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Brain Medical Imaging Registration with Different Modalities

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***Abstract*—Advances in medical imaging technologies have enabled the diagnosis procedure which was not possible a decade ago. Imaging has become an essential component in many fields of medical and laboratory research and in clinical practice.Medical image registration is an exigent task that aligns different image which is acquired using different sensors at different times. Radiologists identify and quantify tumors from MRI&CT scans,neurologists detect regional metabolic brain activity from PET and functional MRI scans. The speed and resolution enhancements of imaging modalities have given doctors more information about their patients.**

I. INTRODUCTION

Digital Image Processing refers to process of creating digital images by means of digital computer. It is composed of a finite number of elements, each of which has a particular location and value. These elements are referred to as picture elements, image elements and pixels. Pixel is the term most widely used to denote the element of a digital image.

Image registration is the process of aligning different images to extract and relate to the corresponding feature between the images. Establishing the correspondence between spatial information in medical images and equivalent structures in the body is the primary goal to have better analysis and interpretation using medical image registration. The patient can be imaged several times by imaging with single modality or imaging with different modality. Medical image registration contains complex process with vital steps has been put below,

Feature Detection

It is a process to find a closed-boundary regions, line intersections, edges, contours etc, in both reference images and images detected while medical imaging.

Feature Matching

It is a step that establishes a correspondence between the features in the reference images and the detected images.

Estimation of Transform Model

It is an estimation that can be done with different transformation techniques; type and parameters of the detected images in medical imaging are mapped with reference images.

Resampling and Transformation

The detected images are transformed by means of estimated mapping parameters.

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II. IMAGE REGISTRATION ALGORITHMS

The algorithm for the registration of medical images estimates transformations that authorize correspondence between points and regions within images, or between physical space and images. The different registration algorithms and their merits and demerits are stated below.

A. Landmark-based Registration

This is an eminent algorithm for calculating the straightforward transformation. This algorithm is based on the identification of the corresponding point landmarks in both reference and sensed images. Three points of landmarks are sufficient to perform the transformation between two 3D image volumes; but, it requires more landmark points in practice.

B. Surface-based Registration

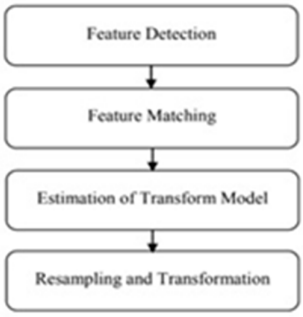
It is an algorithmic mechanism that the corresponding surfaces may be identified and used for the registration. Head-Hat algorithm is widely used but, iterative closest point algorithm are used to have efficient transformation

C. Feature based algorithm

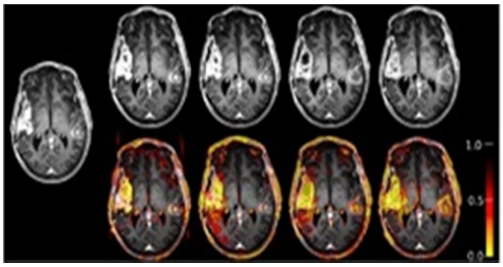
Here in this algorithm, silhouettes of bone or any other structure are described in the form of CT or MRI volume. It is a procedure that uses the properties of the geometry of tangentlines of the 2D image and the tangent plains of the 3D image. It is a fast algorithm but, it is highly dependent on the integrity of the segmentation in both 2D and 3D images.

D. Non-Rigid Registration Algorithms

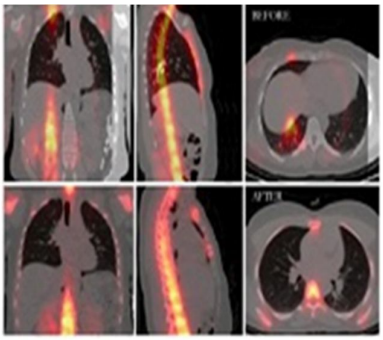
It is the kind of the registration that widely used for the correspondence between images of the patient and the standard atlas or other individual. This technique can also be used to establish a correspondence between the acquired images between the same tissues that are grown over time.



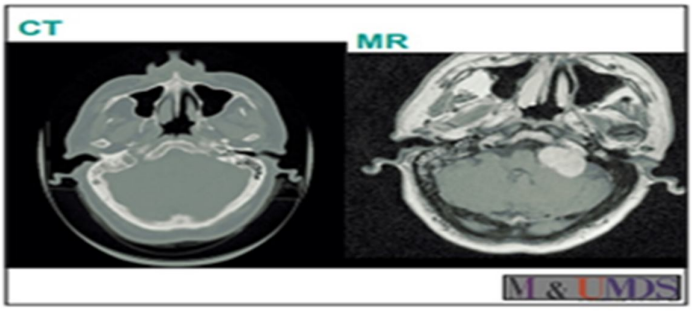
A) Pictorial representation of process



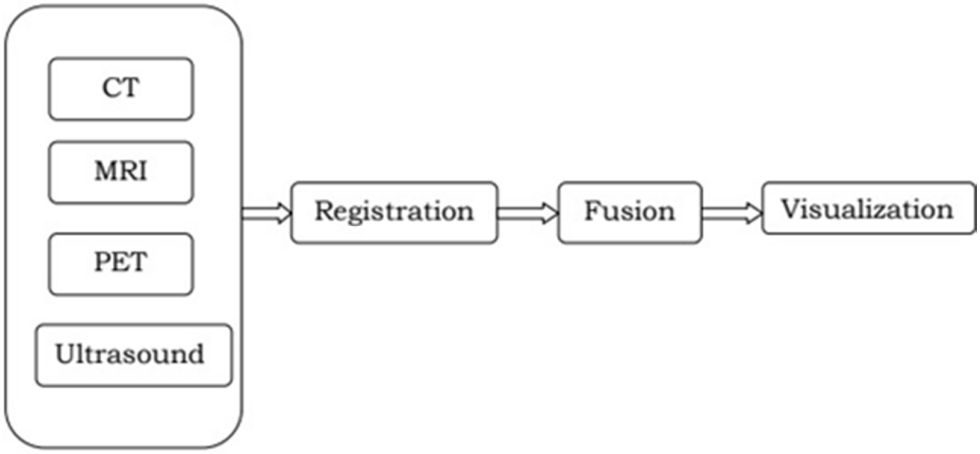
B) Mono modal registration



C) Multi modal registration



D) different scanners images



E) Schematic representation of process

III. Types of Image Transformations

The registration of medical images includes estimation of transformation between the scales of the images. The different scaling mechanics used for the registration of the multiple images from multiple modalities are given below.

A. 2D-2D Transform

2D images are registered solely with a rotation and with two translations in orthogonality. This transform can also be used to appropriate the differences in scaling from the real image and reference image. However, computationally it transforms straightforward. But it is not clinically relevant, because it is much complex task in controlling the geometry of image acquisition. It requires two translations and a rotation to get registered.

B. 3D-3D Transform

This transform had wide spread applicability and treated as accurate registration used for registration of MRI and CT 3D image volumes. It is a process of mapping the coordinates of different 3D medical images and it contains three translations and three rotations. It requires careful calibration to determine the image scaling.

C. 2D-3D Transform

It is a Transform methodology that 2D images establish a correspondence with the coordinates of the 3D volumes. Image-guided interventions had a major application with this transform.

D. Time Transform

Sometimes, this could be like the fourth dimension. Acquiring images over time is very much used to study the performance such as perfusion of tissue, metabolic and other physiological processes.

IV. Need for Image Processing in Medical

- The image produced by equipments like CT scanner, MRI, X-ray etc, are composed of pixels, to which discrete brightness and color values are assigned.
- Through image processing they can be efficiently processed,evaluated and analysed.
- It is possible for doctors to see the interior portion of human body with extreme clarity,ease and detail.
- It has also helped the doctors to mak key hole surgeries without opening too much of the body.

IV. Conclusion

Present days, image registration is a successful topic with numerous applications like analysis in medical applications. This article has introduced the grounds for the image registration and the various algorithms involved in the process. The merits and demerits of each algorithm have also been put forward. All the

algorithms are tested and simulated to obtain the factors of complexity and accurateness. The soft computing techniques have complexity in training but, exhibits perfect correspondence between the sensed and referenced images.

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