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# Image Registration Using Intensity Based Technique

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***ABSTRACT*:** *In many practical areas, like Computer Vision and Pattern Recognition, Medical Image Analysis and Remote Sensing Data Processing, super resolution imaging, it is required to align the images. Image registration is the process of overlaying two or more images of the same scene taken at different times, from different viewpoints, and/or by different sensors. Image registration is a prerequisite step prior to image fusion or image mosaicing. It is a fundamental image processing technique and is very useful in integrating information from different sensors, finding changes in images taken at different times, inferring three-dimensional information from stereo images, and recognizing model-based objects. The registration geometrically aligns the reference and sensed images. This paper defined intensity based techniqe is used for image registration with the help of matlab software and analysis of various simulation output.*

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***Keywords— Image Registration, Reference Image, Sensed Image, Transformation, Fixed Image, Moving Image.***

## I: INTRODUCTION

Image registration is the process of overlaying two or more images of the same scene taken at different times, from different angles, and/or by different sensors. It geometrically aligns two images the reference and sensed images. The need for image registration arises as a practical necessity in many diverse fields. A good alignment of images is necessary for (i) Integrating information from different images (ii) Finding changes in images taken at different times or under different conditions, (iii) model based matching for the purpose of segmentation or object recognition. It is a prerequisite step prior to image fusion or image mosaic. It is a fundamental image processing technique and is very useful in integrating information from different sensors, finding changes in images taken at different times, inferring three-dimensional information from stereo images, and recognizing model-based objects. To register two images, a transformation (spatial mapping) must be found so that each location in one image can be mapped to a new location in the second. This mapping should optimally align the two images wherein the optimality criterion itself depends on the actual structures objects in the two images that are required to be matched. Registration can be performed either manually or automatically. The former refers to human operators manually selecting corresponding features in the images to be registered. In order to get reasonably good registration results, an operator has to choose a considerably large number of feature pairs across the whole images, which is not only tedious and wearing but also subject to inconsistency and limited accuracy. The basic concept of image registration is shown in Fig 1.1 in which gray scale image is registered. Fig 1.1 and Fig 1.2 show two input images, reference image and sense image respectively, which are taken from different position at same viewing angle which causes translation, rotation and scale between two images. By using different image registration algorithm, the above given parameters can be found and image can be registered. Fig 1.3 shows the registered image on reference image.

1.1 Referenced Image

1.2 Sensed Image

1.3 Registered Image

## II: BASIC STEPS IN IMAGE REGISTRATION

Feature detection: 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 (centers of gravity, line endings, distinctive points), which are called control points (CPs) in the literature.

Feature matching: In this step, the correspondence between the features detected in the sensed image and those detected in the reference image is established. Various feature descriptors and similarity measures along with spatial relationships among the features are used for that purpose.

Transform model estimation: The type and parameters of the so-called mapping functions, aligning the sensed image with the reference image, are estimated. The parameters of the mapping functions are computed by means of the established feature correspondence.

Image re-sampling and transformation: The sensed image is transformed by means of the mapping functions. Image values in non-integer coordinates are computed by the appropriate interpolation technique.

## III: INTENSITY BASED IMAGE REGISTRATION

The intensity-based registration methods operate directly on the image gray values, without reducing the gray-level image to relatively sparse extracted information. The basic principle of intensity-based techniques is to search, in a certain space of transformations, the one that maximizes (or minimizes) a criterion measuring the intensity similarity of corresponding voxels. Some measures of similarity are sum of squared differences in pixel intensities, regional correction, or mutual information. Mutual information has proved to be an excellent similarity measure for cross-modality registrations, since it assumes only that the statistical dependence of the voxel intensities is maximal when the images are geometrically aligned. The intensity similarity measure, combined with a measure of the structural integrity of the deforming scan, is optimized by adjusting parameters of the deformation field. Such an approach is typically more computationally demanding, but avoids the difficulties of a feature extraction stage.

## IV: ALGORITHM

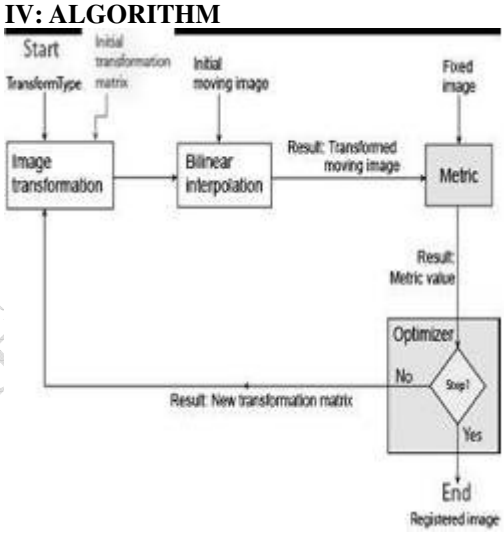


FIG2.1 Intensity Based Image Registration Algorithm

In this algorithm it required to specify a pair of images, a metric, an optimizer, and a transformation type. The metric defines the image similarity metric for evaluating the accuracy of the registration. This image similarity metric takes two images and returns a scalar value that describes how similar the images are. The optimizer defines the methodology for minimizing or maximizing the similarity metric. The transformation type defines the type of 2-D transformation that brings the misaligned image (called the moving image) into alignment with the reference image (called the fixed image).The process begins with the transform type you specify and an internally determined transformation matrix. Together, they determine the specific image transformation that is applied to the moving image with bilinear interpolation. Next, the metric compares the transformed moving image to the fixed image and a metric value is computed. Finally, the optimizer checks for a stop condition. A stop condition is anything that warrants the termination of the process. In most cases, the process has reached a point of

diminishing returns or it has reached the specified maximum number of iterations. If there is no stop condition, the optimizer adjusts the transformation matrix to begin the next iteration.

**V: SIMULATION OUTPUT**

Fig3.1 Fixed Image

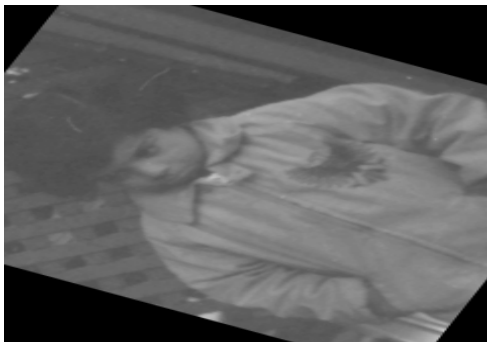

Fig 3.2 Moving Image (Rotated By 65 Degree)

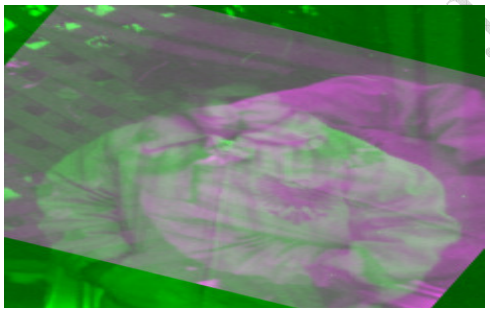

Fig 3.3 Display Fixed and Moving Image combined

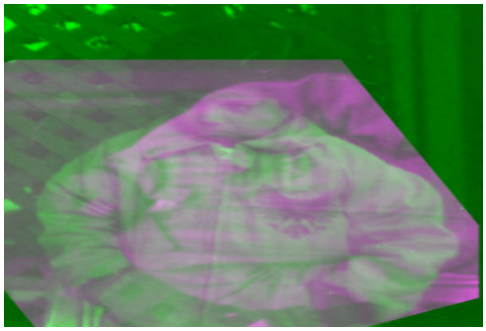

Fig 3.4 Registered Images

Above figures shows result of image registration using intensity based techniques. In this simulation the algorithm is used show in fig 2.1 for this registration process two figures are specified. Fig 3.1 is called fixed image and fig 3.2 is called moving image which is rotated anticlockwise by 65 degree. So moving image is registered on fixed image. Fixed image is reference image. Fig 3.3 shows fixed and moving image in combined. The pink colour define intensity mismatch in two images. And fig 3.4 is registered image using above algorithm. This algorithm can be developed in matlab software using various toolboxes. In this algorithm there are some limitations, when difference between two images is very large then it could not be registered properly.

**VI: CONCLUSION**

It's shown that Image registration is one of the most important tasks when integrating and analyzing information from various sources. It is a key stage in image fusion, change detection, super-resolution imaging, and in building image information systems, among others. This report gives describes classical and up-to-date registration methods, classifying them according to their nature as well as according to the four major registration steps. Here this paper has described intensity based methods and application of image registration and how can they be integrated to generate the optimal solution for a particular application.

**VII: FUTURE WORK**

Although a lot of work has been done in intensity based image registration, still remains an open problem. Here in this paper automatic intensity based technique used for image registration. In future it could be developed some robust algorithms for image registration using image processing toolbox in MATLAB with using different transformation based techniques and compare their result and developing best algorithms compare to existing algorithms and will helpful in many practical application of image registration.

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