the object of the original and shift image, resulting indicated in figure (2), the measurement of the maximum values of x- displacement and y- displacement and NCC.

Areas of the image that were affected by changes as those caused by the movement of objects can be identified by low cross correlation value (in blue).

In digital signal processing is very important to adjustable a number of sub images. The process was modeled considering Gaussian additive noise was added to each subimagepixel.this allowed a realistic definition of received image accuracy in relation to input image.

In MATLAB, this generator is called (random) command a variance equal to one.so that can be investigated the requirements from the stimulated program. A series of random process applied for possible values observed with original image and shift image to simulate image with motion detection. As shown in figure (3) to obtain the maximum value in x and y direction of the pixels in the images and to improve the accuracy of the displacement measurement and the resolution.

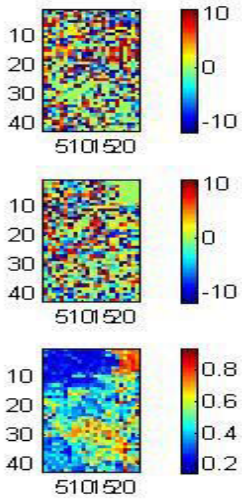

Figure 3 .Normalized Cross Correlation for each sub-images

Therefore, as mention before there are shift in x direction pixels and y direction pixels cross the image. In addition to, below figure 4. Quiver plot showing the displacement across image as arrows represent different direction measurements of displacement vectors in the x and y directions for each pixel obtained after applying the Normalized Cross Correlation (NCC) algorithm.

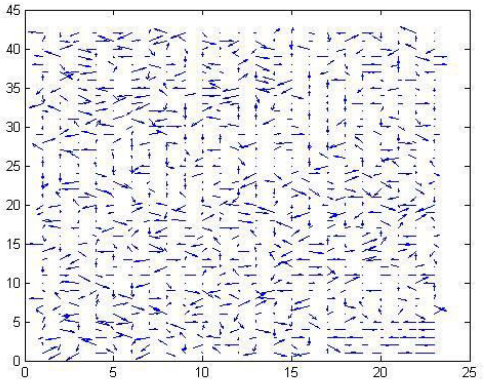

Figure 4. Quiver plot showing X and y displacement vectors in the image

Finally , resulting will be obtained when the measurement of displacements take place with removal the DC component for the input image to give a sharper correlation function ; highlights the largest displacements within the image .

4. Accuracy vs. Noise

The measurement of the accuracy varies according to the random noise that had be added to the image as mention above. This graph figure 6.Insllutrae the relationship between the noise level and the accuracy we noticed that a drop of the accuracy when the level of the noise is increased.

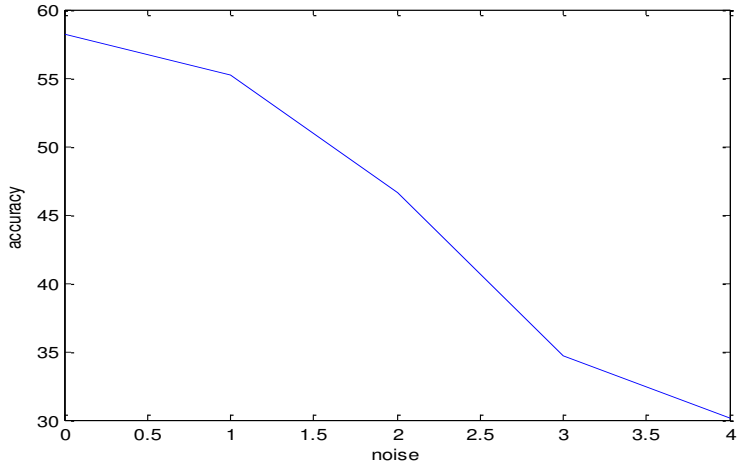

Figure5.plotting accuracy of the signal vs. noise

5. Conclusion

We designed amonitoring security system for electronics' gates at the entrances of the important building and applied practically an algorithm after we have developed to improve the performance of image processing. in this research identifies a single pixel of the image and analysis with noisy image after that it tries to increase the size of this pixel to be larger in two dimension and remove this noises by special algorithm so the image become more clear. This was tested using outdoor IP camera systems that connect with the central network of the building to track and detect motion of persons and cars for security purpose. As a future work, this paper going to achieve data to count the number of irregularities by the strange cars and also to raise up the level of accuracy for the image, aspiring to make a robot provided by a camera and a sensor connected via wireless to the security room and its remotely controlled.

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