International Journal of Application or Innovation in Engineering & Management (IJAIEM)
Web Site: www.ijaiem.org Email: editor@ijaiem.org
Volume 3, Issue 11, November 2014 ISSN 2319 - 4847

New Multi-frame Image Display Method

Mithaq N. Raheema

Lecturer, Ph.D. in Electronic Engineering Head of Computer Engineering Department
Al-Hussain Engineering University College, Holly Karbala, Iraq

ABSTRACT

The available image display functions contained no attributes or organizational information for many analysis and study applications. In this paper several important multi-frame image fusion problems are studied to provide practical fast and robust solution. The proposed algorithm creates a useful multi-frame image display method especially for education and analytical purposes. It works by resizing, scaling, combing of N consecutive images sequence or video frames, and applying brightness approach to the result, then display them in a single figure. Simulation results show the effectiveness of the proposed method for a descriptive vision of object motion in images sequence.

Keywords:- Multi-frame Image, Image Display Function, Images Sequence, Image combining

1. INTRODUCTION

In last few years, the development and commercial availability of increasingly powerful digital computers has been accompanied by the development of advanced digital signal and image processing algorithms for a wide variety of applications such as noise reduction, sonar, video and audio signal processing, pattern recognition, and the processing of large databases for the identification and extraction [1]. Nowadays, digital image is used in DVD players, digital cameras, mobile phones, and also in biomedical applications, etc [2]. A digital image is an image that is recorded in precise numbers (binary codes as 0 or 1) in a digitized code. The pixels are the small units or blocks that comprise a digital image, which may or may not be individually visible, depending on the size of the image [3]. Each pixel in the 2-dimensional plane is located at coordinates (i,j), where i is the pixel's position along the horizontal pixel line and j is its vertical position. The general equation for a pixel point process [4] is:

$$b(i,j) = M[a(i,j)] \qquad (1)$$

Where "a" represents input and "b" is used for output. Subscripts can be used to denote several inputs or output images if more than one is present. "M", called the mapping function, represents any mathematical or logical operation on the input image; which generates an output image [5]. A binary and gray-scale image is represented by one 2-dimensional array, whereas a color image is represented by a 3-dimensional array as shown in figure (1). Display functions create an image and display it in an axes object contained in a figure. The multi-frame image display functions work with a specific type of multi-dimensional array called a multi-frame array. In this array, images, called frames, are concatenated along the fourth dimension. Multi-frame arrays are either R-by-C-by-1-by-P, for grayscale images, or R-by-C-by-3-by-P, for truecolor images, where R, C, and P are the number of rows, columns, and frames respectively. The ability to create N-dimensional arrays can provide a convenient way to store images sequence as shown in figure (2).

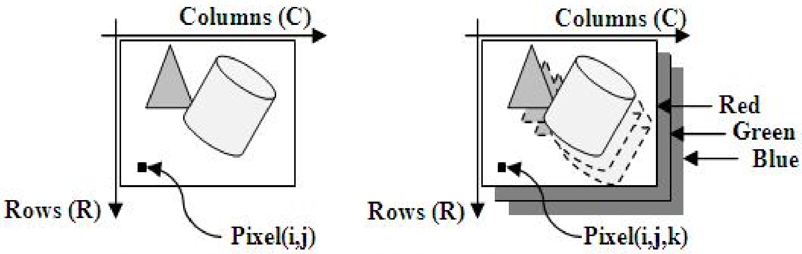

Figure 1 Array representation of image, left: gray and right: color image

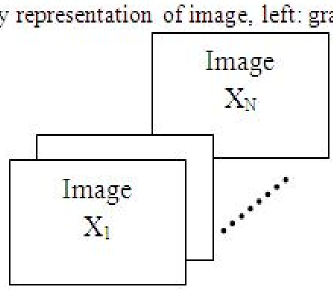

Figure 2 N-dimensional array of images sequence

Some of engineering applications including navigation, image data processing, or quality management [6] work with collections of images related by time, such as frames in a movie, or by spatial location, such as Magnetic Resonance Imaging (MRI) slices. These collections of images are referred to image sequences. To view multiple frames in a multi-frame array at one time, one can use the Montage function as shown in figure (3). Another choice to view image sequences is the Movie Player function. It can display one frame at a time. Video frames that are close in time usually have a large amount of similarity [7].

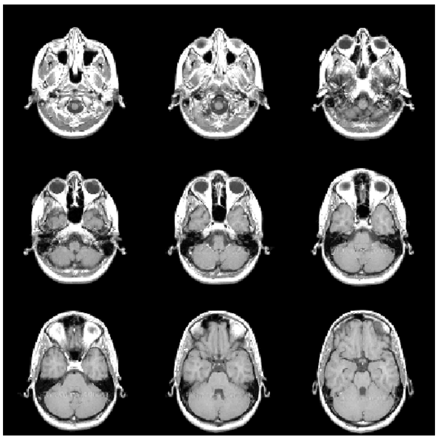

Figure 3 Montage function for MRI slices

Much of the important information needed to support advanced applications is not represented in standard attributes in the available image display functions. Also, display large image sequences means that after each image (frame) display, there is a delay waiting for a response before displaying the next. This is acceptable when the number of frames is small. Moreover, displaying very large image sequences may cause unattached information about object motion and the display need to be restarted from the beginning. Thus, as image sequence studies have become significantly larger, work on providing a new image display mechanisms has been necessary to represent and process all the information in a different manner, and to allow the user to interact with it. This paper is an attempt to define a new multi-image (frame) display function.

2. THE PROPOSED MULTI-FRAME IMAGE DISPLAY ALGORITHM

The idea of the proposed algorithm is to create a sequence of images such as frames from video, which when put together, represents and combines the transition from one image to the other in a single project. Assume a series of source images, called X1, X2, X3, etc. This algorithm creates a single picture consisting of the combine X1 to X2, then combines the result image to X3, and so on as shown in figure (4).

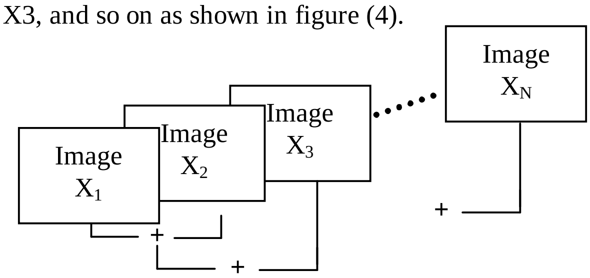

Figure 4 Operation of the proposed algorithm

The new algorithm creates a special image display function can be used for educational and analytical purposes. It formulates a general multi-frame display model with popular matrix notations:

$$Y(i,j,k,p) = \sum_{i=1}^{p} X(i,j,k) \quad \text{for } p=1 \text{ to } N \qquad (2)$$

Where k=1 for gray image, k=3 for color image, Xi is the ith frame, N is the number of images sequence, and Y is the combined array. The result after each step is an image with a background that is at the original frame. The proposed system is contained from the following steps:

1. Reading: It starts by reading a series of images from graphics files in any standard formats, such as TIFF into the combined array. For the set of N video frames, a new base frame is created as a reference by selecting the first video frame and doubling its pixel value.

2. Resizing: As an intermediate step in the proposed algorithm is resizing by removing of the extra size for each image. Where each image will be resized to smallest row and column in all image matrices:

$$R = \min(R_1, R_2, \ldots, R_N)$$
$$C = \min(C_1, C_2, \ldots, C_N) \quad (3)$$

Where Ri and Ci are row and column of image Xi.

3. Storing: The proposed algorithm stores images sequence in a four-dimensional R-by-C-by-k-by-P array. Where k=1 for gray image, k=3 for color image, and P is the number of images.

The image data is usually stored as an array of 8-bit integers. Also 16-bit-per-pixel data from TIFF and PNG files, and 64-bit for the double operations are used.

4. Similarity: Set the similarity in images. For each pair of frames, this step converts the first image coordinates X1(i1, j1) to the matched part in the second image coordinates X2(i2, j2):

$$X_{i+1} = f(X_i) \quad (4)$$

5. Adding: Fuse the objects from image sequences by adding each image to the current axes.

Proposed algorithm adds each element in array X1 (first image) with the corresponding element in array X2 (second image) and returns the sum in the corresponding element of the output array Y (result image). X1, X2 and Y are real and numeric arrays with the same size and class.

$$Y_i = f(X_i + X_{i+1}) \quad (5)$$

In many of the available functions, e.g. imadd(X1,X2) which adds two images, elements in the output that exceed the range of the image type are truncated, and fractional values are rounded, thus losing accuracy in the final result. This work provides three solutions:

5.1. Scaling: To avoid problems with data types, the proposed algorithm works with type double and scales each image data to the range (0 - 1) before addition.

$$X_i = X_i / \max(X_i) \quad (6)$$

5.2. Averaging: The proposed algorithm presents a very accurate solution with averaging source images by:

$$Y = \sum_{i=1}^{S} (X_i / S) \quad (7)$$

Where, S is the number of added images.

5.3. Combining: The proposed algorithm achieves more accurate result by combining the operations, rather than the individual arithmetic adding functions. Image combining computes each element of the output Y individually, in double-precision floating point.

6. Rescaling: In this step if source images are scaled by step (5.1) then the result array will be rescaled by:

$$Y = Y * M_s \quad (8)$$

Where, Ms is the smallest of maximum numbers from all images.

7. Brightness: This step allows adjusting the brightness of the combined image to a required degree.

8. Displaying: The proposed algorithm displays matrix Y as an image. Each element of Y is interpreted into the figure's colormap or directly as RGB values, depending on the data specified. The system flow diagram in figure (5) shows the major components of the proposed image combined system making use of multi-frame.

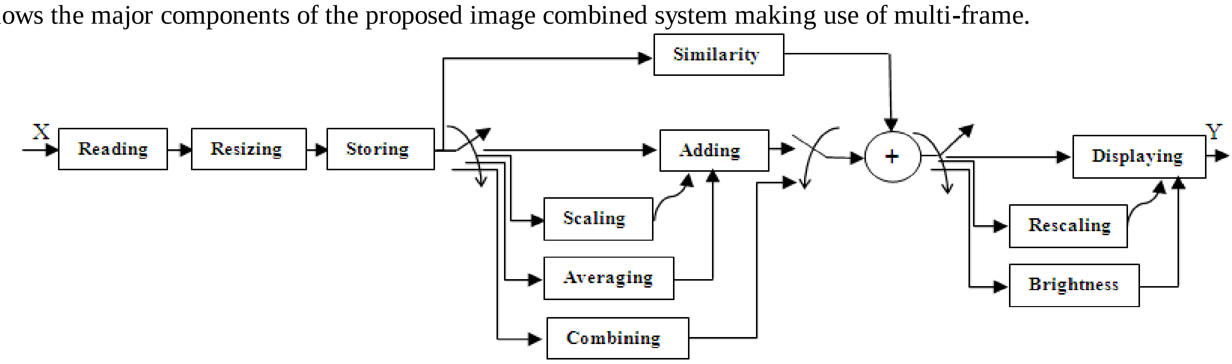

Figure 5 Multi-frame image display system

3.RESULTS

The proposed process is tested with real-world video frames and image sequences. In the first experiment a sequence of 9 images is created. One of these images is shown in figure (6.a). The result of applying the proposed method on this sequence is shown in figure (6.b). The result image of adding is influenced by all images used and it is not strange from them. Scaling and averaging then adding these images is shown in figure (6.c). By averaging and scaling video frames, truncating is reduced. In the second experiment, subtracting these images is shown in figure (6.d). Comparing to the figure (6.b), the object motions are fused more effectively in figure (6.d). In the third experiment, following step (5.3) of the process; combined these frames is shown in figure (6.e). It is clear that the resulting image has a better quality than the adding frames or other fusing methods. Where, the brightness approach shows clear improvement in image quality as shown in figure (6.f). Simulations tests of the proposed multi-frame image display algorithm have shown its potential for performance in terms of descriptive vision of object motion, when compared against single frame display functions. Combining between the images achieves very interest results since the images are roughly of the same size and colors.

Figure 6 Experimental results of the proposed algorithm: (a) one of image sequence used (b) adding (c) adding with scaling and averaging (d) subtracting (e) combining and (f) brightness adjust of the result image.

4.CONCLUSION

In this paper, based on the some combined functions, a new method of multi-frame image display is proposed, which increases the information vision and reduces the display picture size of a set of images sequence.

The proposed system is an image display management and presentation process with powerful features:

- It is very simple for image processing applications, especially for fast observation.
- It supports most image formats including BMP, JPEG, TIFF, PNG, and GIF. It is applicable to all multiframe images of binary, grayscale, or truecolor image array.
- It does not need to convert values because of all images in the same type. The result combined image array can be logical, uint8, uint16, int16, single, or double.
- In the proposed algorithm all images are recreated automatically at a size suitable for combining.
- It can be work with any portion of the image when one doesn't wish to combine an entire image.
- It performs the image addition in double precision and only truncates the final result.
- It rescales image data to the full range of the current colormap and displays the image.
- It is easy to adjust brightness, contrast and color balance of the result image without having to go to any additional software.

The proposed method of the combined picture creation assumes there is no zooming or rotational variation in the video. Visibility improvement can come from reduce the truncation through averaging and scaling. Since the common information is the same contained within any single image, the shared information does not need to be replicated for each frame. Thus the proposed algorithm can be used as a multidimensional compression scheme.

REFERENCES

[1] S. V. Vaseghi, “Advanced Digital Signal Processing and Noise Reduction”, Third Edition, John Wiley & Sons Ltd, England, 2006.
[2] M. Najim, “Digital Filters Design for Signal and Image Processing”, ISTE Ltd, USA, 2006.
[3] I. Singh, “Digital Camera–A Review of its Applications in Urology and Genitourinary Surgery”, Journal of Clinical and Diagnostic Research, Vol. 3, issue 1, pp.1341-1347, Feb. 2009.
[4] R. Maini and H. Aggarwal, "A Comprehensive Review of Image Enhancement Techniques", Journal of Computing, vol. 2, issue 3, pp. 2151-9617, March 2010.
[5] J. Sanchez and M. P. Canton, “Space Image Processing”, CRC Press LLC 1998.
[6] S. Stergios, "Advanced Signal Processing Handbook", CRC Press LLC, 2001
[7] L. Guan, S. Y. Kung and J.n Larsen, "Multimedia Image and Video Processing", CRC Press LLC, 2001.

AUTHORS

Mithaq N. Raheema received the B.S. and M.S. degrees in Electronic Engineering from University of Technology, Iraq, in 1998 and 2000, respectively. During 2002-2005, he stayed in Department of Electrical and Electronic Engineering, University of Technology as an Assistant Lecturer. He received the Ph.D. degrees in Electronic Engineering from University of Technology in 2007. Lecturer during 2008-2012. Head of Computer Engineering Department (2011-2014) in Al-Hussain University College, Holly Karbala, Iraq.