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A COMPARISION USING PHASE CONGRUENCY AND NON-LINEAR DIFFUSION BASED SIFT FOR MEDICAL IMAGE AND SAR IMAGE

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***Abstract*—Image registration is the process of identification of the similar portions in the images and transforming the target images similar to the reference image. The registration process requires a effective point matching method for identifying similar portions in the images. The point matching methods identifies the most interested points in the images based on the identification of the edge portions in the images. The most interested points were then matched based on the matching process. The number of most interested points were minimized based on the identification of the outlier in the points. The performance of the process is measured based on the RMSE value calculated. Registration process is the transformation of reference image similar to target image. The transformation is employed by combining the identified matching key points from the reference and target images. The registration process is applied by replacing the matching pixel in the reference image with the target image. The register image is similar to the target image. Scale invariant feature transform algorithm has been widely used since SIFT has limited applications over multiple speckle noise and hence we applied synthetic aperture radar(SAR). In this algorithm it is combination of SIFT, non-linear diffusion and phase congruency. Phase congruency is used in the place of key point matching for removal of erroneous key points.**

I. INTRODUCTION:

Registration is the determination of a geometrical transformation that aligns points in one view of an object with corresponding points in another view of that object or another object. We use the term "view" geometrically to include a three dimensional image, a two dimensional images, or the physical arrangement of an object in space. Three-dimensional images are acquired by tomography (CT),magneticresonance(MR)imaging, single-photon emission tomography(SPECT),and positron emission tomography(PET). The SIFT algorithm is widely used to detect and recognize an object present in different image and provide greater efficiency.SAR is coherent image system and it works under all weather condition and produce high resolution. The performance of SIFT is poor in SAR images. Change detection[1] on SAR is a process acquired images of same geographical area at different times to identify the difference between two acquisition. SIFT detect key points by searching external values in DOG pyramid and then compute key points.

SIFT cannot produce the satisfied results to the optical image registration because it has two reasons. Firstly we say, SAR images are corrupted multiple speckle noise which affects key point extraction[3]. Second, Gaussian scale information[GSS] in SIFT degrade edge information. Due to degradation there is lose of details and leads to blurring of image. SIFT will obtain erroneous initial keypoints from DOG

In the case of SIFT, to overcome this non-linear diffusion is utilized to produce scale space. It preserves the edges. (ROEWA) operator is used to compute gradient information during the construction of NDSS. In each of these modalities ,a contiguous set of two-dimensional slices provides a three-dimensional array of image intensity values. Typical two-dimensional images may be x-ray projections captured on film or as a digital radiograph or projections of visible light captured as a photograph or a video frame. In all cases, we are concerned primarily with digital images stored as discrete

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arrays of intensity values .In medical applications, which are our focus ,the object in each view will be some anatomical region of the body .the two views are typically acquired from the same patient, In which case the problem is that of intrapatient registration, but interpatient registration has application as well. From an operational view, the inputs of registration are the two views to be registered; the output is a geometrical transformation, which is merely a mathematical mapping from

Points in one view to points in the second. To the extent that corresponding points are mapped together, the registration is successful. Christo Ananth et al. [4] proposed a work, in this work, a framework of feature distribution scheme is proposed for object matching. In this approach, information is distributed in such a way that each individual node maintains only a small amount of information about the objects seen by the network. Nevertheless, this amount is sufficient to efficiently route queries through the network without any degradation of the matching performance. Digital image processing approaches have been investigated to reconstruct a high resolution image from aliased low resolution images. The accurate registrations between low resolution images are very important to the reconstruction of a high resolution image. The proposed feature distribution scheme results in far lower network traffic load. To achieve the maximum performance as with the full distribution of feature vectors, a set of requirements regarding abstraction, storage space, similarity metric and convergence has been proposed to implement this work in C++ and QT. The larger system may alternatively use the registration simply to provide a pair of movable cursor on two electronically displayed views linked via the registering transformation so that the cursors are constrained to visit corresponding points. are rigid registration problems.

II GEOSCIENCE AND REMOTE SENSING

Remote sensing can be broadly defined as the collection and interpretation of information about an object, area, or event without being in physical contact with the object. Aircraft and satellites are the common platforms for remote sensing of the earth and its natural resources. Aerial photography in the visible portion of the electromagnetic wavelength was the original form of remote sensing but technological developments has enabled the acquisition of information at other wavelengths including near infrared, thermal infrared and microwave. Collection of information over a large numbers of wavelength bands is referred to as multispectral or hyper spectral data. the development and deployment of manned and unmanned satellites has enhanced the collection of remotely sensed data and offers an inexpensive way to obtain information over large areas. the capacity of remote sensing to identify and monitor land surfaces and environmental conditions has expanded greatly over the last few years and remotely sensed data will be an essential tool in natural resource management

III SAR IMAGE REGISTRATION USING PHASE CONGRUENCY AND NONLINEAR DIFFUSION-BASED SIFT

Due to multi speckle noise the performance of SIFT is reduced and hence here, the improved SIFT for SAR image registration is used. The focuses of the algorithm are 1)use nonlinear diffusion to generate scale space 2)introduce the robust approach to compute the gradient information involved in NDSS for SAR image 3)outlier removal using phase congruency.

A.*Creation of scale space with Nonlinear Diffusion*

In the SIFT method, the GSS can be produced from the convolution of original image with Gaussian filters at different scales[2].Noise can be removed by Gaussian smoothing., but however some important fine details may be lost which leads to bad feature detection. It is defined as,

$$\frac{\partial f(x,y)}{\partial t} = f_t = (c(x,y,t)\nabla f)$$
$$=c(x,y,t)\Delta f + \nabla c.\nabla f$$

Where t is the scale parameter:
Div is the divergence;
Are the gradient and laplacian operator
C(x,y,t) is the diffusion coefficient, and it is a constant, which is equivalent to Gaussian smoothing

$$c_1 = e^{\left(\left(\frac{|\nabla f|}{k}\right)^2\right)}$$

$$c_2 = \frac{1}{1+\left(\frac{|\nabla f|}{k}\right)^2}$$

The parameter K is constant factor that controls the level of diffusion, and determines which edge has to be selected. If the value of K is larger the there is less edge information. The K value can be either empirically fixed or estimated.

The scale space produced by the two coefficients are different, first one is enhanced high-contrast edges rather than low contrast edges, and the latter one wide region over small region .In the above c_2 is considered as diffusion coefficient.

Since, there is no analytical solution for solving nonlinear diffusion equation ,the additive operator splitting(AOS)scheme is used.

$$f^{k+1} = (I - t\sum_{l=1}^{m} A_l(f^k))^{-1} f^k$$

In the creation of NDSS, the gradient is needed due to multi speckle noise it cannot be applied for SAR images. ROEWA is introduced against the multi speckle noise through the two gradient computation method. The multiscale representation of a SAR is generated can be given by a expression;

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$$\sigma_i(o,s) = \sigma_0 2^{0+\frac{s}{S}}, o\epsilon[0,\ldots,O-1], s\epsilon[0,\ldots.s+2, i\epsilon[0,\ldots W-1]]$$

Where is the base scale value, and W is the total number of smoothened image; o and s are the index of octave O and sublevel S.

Algorithm –Multiscale representation generates by nonlinear diffusion

Input: image $f^{0,}$ contrast factor K, scale level σ_i

For i=0→W-1 **do**

1) Compute scale value $t_{i.}$

2) Deduce diffusion coefficient c based on image gradient │∇f│obtained with ROEWA.

3) Compute matrix $A_l(f^i)$.

4) Update iteratively f based on AOS scheme:

$$f^{i+1} = \left(I - (t_{i+1})\sum_{i=1}^{m} A_{i(f^i)}\right)^{-1} f^i$$

If o_i+1>o_i**then**

Downsample the image f^i, and modify contrast factor K value

End if

End for

Output: a stack of smoothened image f^i,i=0,…..W-1

B. Removal of outlier using phase congruency

Due to the presence of multi speckle noise, a large number of unreliable kepoints may be detected, these unreliable keypoints leads to inaccurate matching. So that we introduced a concept of phase congruency. The phase congruency information is the image obtained by analyzing the lograthamic Gabor filter response over different orientation and scale. The outlier is accomplished by following steps:

1)Compute phase congruency information at each point in the reference image and the sensed image; the correspondence phase congruency information can be defined as

$$P(x,y) = \frac{\sum_n W(x,y)[A_n(x,y)\Delta\phi_n(x,y) - T]}{\sum_n A_n(x,y) + \in}$$

Where (x,y) indicates the coordinate of a point

subscript n is the scale of the filter

W(x,y) is the weighting factor based on frequency spread

A_n(x,y)and ϕ_n(x.y) is the amplitude and phase at scale n

2)For the SAR image ,If the phase congruency value is larger than the threshold ie.,P_i>=th, then the point is validated. If P_i below th, then the point is rejected

IV EXPERIMENTAL RESULTS AND ANALYSIS

- SIFT Feature extraction
- Feature matching
- Image registration
- Performance Measures

Module description

A.SIFT FEATURE EXTRACTION:

Scale Invarientfeature transform is a point selection method that selects the specific edge points in the image. The derivative of the images is calculated .The calculated values gives the changes in the color and the gray scale values of the image which indicates the information in the image. The Laplacianfunction calculates the edges in the images based on the derivative values. The values are then arranged in order in a matrices format. The values in the particular circle region is first chosen. The values in the chosen region were dilated. In the dilation process the values are compared and the values that have the lowest values are combined. Then the values that having the minimum values are then removed. The resulting points are saved as the HRL points. The obtained HRL points are then used along with a image in order to find the main orientation points in the images.

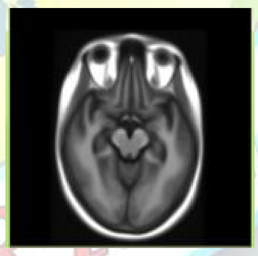

Figure Reference Image

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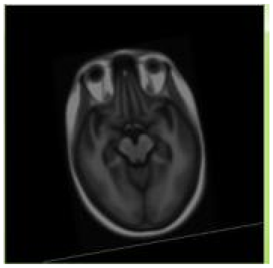

Figure Target Image

B.FEATURE MATCHING:
Calculate the number of matching points. Key points having similar invariant descriptors are considered as the matching points. The similarity is identified with the help of the distance calculation .the features that were having similar value will have small distance compared to others. T he matching points identifies the similar portions in the images. The matching points were then used for the transformation of the image.

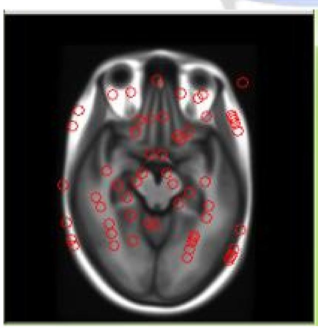

Figure Keypoints Image1

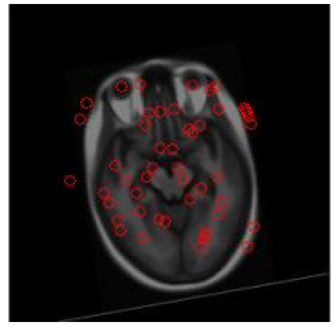

Figure Keypoints Image2

C. IMAGE REGISTRATION

The process of comparing reference image and target image using SIFT algorithm and by using match points andkeypoints the registration of an image is performed

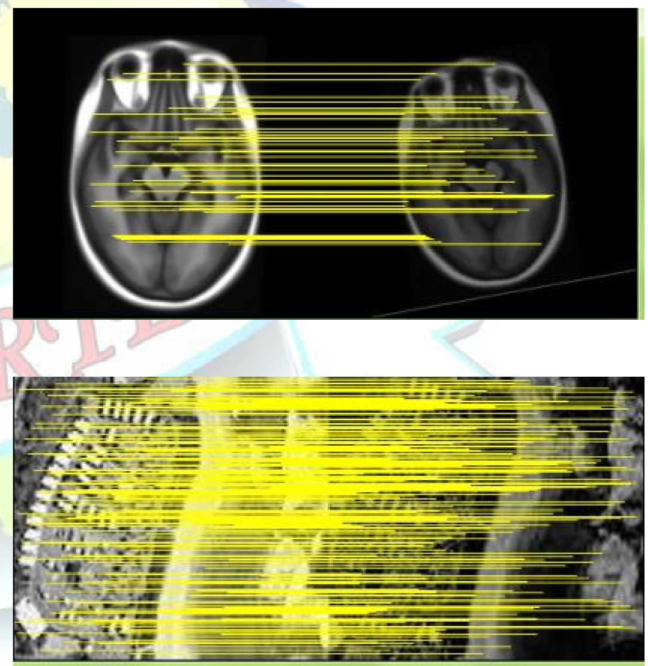

Figure Matching Image Keypoint

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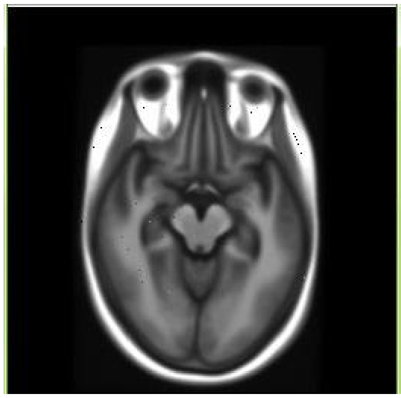

D. SPERFORMANCE MEASURES

The performance of the process is measured in-terms of the Root Mean Square Error

. The RMSE is measured using the following formula

$$RMSE = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(x_i - x_i')^2 + (y_i - y_i')^2}$$

(xi,yi)denotes the reference image pixels.
(xi',yi')denotes the target image pixels.
n denotes the number of pixels.

SOFTWARE REQUIREMENTS:
OS: Windows
Software: MATLAB

HARDWARE REQUIREMENTS:
Processor :Intel Pentium
RAM:2GB

SAR images	method	Number of keypoints	RMSE/pixel	$RMS_{1,00}$/pixel	Time/s		
		Reference image	Sensed image	Match			
Data set 1	BFSIFT	1940	1902	5	8.35	5.42	45.79
	SIFT+NDSS	3237	3291	12	1.17	1.14	39.52
	Our approach	1914/3237*	1807/3291	12	0.81	0.83	39.04
Data set 2	BFSIFT	556	335	14	24.47	23.06	41.12
	SIFT+NDSS	793	440	20	2.89	2.86	13.53
	Our approach	337/793	230/440	11	0.94	0.95	16.61
Data set 3	BFSIFT	590	503	4	0.95	0.97	38.72
	SIFT+NDSS	796	648	6	0.65	0.70	13.29
	Our approach	578/796	499/648	4	0.49	0.51	15.85

SOFTWARE DESCRIPTION

MATLAB is a high-level technical computing language and interactive environment for algorithm development, data

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visualization, data analysis, and numerical computation. Using MATLAB, you can solve technical computing problems faster than with traditional programming languages, such as C,C++, and Fortran..MATLAB is a data analysis and visualization tool which has been designed with powerful support for matrices and matrix operations. As well as this, MATLAB has excellent graphics capabilities, and its own powerful programming languages. One of the reasons that MATLAB has become such an important tool is through the use of sets of MATLAB programs designed to support a particular task. These sets of programs

Are called tool boxes, and the particular tool box of interest to as is the image processing toolbox. Rather than give a description of all of MATLAB's capabilities we shall restrict ourselves to just those aspects concerned with handling of images. we shall introduce functions, commands and techniques as required. MATLAB'S standard data type is the matrix all data are considered to be matrices of some sort. Images, of courses, are matrices whose elements are the gray values(or possibly the RGB values)of its pixels. single values are considered by MATLAB to be matrices, while a string is merely a matrix of characters; being the string's length. In this chapter we will look at the more generic MATLAB commands, and discuss images in further chapters.

When you start up MATLAB, you have a blank window called the command window in which you enter commands. given the vast number of MATLAB's functions, and the different parameters they can take, a command line style interface is in fact much more efficient than a complex sequence of pull down menus. You can use MATLAB in a wide range of applications, including signal and image processing, communications, control design, test and measurement financial modeling and analysis. Add-on tool boxes (collections of special-purpose MATLAB functions)extend the MATLAB environment to solve particular classes of problems in these applications areas. MATLAB provides the number of features for documenting and sharing your work. You can integrate your MATLAB code with other languages and applications, and distribute your MATLAB algorithm and applications.

When working with images in MATLAB, there are many things to keep in mind such as loading an image, using the right format, saving the date as different data types, how to display an image, conversion between different image formats. Image processing toolbox provides a comprehensive set of reference-standard algorithms and graphical tool for image processing, analysis, visualization, and algorithm development. You can perform image enhancement, image de-blurring, feature detection, noise reduction, image segmentation, spatial transformations, image registrations. Many functions in the toolbox are multithreaded to take advantage of multi-core and multiprocessor computers. MATLAB and images

- The help in MATLAB is very good, use it!
- An image in MATLAB is treated as a matrix
- Every pixels is a matrix element
- All the operators in MATLAB defined on matrices can be used on images:+,-,*,/,^, sqrt, sin, cos etc.,
- MATLAB can import/export several image formats
    - BMP(Microsoft Windows Bitmap)
    - GIF(Graphics interchange files)
    - HDF(Hierarchical Data Format)
    - JPEG(Joint Photographic Experts Group)
    - PCX(Paint Brush)
    - PNG(Portable network graphics)
    - TIFF(Tagged Image File Format)
    - XWD(X Window Dump)
    - MATLAB can also load raw-data or other types of image data.
    - Data types in MATLAB.
    - Double (64-bit double –precision floating point)
    - Single (32-bit single-precision floating point)
    - Int 32(32-bit signed integer)
    - Int 16(16-bit signed integer)
    - Int 8(8-bit signed integer)
    - Uint32(32-bit unsigned integer)
    - Uint16(16-bit unsigned integer)
    - Uint8(8-bit unsigned integer)

Images in MATLAB
Binary images :{0,1}

- Intensity images :[0,1] or uint8,double etc.
- RGB images: m-by-n-by-3
- Indexed images: m-by-3 colour map
- Multidimensional images m-by-n-by-p(p is the number of layers)

IMAGE TYPES IN MATLAB

Outside MATLAB image may be of three types that is black & white, gray scale and colored. In MATLAB, how ever, there are four types of images. Black and white images are called binary images, containing numbers in the range of 0 to 255 or 0 to1 .Colored images may be represented as RGB image or indexed images.

In RGB image there exist three indexed images. First image contains all the red portion of the image, Second green and Third contains the blue portion. So for a 640x480sized image

The matrix will be 640x480x3. An alternative method of colored image representation is indexed image. It actually exist of two matrices namely image matrix and map matrix.

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Each color in the image is given an indexed number and image matrix each color is represented as an index number. Map matrix contains the data base of which index number belongs to which color

IMAGE TYPE CONVERSION:

- RGB Image to Intensity Image(rgb2gray)
- RGB Image to Indexed Image(rgb2ind)
- RGB Image to Binary Image(rgb2bw)
- Indexed Image to RGB Image(ind2rgb)
- Indexed Image to Intensity Image(ind2gray)
- Intensity Image to Binary Image(im2bw)
- Intensity Image to Indexed Image(gray2ind)
- Indexed Image to Binary Image(im2bw)
- Intensity Image to RGB image(gray2ind,ind2rgb)

Key features

- High-level language for technical computing development environment for managing code, file, and data
- Interactive tools for interactive exploration, design and problems solved
- Mathematical function for linear algebra, statistics, Fourier analysis, filtering, optimisation and numerical integration
- 2-D and 3-D graphics functions for visualising data
- Tools for building custom graphical user interface
- Functions for integrating MATLAB based algorithm with external application and languages, such as C,C++,Fortran, Java, COM, and Microsoft Excel

CONCLUSION:

In this chapter, SAR image registration has been proposed with the combination of SIFT, non-linear diffusion and phase congruency. NDSS with ROEWA used to demonstrate on image. Phase congruency information used to reject the false keypoint in the reference image. By the comparison of NDSS+SIFT, the BFSIFT is introduced, the result has shown that the number of keypoints obtained using our approach is more than that by BFSIFT with bilateral filter. Then phase congruency information of keypoints, our method has a more improvement in match accuracy.

REFERENCES:

[1]F.Wang et al., “Unsupervised change detection on SAR image using triplet Markov field model,”IEEEGeosci. Remote sens.Lett,vol.10,no.4,pp.697-701,Jul.2013.

[2]D.G.Lowe,”Distinctive image feature form scale invariant keypoints,”Int.J.Comput.Vis.,vol.60,no.2,pp.91-110,Nov.2004.

[3]H.Goncalves,L.Corte-Real,and J.A.Goncalves,”Automatic image registration through image segmentation and SIFT,”IEEE Trans.Geosci.Remote Sens.,vol.49,no.7,pp.2589-2600,Jul.2011.

[4] Christo Ananth, R.Nikitha, C.K.Sankavi, H.Mehnaz, N.Rajalakshmi, “High Resolution Image Reconstruction with Smart Camera Network”, International Journal of Advanced Research in Biology, Ecology, Science and Technology (IJARBEST), Volume 1,Issue 4,July 2015, pp:1-5

[5]P.Schwind, S.suri, P.Reinartz, and A.Siebert,”Applicability of the SIFT operator for geometrical SAR image registration,”Int. J.Remote Sens., Vol.31,no.8,pp.1959-1980,Mar.201.0