ISSN: 0975-8585

Research Journal of Pharmaceutical, Biological and Chemical Sciences

Improved Intensity-Based Image Registration Technique For Diagnosing Brain Cancer.

Ponmani E*[1], Ananthakrishnan S[1], Bagyalakshmi G[2], and Samundeeswari S[1].

[1]School of Computing, SASTRA UNIVERSITY, Thanjavur – 613402, Tamil Nadu, India.
[2]School of Electrical & Electronics, SASTRA UNIVERSITY, Thanjavur – 613402, Tamil Nadu, India.

ABSTRACT

Image Processing is a promptly evolving with growing use in science and Engineering field. In the proposed method the most common Brain cancer is identified in the MRI images of brain. Image registration technique is used to compare multiple MRI images of brain to identify the similarity to ensure the occurrence of brain cancer. Image segmentation is also employed which is used to focus the image pixel and image parts in different view. Using these techniques we able to identify the brain cancer affected area in brain which can use for the further analysis. Finally a comparison is done with various methods of image registration technique to identify the best technique.

Keywords: Image registration, Image segmentation, MRI.

Corresponding author

ISSN: 0975-8585

INTRODUCTION

Processing of medical images is most important in the field of medical diagnosis. Mainly the various diseases can be identified just by comparing the test image with the template image of part of the human body. Hence the method of intensity based image registration is applied to MRI brain images to find the quantitative evaluation. This above method has three main techniques such as Global, local and an improved technique. Main part of this paper is to analyze the brain image to access the suitability of three methods. Here we applied the algorithm name as Affine, demons and affine B-spline, which is used to find the accuracy and robustness of the images. So our proposal of concludes and calculate the suitable registration method for MRI brain images to find the affected carcinoma cells.

Brain Images of MRI

MRI is means that uses of magnetic field and radio waves energy to create picture of original organs and structure of inside the human body. The main advantage of MRI is the high resolution of the human body and this has the details of the problems and also which is placed to identify the wherever in the human body. The special function of the MRI is detecting and tracking the brain tumor. So when it identified, immediately the patient will comes under the medical treatment and continuous observation of the human body. The well trained medical technologist are to diagnose the brain MRI scan who is affected person will manually prescribe the position and scanning volume. Using automatic computer algorithm is explain recumbence for patient condition and acquires brain MRI scan in a predefined reference orientation. Human body is most complex system, each parts of the human structure which are placed in very critical position especially the brain. Physicians are monitoring the human brain function and test many long standing research theories of human brain functions. The huge amount of human brain data are under research and collect it safely. Multidimensional Time Series (MDTS) are large spatial and temporal data which is form of the neuro imaging and neuro physiological signals. Enormous medical data needs for efficient and sophisticated technique to apply simultaneously. This technique perform the segmenting the brain image and it comparing to indication surface.

MRI method includes T1 –Weight T2-weight and Fluid Attenuated Inversion Recovery (**FLAIR**) sequence, which are used to compare the image and identify the affected area of the human brain.T1-weight perform to identify the Gradient Echo (GRE) then T2-weight is used to identify the Spin Echo (SE) and last sequence FLAIR is used to inversion recovery pulse. From these three sequence results will produce accurate tissue segmentation and particular image has become essential for the further diagnosis of research. This diagnosis used for pathology and mainly for pre-surgical planning.

Image registration

Image registration represents the aligning two images, so that this had common characteristics and differences are readily apparent. In figure 1 the alignment is done between the affected images and with normal image. The next step of this process is point out the affected area of the target image and this will compare with the normal image.

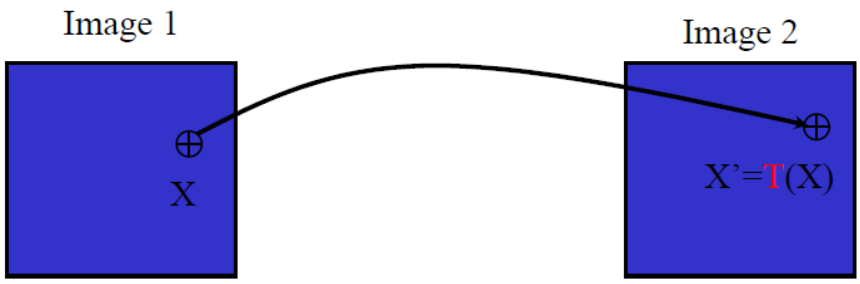

Figure 1: Image registration

ISSN: 0975-8585

Proposed system

In Medical application need and essential for the Image Registration which is used to find the problems of the particular image, which is used to analyze the Mammographic image. Main use of image registration is to find the some variety and important feature, such as breast deformation. Here we find the deformation of internal region for several approaches for robust register. In this paper we proposed and mention the quantitative appraisal of three intensity based image registration applied to MRI brain image. Here in figure 2 we give importance to the three categories such as global, local and improved methods. We already said that, prefer the affine transformation for global, demons for local and last one is b-spline for improved methods. So finally we search the similarity matrices for re-constructed image with the reference image. So that similarity matrices, we come to conclude is which one is better MRI brain image reference for these three methods.

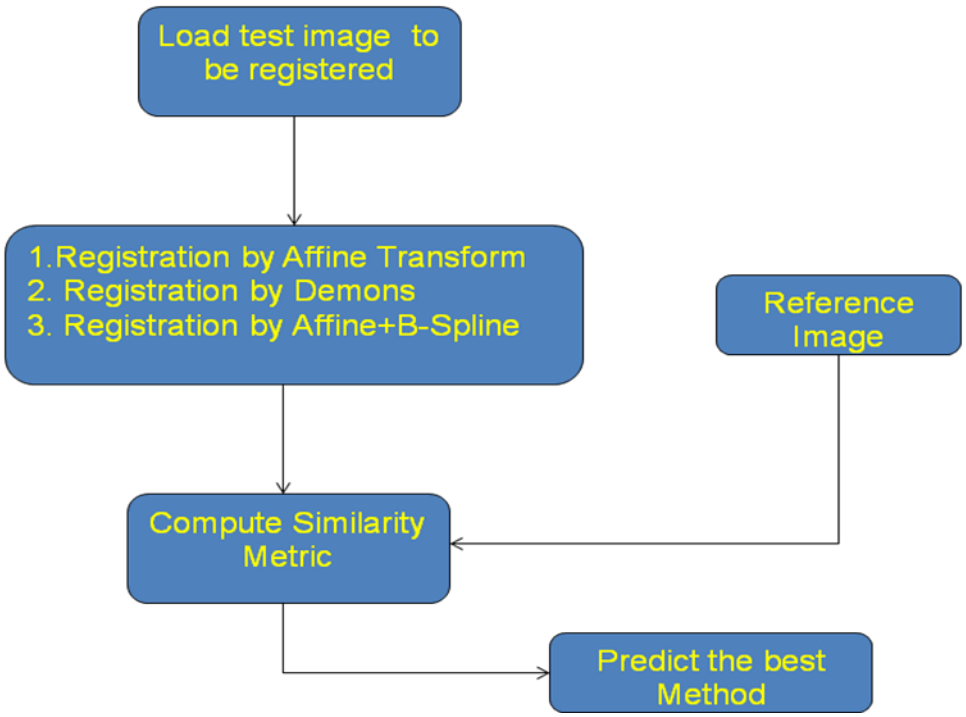

Figure 2: Flowchart of the proposed system

Registration using Affine Transformation

A geometric transformation is applied on the image coordinate system results in a special transformation. Using spatial transformation each point of the given image is mapped to another point in the new coordinate system. Mapping of (x, y) with (u, v) coordinates using u=f(x, y) and v=f(x, y). An affine transformation preserves both co linearity and radio of distances. An affine transformation can applied with set of rotations, translations, shears, scaling namely called as composite transformations. In u = s11x + c12y + t13 and v = c21x + s22y + t23, t13 and t23 for translations, s11 and s22 for scaling, and the combination affects rotations and shears.
Rotation is performed by θ

$$u = x \cos\theta + y \sin\theta$$

$$v = -x \sin\theta + y \cos\theta$$

Shearing and a rotation are performed by
u = x + 0.2y
v = - 0.3x + y

ISSN: 0975-8585

Shearing in the x direction is performed by
u = x + 0.2y
v = y

Finally the matrices for translation followed by scaling and rotation are,

$T = \begin{bmatrix} 1 & 0 & x_0 \\ 0 & 1 & y_0 \\ 0 & 0 & 1 \end{bmatrix}$ Translation by (x_0, y_0)

$T = \begin{bmatrix} s_1 & 0 & 0 \\ 0 & s_2 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ Scale by s_1 and s_2

$T = \begin{bmatrix} \cos\theta & \sin\theta & 0 \\ -\sin\theta & \cos\theta & 0 \\ 0 & 0 & 1 \end{bmatrix}$ Rotate by θ

Point Matching

Discover the number of points {p0, p1, . . . , pn−1} in the given image that match points {q0, q1, . . . , qn−1} of the second image B. Here each point is represented by homogeneous coordinates as a column in matrices P and Q:

$$P = \begin{bmatrix} x_0 & x_1 \cdots & x_{n-1} \\ y_0 & y_1 \cdots & y_{n-1} \\ 1 & 1 \cdots & 1 \end{bmatrix} = [p_0 \quad p_1 \quad \ldots \quad p_{n-1}]$$

$$Q = \begin{bmatrix} u_0 & u_1 \cdots & u_{n-1} \\ v_0 & v_1 \cdots & v_{n-1} \\ 1 & 1 \cdots & 1 \end{bmatrix} = [q_0 \quad q_1 \quad \cdots \quad q_{n-1}]$$

Registration by demons algorithm

These registration methods may be called as local methods in which the transformation is applied locally depends on the position and local similarity. In Demon's algorithm the registration is viewed as a diffusion process using the second order derivatives of the image.

Registration by Affine Transform in hybrid with spline

In target coordinate system the values of the image at grid points can be identified using interpolation. The grid points are located in the B coordinate system by mapping operation. After mapping, interpolation should be applied to find the missed grid points of A in the B coordinate system. Projection points may be used to find the closest points.

Inverse Projection

In the process of transformation the intensity of the original image plane I (x, y) is mapped to the transformed image plane I (x', y'). Here the original image pixel may not be properly aligned with the transformed image coordinate system. So an interpolation is applied to get the exact intensity value of the pixel (x, y) which is placed in the transformed image coordinate system. The following convolution operation is used as $I(x, y) = \sum_{i,j} I(i, j)\, h(x - i, y - j)$. Computational complexity might be reduced using symmetrical and separable interpolation of h (x, y) = h(x) h(y). The quality of resampling is maintained by higher order interpolation. Hence spline functions are to be used, for instance B-spline kernel is used with the size of N=4.

$$h(x) = \begin{cases} 1, & 0 \le |x| \le 0.5 \\ 0, & \text{elsewhere} \end{cases}$$

ISSN: 0975-8585

$$h(x) = \begin{cases} \frac{1}{2}|x|^3 - |x|^2 + \frac{2}{3}, & 0 \le |x| \le 1 \\ -\frac{1}{6}|x|^3 + |x|^2 - 2|x| + \frac{4}{3}, & 1 \le |x| \le 2 \\ 0, & \text{elsewhere} \end{cases}$$

Computation of SSD and MI

The SSD (Sum of Squared Differences) parameter computes the differences of intensity of corresponding pixels. This parameter easily identifies the difference. Here an optimal value 0 denotes that images are identical. The following equation is used to find the differences of two images A, B through iterations.

$$\textbf{SSD (A,B)} = \frac{1}{I}\sum_{i=1}^{N}(A_1 - B_1)^2$$

The MI (Mutual Information) parameter identifies the probabilistic mutual dependence among two intensity distributions. MI is defined as **MI(A,B)=H(A)−H(B|A)=H(A) + H(B) − H(A,B)**. Here large value of MI means that both images are similar in nature.

RESULT ANALYSIS

The values of SSD and MI are computed by applying registration between the test image and sample image. These parameters are then used to compare various registration methods like affine, demon and affine with spline. Even though these metrics are difficult to assess, results are useful for the comparison. Table 1 various methods of registrations are compared for brain cancer detection. In the comparison various parameters like SSD, MI, Mean and variance are used. It shows that Demon's algorithm gives the best performance as it measures high value of SSD.

	Affine	Demon	Affine+Spline
SSD	179.5295	194.0753	158.8990
MI	0.6887	0.0163	0.6918
Mean	27.4432	38.9795	39.1453
Variance	1.2241e+03	1.5819e+03	1.6594e+03

Table 1: Comparison of registration methods

CONCLUSION

The image registration technique used for identification of cancer may result in effective manner. The various image registration techniques are compared against many parameters. But still it is a semi automatic registration. So that in future to improve the efficiency of image registration it can be extended as automatic registration which is used for more accurate prediction of diseases.

REFERENCES

[1] E. D. Pisano, C. A. Gatsonis, M. J. Yaffe, R. E. Hendrick, A. N. A. Tosteson, D. G. Fryback, L. W. Bassett, J. K. Baum, E. F. Conant, R. A. Jong, M. Rebner, and C. J. D'Orsi, "American college of radiology imaging network digital mammographic imaging screening trial: Objectives and methodology," Radiology, vol. 236, no. 2, pp. 404–412, Aug. 2005.

[2] K.Marias, C. P. Behrenbruch, S. Parbhoo, A. Seifalian, and M. Brady, "A registration framework for the comparison of mammogram sequences," IEEE Trans. Med. Imaging, vol. 24, no. 6, pp. 782–790, Jun. 2005.

[3] R. Marti, D. Raba, A. Oliver, and R. Zwiggelaar, "Mammographic registration: Proposal and evaluation of a new approach," in Digital Mammography/ IWDM, Lecture Notes in Computer Science, vol. 4046. New York, Springer, 2006, pp. 213–220.

[4] M. Tortajada, A. Oliver, Y. D´ıez, R. Mart´ı, J. C. Vilanova, and J. Freixenet, “Improving a CAD system using bilateral information,” Proc. IEEE Eng. Med. Biol. Soc. Conf., Buenos Aires, Argentina, 2010, pp. 5054–5057.

[5] J. B. A. Maintz and M. A. Viergever, “A survey of medical image registration,” Med. Image Anal., vol. 2, no. 1, pp. 1–36, 1998.

[6] D. Hill, P. Batchelor, M. Holden, and D. Hawkes, “Medical image registration,” Phys. Med. Biol., vol. 46, 2001, pp. R1–R45.

[7] B. Zitova, “Image registrationmethods:Asurvey,” Image Vision Comput., vol. 21, no. 11, pp. 977–1000, Oct. 2003.

[8] Y. Guo, R. Sivaramakrishna, C.-C. Lu, J. Suri, and S. Laxminarayan, “Breast image registration techniques: A survey,” Med. Biol. Eng. Comput., vol. 44, no. 1, pp. 15–26, Mar. 2006.