

Comparing the Process of Stitching Output Images from Colored and Un-colored Ultrasound Doppler Devices

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Abstract - Panoramic imaging is a recent technique in Doppler ultrasound field which used to give overview medical ultrasound images for an accurate clinical diagnosis and measurement. There are two types of 2D Doppler produced images; colored and un-colored which differs in their features. In this paper we introduce a comparing between these two types of images in process of stitching them to get a single panoramic Doppler image. Also, we proved the success of our proposed method in stitching both of those images types. The proposed method in this paper depends on finding the coordinates of the artery center of each image for both the artery sides.

Key Words: Panoramic, Image, Doppler, Ultrasound, Comparing.

1. INTRODUCTION

Doppler ultrasound scanning (DUS), a form of ultrasound waves, is used now to detect and measure the flow of blood and verify the existence of arteries' defects (measurement of stenosis and plaque) [1, 2, 3]. For the purpose of pinpointing the affected areas from the artery, a complete scene should be provided from the accurate sequential images given by the physician, especially for the Peripheral arterial disease and arteriosclerosis which are the most common diseases of the blood vessels. They lead to localized narrowing in the artery as a result of the buildup of plaque inside the artery and cause disturbances in the blood supply from the arteries of the legs, neck and others. Nowadays doctors can use imaging tests in the diagnosis of arterial diseases. Due to the limited field of view for the Doppler's prop, the physician can examine only small different parts of the whole operating field at once. DUS exam results are more than 10 videos or images especially for the long artery or vein. This large number of images makes the determination of affected areas for the whole artery difficult and inaccurate [4, 5, 6].

Creating a panoramic single image for those results images or videos can overcome this problem and help to get an

accurate determination and diagnosis for this kind of diseases.

Doppler devices have different types of transducers (props) which are used for hand movement on the scanned regions. In our study we should use only the liner transducer to get a rectangular output images and avoid using the other types which produce triangle output images that not possible to stitch them to get a rectangular panoramic image.[7, 8, 9]

2. IMAGE STITCHING

Before you begin In this paper we determined the coordinates of four points at the beginning and the end from the pair stitching images. The red points coordinates are determined in fig.(1). The distance from the upper artery edges in the selective images will be recorded on the right side in Fig. (1). To determine the center of the artery sides (the blue points in Fig. (1)), the computed distances will subtract as shown in Eq. (1), (2), (3)

$$x_s = x_{s2} - x_{s1} \quad (1)$$

$$x_e = x_{e2} - x_{e1} \quad (2)$$

$$x = x + (x_e - x_s) \quad (3)$$

where x_{s1} , x_{s2} is the distance from top of image to the up/down red point respectively at the beginning edge of the artery, x_{e1} , x_{e2} at the end edges of the artery, x is the blue point.

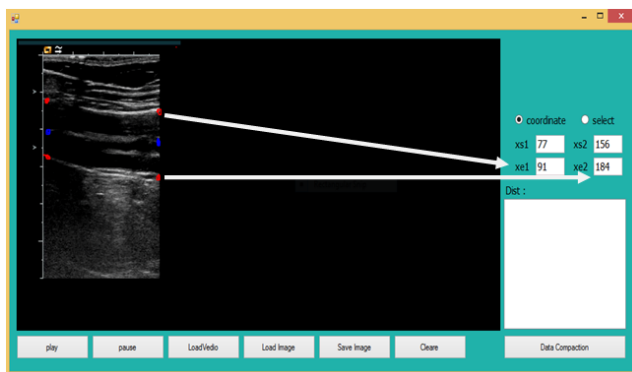


Fig-1: Computation of the limitation distances xs_1 , xs_2 , xe_1 , xe_2

3. DETECTED OVERLAP AREA AND OBLIQUE IMAGES

For different output images that's produced from the different Doppler devices, images size and quality are differs.[10, 11] This different affect on the process of images stitching, thus the same process cannot successfully used for all the results images.[12] To solve this problem we design a method which can be used for all Doppler images types. This method works on changing the overlap area according to the size and clearness of the Doppler images directly and easily from a designed interface. The overlap area changes as a percentage from the whole image size, it could be (5%, 10% ...ect) from the whole size. The implementation of this method with colored and un-colored Doppler images also gives a good image stitching results. Fig.(2) shows a panoramic image for a colored Doppler results before using the suggested overlapping method.

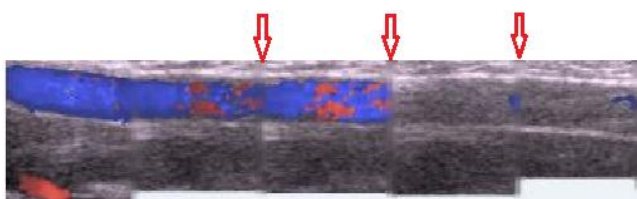


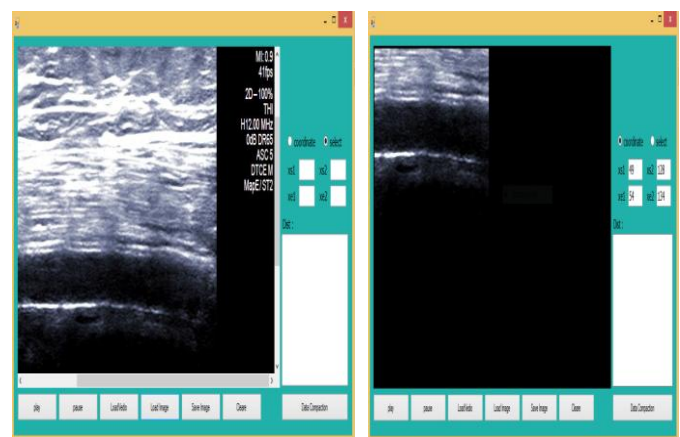
Fig-2: Overlapping areas between the stitched images before using the suggested overlapping method

4. RESULTS AND DISSCUSION

4.1 For un-colored Doppler images

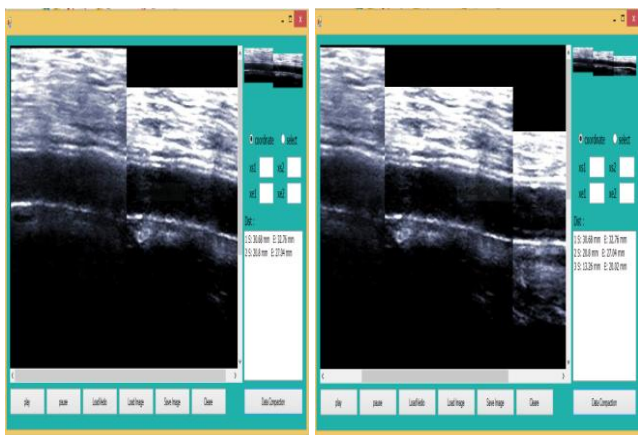
Non-colored Doppler images are not clear images and cannot easily distinguish their details.[13] First step was with helping of the specialists in reading Doppler

images to follow the Thigh artery walls through all the images need to be stitched. It is not easy for completely distinguish the parties and the walls of the artery in these poor images by using the program. The used images must be sequential images to facilitate the integration process.[14, 15] To avoid the difficulty of the irregular artery path and it differs in dimensions from one region to another,[16, 17, 18] we introduced our idea in this new field to make a panoramic image from Ultrasound images. The procedure is shown in fig. (3), the useful image is loaded on the view as in figure (3.a), removed the un- wanted edges figure (3. b) and choose the coordinate option to determine the beginning and end points on the artery. Design a program using the coordinate of each image to compute the centers coordinate for the Parties of the artery/vine in each image. For stitching the first image with other selective image is shown in fig. (3. c), the specified centers in the first and second images programmed to be integrity and the line connecting the centers, almost parallel to the horizontal axis of the images. The program restores the step above to stitch the third image and so on for all the images as shown in Fig. (3. d). The result panoramic image is shown in figure (4).



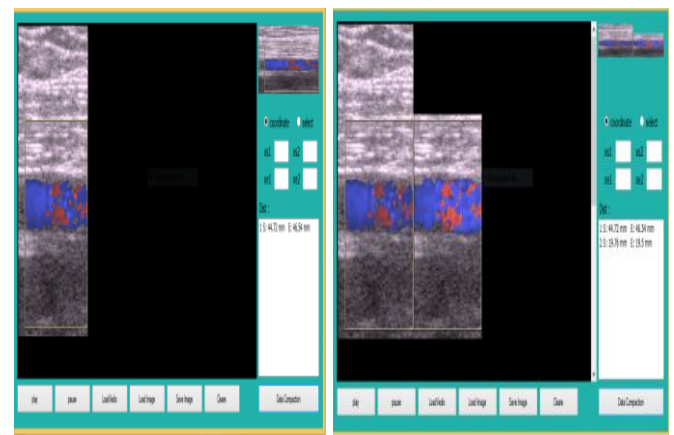
(a)

(b)



(c)

(d)



(a)

(b)

Fig-3: Stitching images for non-colored Doppler device, (a)load image, (b) select a useful area and determine coordinates for beginning and end points, (c)Stitch tow images according to their centers ,(d) stitch three images according to their centers.

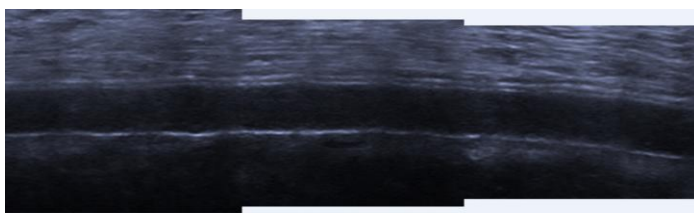
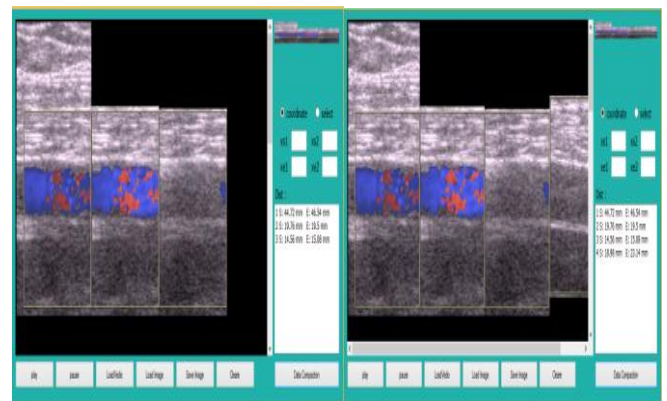


Fig-4: The result panoramic image after processing for the artery in the thigh with non-color Doppler device.

4.2 For colored Doppler images

Colored Doppler images are clear more than the non-colored one, we can see the edges of the arteries and veins easier than the previous type [19, 20] but it's not easy by using a program. We couldn't depend on the red color in the artery and the blue color in the vine to make the panoramic due to the different degree of color between the images. In addition, there is no possibility to full the artery /vein in all the images with red /blue respectively. So we use our previous method to stitch the images as shown in figure (5).



(c)

(d)

Fig-5: Stitching images process for color Doppler,(a)load image, (b) select a useful area and determine coordinate, (c)Stitch tow images,(d) stitch three images

The program will process the result panoramic image results from stitching the images to be as shown in Fig. (6).

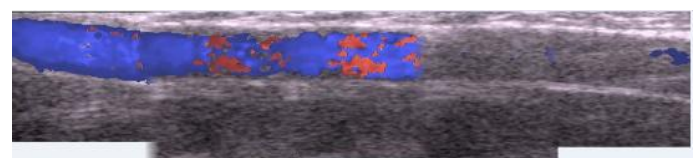


Fig-6: Panoramic image for the vein in the thigh from sequential images after the program processing from Doppler device MEDISON, 2D, 92db, 1.5 KHz

3. CONCLUSIONS

We present an idea for combining several artery /vein images resulting from a Doppler device with linear transducer to find a panoramic image which gives the

physician a large field of view for an accurate diagnosis. Doppler devices produced different images in size, frequency brightness and clearness, our program can treat with any type of this devices.

The walls of the artery were not easily recognized in the un-colored Doppler images especially for the deep and small ones, that make the stitching of the walls fully automatically is not accurate for the whole cases spatially when the images are not taken very sequentially.

Using images taken from colored Doppler is clearly shown for the artery walls. We cannot make a panoramic image with depend on images colors values. Those colors have different values in the different computed images. The distance from the top of the selective images to the center of the artery can be measured accurately and we can use this distance successfully to stitch the images produced from colored and un-colored Doppler devices

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