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A Framework for Generic Image Registration

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***Abstract*-Image registration is the process of geometrically aligning two or more images taken at different times, at different orientation and with different sensors.It geometricallyaligns two images - the reference and sensed images. The present differences between images are introduced due to different imaging conditions. Image registration is a crucial step in all image analysis tasks in which the final information is gained from the combination of various data sources like in image fusion, change detection, and multichannel image Restoration. This paper aims to present a review of recent as well as classic image registration methods. The registration geometrically aligns two images (the reference and sensed images). The reviewed approaches are classified according to their nature (areabasedand feature-based) and according to four basic steps of image registration procedure: feature detection, feature matching, mappingfunction design, and image transformation and resampling .In this paper, a new rotation invariant and geometric features based image registration algorithm is proposed. Also, a hybrid filter for the noise removal is introduced which substantially removes the noise from the given noisy image.**

Index Terms: **registration, transformation, and control point, filter**

I. INTRODUCTION

Image registration is one of the most popular techniques [4] in the field of image processing. Registration is a process which determines the geometric view of the objects with the corresponding points in another view of that object or other object [8]. Image registration is the process of overlaying Images (two or more) of the same scene taken at different times, from different viewpoints, and/or by different sensors [5].Registration can be applied on 2D image, 3D image and physical arrangement of the object in space [7]. Registration is used in computer vision, medical imaging [5] military automatic target reorganization, and compiling and analyzing images and data from satellites. Registration is necessary in order to be able to compare or integrate the data obtained from these different measurements.

It is not simply mapping the two images because two images may be taken at different resolution, different time and different view point [9]. To make the registration of two images, transformation is needed so that, the each point of the image maps correctly. Here in this problem various algorithms are proposed so far [8]. According to the database of the Institute of Scientific Information (ISI), in the last ten years more than 1000 papers were published on the topic of image registration. A comprehensive survey of image registration methods was published in 1992 by Brown [1]. Methods [4] published earlier days are classic and those are still in use. It is found that the type of transformation used to register two images is one of the best ways to categorize the methodology and to assist in selecting techniques for particular applications [6]. Various types of transformations are there, what kind of transformation needs to be used that depends on the particular scenario. There are many image registration methods, and they may be used based on the particular circumstance [2-4]. Maintz has suggested a nine-dimensional scheme that provides an excellent categorization [4].

II. METHODOLOGY

A. Registration technique

Image registration technique is widely used in remote sensing, medical imaging, computer vision

etc. In general, its applications can be broadly classified into four main steps [3]. Those steps are given below.

B. Feature detection

First we have to understand that what kind of feature we should for our task, each and every feature should be detectable properly [6]. The detected feature setsin the reference and sensed images must have enough common elements, even in situations when the images do not cover exactly. Based on which properties we should choose the feature that is the most important note in a particular circumstance [3]. Salient and distinctive objects (closed-boundary regions, edges, contours, line intersections, corners, etc.) are manually or, preferably, automatically detected. For further processing, these features can be represented by their point representatives (centres of gravity, line endings, distinctive points), which are called control points (CPs) [10].

C. Feature matching

In the feature matching step, problems caused by incorrect feature detection or by image degradations can arise [4]. In this step, the correspondencebetween the features detected in the sensed image andthose detected in the reference image is established [2]. Various feature descriptors and similarity measuresalong with spatial relationships among the features areused for that purpose.

D. *Area-based methods*

Area-based methods put emphasis rather on the feature matching step than on their detection [5]. No features are detected in these approaches so the first step of image registration is omitted. The methods belonging to this class will be covered in sections corresponding to the other registration steps.

E. Feature-based methods

The second approach is based on the extraction of salient [5] structures–features—in the images. Significant regions (forests, lakes, fields), lines (region boundaries, coastlines, Roads, rivers) or points (region corners, line intersections, points on curves with high curvature) are understood as features here[10]. They should be distinct, spread all over the image and efficiently detectable in both images.

F. Transform model estimation

The type and parameters of the so-called mapping functions, aligning the sensed image with the reference image, are estimated [8]. The parameters of the mapping functions are computed by means of the established feature correspondence.

G. Image resembling and transformation

The sensed image is transformed by means of the mapping functions [9]. Image values in non-integer coordinates are computed by the appropriate interpolation technique.

In this paper we have proposed a methodology for generic image registration which is given here:

Step 1: read image

Step 2: pre-processing

Step 3: Image enhancement

Step 4: feature detection and feature matching

Step 5: output image

III. RESULT AND DISCUSSION

Area-based methods put emphasis rather on the feature matching step than on their detection [2]. No features are detected in these approaches so the first step of image registration is omitted [10]. The methods belonging to this class will be covered in sections corresponding to the other registration steps [1]. Area-based methods, sometimes called correlation-like methods or template matching merge the feature detection step with the matching part [5]. These methods deal with the images without attempting to detect salient objects.

Windows of predefined size or even entire images are used for the correspondence estimation during the second registration step.

$$CC(i,j) = \frac{\sum_W (W - E(W))(I_{(i,j)} - E(I_{(i,j)}))}{\sqrt{\sum_W (W - E(W))^2} \sqrt{\sum_{I_{(i,j)}} (I_{(i,j)} - E(I_{(i,j)}))^2}}$$

The classical representative of the area-based methods is the normalized CC and its modifications [9]. Sensed image and reference image are there; here we have used cross correlation to compute the maximum similarity between these two images. This measure of similarity is computed for window pairs from the sensed and reference images and its maximum is searched. The windowpairs for which the maximum is achieved are set as the corresponding ones [8]. If the sub pixelaccuracy of the registration is demanded, the interpolation of the CC measure values needs to be used. Although the CC based registration can exactly align mutually translated images only, it can also be successfully applied when slight rotation and scaling are present.

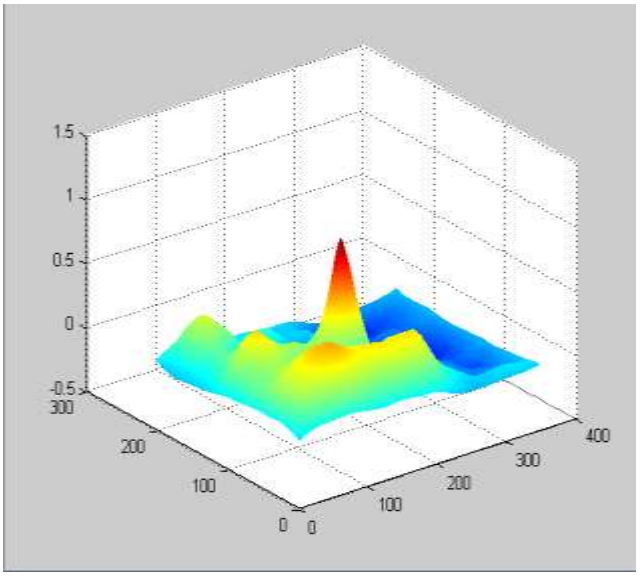

Fig. 1: maximum similarity point using normalized cross-correlation

IV. CONCLUSION

Area-based methods should be applied when the images have not specific details and the distinctive information [4]. Area-based methods have two main limitations. Reference and sensed images must have somehow ‘similar’ intensity functions. Either identical, that’s why we have used here cross correlation method [6]. From the geometric point of view, only shift and small rotation between the images are allowed when using area based methods [2]. To increase the searching speed, area-based methods often employ pyramidal image representations and sophisticated optimization algorithms to find the maximum of the similarity matrix.

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