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− A Short Note

IMAGE REGISTRATION METHODS

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ABSTRACT

Image registration, an important preprocess in image fusion, is the process of geometrically aligning two or more images. The image registration can be applied for fusion of medical images, satellite images or images obtained by different sensors at the same time or by same sensor at different times. Image registration involves selection of a control point, which can be done manually or automatically. Manual selection of control point, though simple, is time consuming and can be inaccurate. Automatic image registration does not involve human intervention and many algorithms are available in the literature. Though one algorithm cannot be applied to all applications, algorithms should not be very much application specific. In this paper we study different methods for image registration of different types of images.

Key words: Image registration, Automatic registration, Evalaution.

INTRODUCTION

Image registration mainly deals with overlaying of two (or more) images to detect changes, to identify targets or for medical diagnosis. Images obtained from different angles of the same scene can be combined through image registration followed by image fusion. This is referred to as multiview analysis[1]. Images of the same target area taken at different times can be registered and fused to detect changes over a certain period of time. This is referred to as multitemporal analysis[1]. The information that can be obtained from an image depends on the sensor used. In remote sensing applications different sensors like multispectral, infrared, panchromatic, optical etc, are used to obtain images. In medical applications different sensors like CT, MRI, and X-ray are used to obtain images of the same organ. Such images need to be combined to obtain more information than can be provided

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by the individual images. This is referred to as multimodal analysis[1]. In scene to model registration[1] or template registration[2], images of a scene and its model or a template are registered for analysis or classification. All these require image registration which involves a transformation that can align points in an image to the corresponding points in the second or subsequent images[2].

Steps in image registration

Image Registration normally involves steps of preprocessing, feature detection, feature matching, transform/model estimation and image resampling[1,3]. In feature detection the salient features like regions[4-6], line features[7-9], edges[10-12], and corners[13-15] are identified. The control points can be identified manually or automatically. Feature matching involves matching the features between the sensed image and the reference image. This includes area based methods like correlation based methods, fourier methods, mutual information methods and feature based methods using spatial relations, invariant descriptors, pyramids and wavelets. This is followed by the computation of the mapping functions including global mapping methods, local mapping methods, mapping by radial basis functions. This is followed by image transformation and resampling of the sensed image.

Automatic image registration

Automatic registration of images has been developed to reduce manual errors, time taken and to have real time registration of images. Most of the earlier literature covered multiresolution approaches, mutual information or both like DWT[16], Mutual information[17], SAD and MI[18], DWT and MMI[19,20] MI and SI[21]. Automatic registration based on heterogeneous futures has been discussed in[22]. Biological Computing techniques like genetic algorithms[23] and particle swarm optimization[24] have also been proposed to find a good initialization of the registration parameters in the literature.

Evaluation of image registration

Any system needs to be evaluated for its accuracy and efficiency using suitable parameters. Image registration can be evaluated using localization error, alignment error and matching error. Localisation error is concerned with the displacement of control points due to inaccuracy in the detection step[1]. This can be minimized by using a good detection algorithm. Matching error relates to the number of false matches that occur when correspondence is established between control points. Alignment error relates to the mapping model that has been used and can be evaluated by finding the mean square error at control points or test points.

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