



## Introduction to Image Registration in Remote Sensing using Matlab

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### Abstract

*Image registration is used as a preliminary step in other image processing applications. It is difficult to find an accurate, robust, and automatic image registration method, and most existing image registration methods are designed for a particular application. Image registration is mostly used in medical and remote sensing applications. In remote sensing applications data is captured from satellites so it is very noisy and difficult to recognize the exact places so, image registration is needed. For this she used Matlab 7.0 R14. In Matlab for image registration various methods and in this paper I studied that methods.*

**Keywords** — *Image Registration, Remote Sensing, Matlab, Control Point Registration*

### Introduction

Image registration in remote sensing is the process of geometrically aligning one image to another image of the same scene taken from different viewpoints at different times or by different sensors. It is an important image processing procedure in remote sensing and has been studied by remote sensing image processing professionals for several decades. Nevertheless, it is still difficult to find an accurate, robust, and automatic image registration method, and most existing image registration methods are designed for a particular application. Image registration determines the correspondences between locations within multiple images. It helps overcome issues such as image rotation, scale, and skew that are common when overlaying images. Image registration is often used as a preliminary step in other image processing applications.

This process involves designating one image as the reference (also called the reference image or the fixed image), and applying geometric transformations to the other images so that they align with the reference. Images can be

misaligned for a variety of reasons. Commonly, the images are captured under variable conditions that can change camera perspective. Misalignment can also be the result of lens and sensor distortions or differences between capture devices. A geometric transformation maps locations in one image to new locations in another image. The step of determining the correct geometric transformation parameters is key to the image registration process.

There are 3 image registration methods:-

- Intensity-Based Automatic image registration
- Control Point Registration
- Finding Rotation and Scale of an Image Using Automated Feature Matching

### Methodology

#### A. Intensity-Based Automatic image registration

Intensity-based automatic image registration is an iterative process. It requires that you 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).

### B. Control Point Registration

The parameters of the transformation required to bring an image into alignment with another image. In point mapping, you pick points in a pair of images that identify the same feature or landmark in the images. Then, a geometric mapping is inferred from the positions of these control points.

### C. Finding Rotation and Scale of an Image Using Automated Feature Matching

This method shows how to automatically align two images that differ by a rotation and a scale change. Instead of using a manual approach to register the two images, it utilizes feature-based techniques.

### D. Supported image files

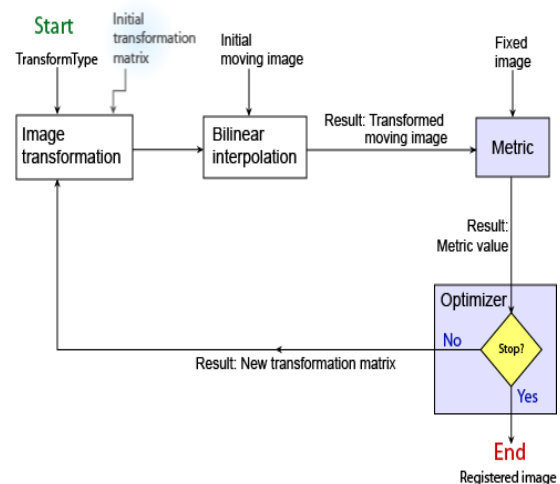
BMP — Windows Bitmap, JPEG — Joint Photographic Experts Group , PNG — Portable Network Graphics, CUR — Cursor File, JPEG 2000 — Joint Photographic Experts Group 2000, PPM — Portable Pixmap,GIF — Graphics Interchange Format , PBM — Portable Bitmap, RAS — Sun Raster,HDF4 — Hierarchical Data Format, PCX — Windows Paintbrush, TIFF — Tagged Image File Format,ICO — Icon File, PGM — Portable Graymap, XWD — X Window Dump

Other than this type of image files, matlab also support the large size binary images also, which extension could be .dat,.slc,.raw,etc..

## Architecture

### A. Intensity-Based Automatic image registration

The process begins with the transform type you specify and an internally determined transformation matrix. Together, here 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.

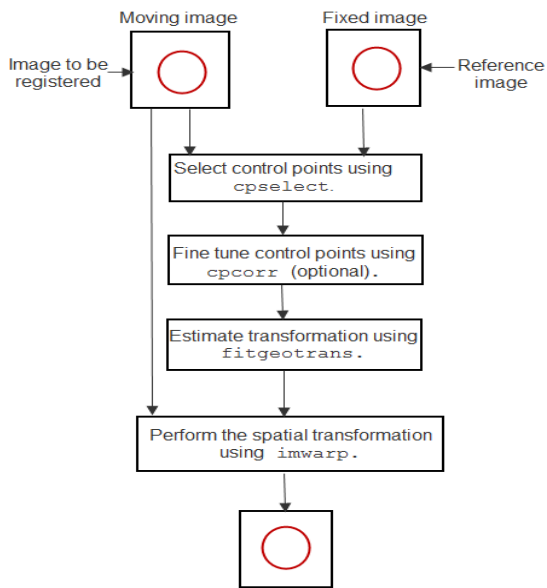


**Fig.1** Architecture of Intensity based Image Registration

- Perform intensity-based image registration with the following steps:
  1. Read the images into the workspace with imread.
  2. Create the optimizer and metric with imregconfig.
  3. Register the images with imregister.
  4. View the results with imshowpair or save a copy of an image showing the results with imfuse.

## B. Control Point Registration

The following figure provides a graphic illustration of this process. This process is best understood by looking at an example.



**Fig.2** Architecture of Control Point based Image Registration

## C. Find Image Rotation and Scale Using Automated Feature Matching

In this method, she will use detectSURFFeatures and vision. Geometric Transform Estimator System object to recover rotation angle and scale factor of a distorted image. She will then transform the distorted image to recover the original image.

- Perform Image Rotation and Scale Using Automated Feature Matching with the following steps:

- 1: Read Image
- 2: Resize and Rotate the Image
- 3: Find Matching Features Between Images
- 4: Estimate Transformation
- 5: Solve for Scale and Angle
- 6: Recover the Original Image

## Conclusion

Image registration is the process of transforming different sets of data into one coordinate system. Data may be multiple photographs, data from different sensors, times, depths, or viewpoints. Image registration is maximum used in medical

imaging and in the remote sensing image processing. By automatic image registration she can easily recognize that two different images are of same area or different. Control Point selection image registration is used for manually registering two images by choosing control points in two images by user.

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