International Journal of Engineering Applied Sciences and Technology, 2018
Vol. 3, Issue 2, ISSN No. 2455-2143, Pages 48-51
Published Online June 2018 in IJEAST (http://www.ijeast.com)

IMAGE REGISTRATION TECHNIQUES FOR (CT-MRI)

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Abstract— **Recently medical image registration is considered as a valuable tool in comparing images that are obtained from either same or different modalities. To register two images means to align them so that common feature overlaps and differences, if there be any between the two images. This process will raise its ability to help the expert in diagnosis in diseases evolution to decide the necessary therapies basing on the patient's condition This paper mainly illustrates the common diagnostic images including main characteristics of each of them in detail, medical image registration and medical image fusion. Here we are describing the most well-known tools that are developed to help the registration work. Finally, it involves in presenting challenges which are associated with medical image registration and fusion through illustrating the recent diseases/disorders that were addressed through such an analyzing process.**

Keywords— **Scanning, Tomography, Image Registration, medical imaging.**

I. INTRODUCTION

Register two images means align the images, due to this alignment we get the common features, if differences, we have to emphasizes on them. The aligning of two Images we call it as image registration. There are so many clinical applications for image registration.

In medical Imaging, we are using combination of magnetic resonance imaging (MRI) and computer tomography (CT) [3]images to get accurate information about human body.

II. EXISTING/RELATED WORK:

Let's see one example, would like to compare patient's two Computed Tomography (CT)[3] scans are taken one
Scanning report is of six months ago scan and yesterday's scan, and compare the differences between those two scans, e.g., the growth of a tumor during the intervening six months. One could also want to align Positron Emission Tomography (PET) data to an MR image, so as to help identify the anatomic location of certain mental activation. And one may want to register lung surfaces in chest Computed Tomography (CT)[3] scans for lung cancer screening. While comparing of all these similarities can be done in the radiologist's head, the possibility always exist small, but critical, features could be missed. Also, beyond identification itself, the extent of alignment required could provide important information, e.g., how much a tumors volume has changed.

III. PROPOSED WORK

Images used in this process are:
(i) Referenced image which is used for the reference and remains unchanged.
(ii) Target or sensed image.
Geometric transformation functions are used so that mapping of location of target or sensed image into referenced image can be done by using control points of images.

Image registration process:
Image registration has mainly following steps:-

a. Pre-processing: Once images are captured in various different conditions, need to be processed as image smoothing, de-blurring, and image segmentation.

b. Feature extraction: Feature like line intersections, regions, corners; templates, etc. are extracted from both the image. In this step, extract the characteristic features of the registered images and producing one or more feature maps for each of the input images. Decision labeling is based on, set of decision maps are produced through applying decision operator that aims to label the registered images' pixels or the feature maps.

c. Feature Correspondence: Determining the corresponding mapping between both the images and transformation of sensed image is done by using estimated mapping functions parameters.

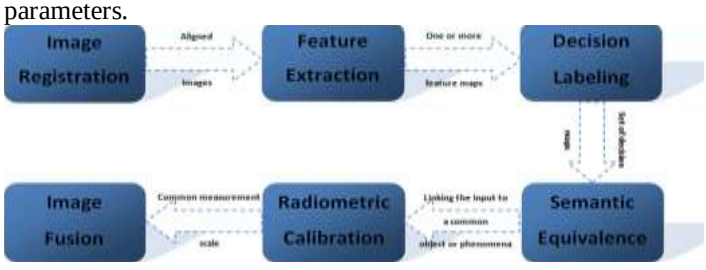

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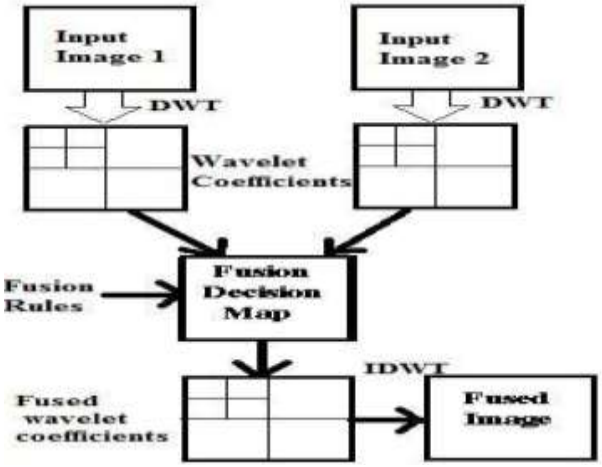
Image Registration:
In image fusion register the input images in the first step. Image registration is the process of mapping the input images with the help of reference image. The goal of this mapping is to match the corresponding images based on some features to assist in the image fusion process. In general, the registration framework is considered as an optimization problem whose aim is to maximize the similarity or minimize the cost.

Number of classifications was proposed for image registration. Here we have various categories which depend on, area based method, application based and feature based method etc.
In 1992 Brown suggested four classes of image registration as per image acquisition. The following are the image registration applications can be divided broadly into four groups.
a. Multiview analysis (Different viewpoints): This is based on different viewpoints of two-dimensional images. Image mosaic king in remote sensing is one of the examples.
b. Multitemporal Analysis (Different times): It's based on different time (regular basis) and conditions images are captured so that there is a continuous monitoring at different time can be put-up . Like in surveillance, landscaping of global land use, in medical imaging keeping eye on different diseases.
c. Multimodal Analysis (Different sensors): Different sensors and devices are used to capture same image scene in order to perform number of tasks. Like in computer tomography (CT) and medical imaging magnetic resonance imaging (MRI) images are combined in order to get accurate information about human body in medical diagnosis and in computer vision biometric system.
d. Scene of model registration: Image and its corresponding model of a scene needed to be registered .It's using as registration of satellite data into maps (remote sensing), template matching (computer vision) etc.

Semantic equivalence:
In some situations, the obtained feature/decision maps might not refer to the same object/phenomena. In this situation, semantic equivalence is applied to link these maps to common object/ phenomena to facilitate the fusing procedure. It is important to note that such procedure is unnecessary for the inputs obtained from the same type of sensors.
In this step, the spatially aligned the input images and feature maps are transformed to a common scale to result in a common representation format to act as an input to the upcoming fusion step.

Image fusion:
In the last step, the resulting images into a single output image containing a better description of the scene than any of the inputs images. The ultimate use of image fusion is the quality of the information contained in the output image.
Other benefits involve: extending the range of operations, extending spatial and temporal coverage, reducing uncertainty, increasing reliability, achieving robust system performance and representing the information more compactly.
Image fusion algorithm: Image Fusion Algorithm the steps in the algorithm for image fusion using DWT as shown in Figure 2 are as follows:
(1) Read the input images (MRI & CT Scanned).
(2) Register and Resample both these images.
(3) Apply the 2D-discrete wavelet transform to these images which decompose it into four sub-bands (LL, LH, HL and HH).
(4) Obtained the Wavelet coefficients from both the images are fused using the rules for fusion.
(5) The final fused image is reconstructed by applying the inverse discrete wavelet transform to fused image.



Medical image registration [5]
The goal of the registration process is to align the corresponding features in some sensed images with respect to a reference. The process is essential to achieving the fusion process. Its importance is to merging/fusing the images that is primarily performed based on the corresponding features of these images. Various methods, throughout the time were presented to perform image alignment registration task. These methods can be defined, depending on the number of criteria.
Image registration is based on nine criteria mainly used for medical imaging, describes as follows
a. Based on 3D or 2D dimension: Describes the image dimension which have two dimensional or three dimensional.
b. Registration method: Means how registration process takes place for two views either matching based on image information or based on coordinate matching.
c. Transformation type: It describes about various type of transformation like rigid, projective, affine, curved etc.
d. Domain of transformation: Means measured transformation is global or local.
e. Interaction type: It is freedom given to user for any registration algorithm.
f. Quality of optimization for registration:-It measures to calculating quality of registration while using any registration algorithm.

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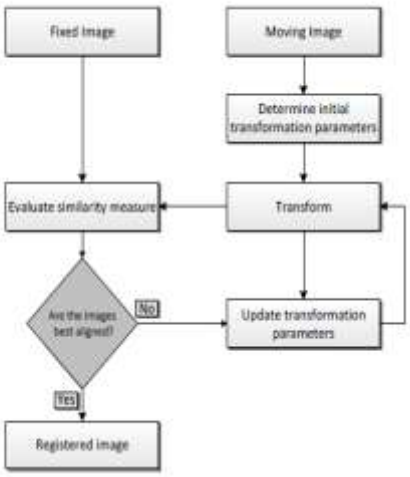
g. Modalities involved: It describes about how the images are captured, which are used for registration process.
h. Subject: It describes about type of sensed image.
i. Object: It tells various region image registrations.

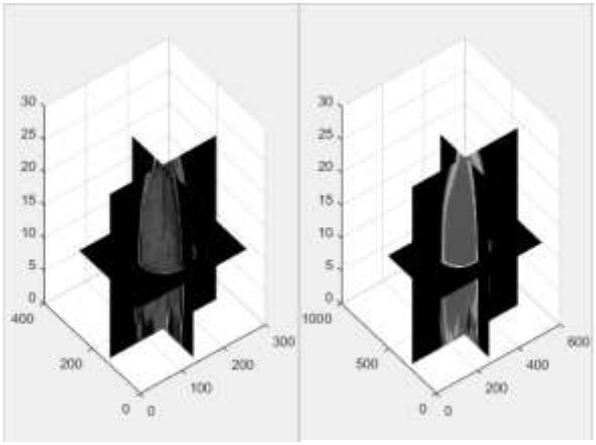
IV. MEDICAL IMAGE REGISTRATION FOR MRI [5]:

Intensity-based automatic image registration is a repeated process. It requires the specific images which we wants to compare the similarities between them.. The pair of images is the reference or fixed image which is of size 512*512 and the CT image (called the moving or target image) which is of size 256*256. The metric is used to define the similarities between image metric for evaluating the accuracy of the registration. This image metric takes the similarity between two images with all the intensity values and returns a scalar value. This defines how similar the images. The optimizer defines the methodology for minimizing or maximizing the similarity metric. The transformation type use rigid transformation (2-Dimension) that work translation and rotation for target image. Before the registration process begins with the processing two images (CT and MRI) have to be pre-processed to get the best alignment results. After the pre-processing process it means images are ready for alignment. In the first step the registration process specify the transform type with an internally determined transformation matrix. Together, they determine the specific image transformation that is applied to the moving image. Next, the metric compares the transformed moving image to the fixed image and a metric value is computed. Finally, the optimizer checks for the stop condition. In this case, the stop condition is the specified with maximum number of iterations. If its not found stop condition, the optimizer adjusts transformation matrix to begin the next iteration. And display the results of it in part of result.

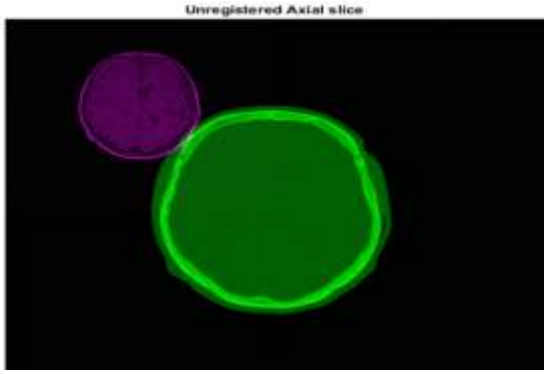
$$S(P) = -\sum_{i=1}^{n} m(p_i) \log m(p_i)$$



Load Images[3]



In the image we can see single planes from the fixed and moving volumes to get a sense of the overall alignment of the volumes. In the overlapping image gray areas correspond to areas that have similar intensities, while magenta and green areas show places where one image is brighter than the other. Use image show pair to observe the mis-registration of the image volumes along an axial slice taken through the centre of each volume.



1) ***Set up the Initial Registration***

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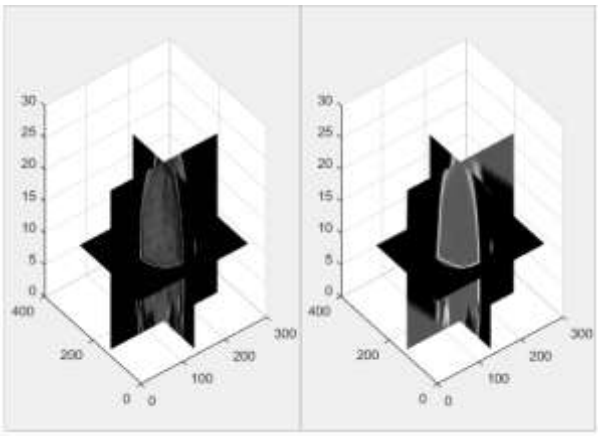

2) ***Apply Geometric Transformation Estimate To Moving Image Volume****.*

V. CONCLUSION

This paper is used for rigid image registration using wavelet based image fusion. It is performed using CT and MRI images. Correlation Coefficient technique is used to verify and check the quality of the images. The original input images and their corresponding registration and fusion results using the proposed technique are depicted in detail. The intensity based registration method was applied to the two input images, the quality of the registration was measured using the Correlation function to measure the similarity between the images before and after the registration the values of the correlation and time taken for registration process were displayed in percentage, then registered and reference images were applied the wavelet based image fusion algorithm. These images are then decomposed with certain fusion rules. Finally the inverse decomposition was done to obtain the final fused images that contain information from both images. The quality of the fused images using the different fusion rules was done by measuring the Correlation Coefficient for each image fusion rule, and the resultant images are shown in the part of the result.

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