A fast image registration approach based on SIFT key-points applied to super-resolution

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Abstract: An accurate image registration is a fundamental stage in many image processing problems. In this paper, a new and fast registration approach based on scale invariant feature transform (SIFT) key-points, under Euclidean transformation model, is proposed. The core idea of the proposed method is estimation of rotation angle and vertical and horizontal shifts using averaging of differences of SIFT key-point pairs locations. The method is simple but requires some tuning modules for accurate estimation. Orientation modification and compensation and shift compensation are some of the proposed modules. The proposed method is fast, about ive times faster than RANSAC method for model parameters estimation. The accuracy of the proposed method is compared with some popular registration methods. Various comparisons have been done with LIVE database images with known motion vectors. The experimental results over two real video sequences show the high performance of the proposed algorithm in a super-resolution application.

Keywords: image registration, super-resolution, SIFT key-points

1 INTRODUCTION

One of the most critical aspects of many applications in image processing and computer vision, including super-resolution, is the image registration problem. 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. It geometrically aligns two images, the reference and sensed images.[1]

In image processing literatures, a variety of registration categories has been used. Regarding the transformation model among the images (such as translation, affine or projective), the registration method may be different. However, they can be categorised into two main approaches: area-based methods and feature-based methods. While the former uses the information from all pixels, the latter requires only a sparse set of feature correspondences to fit the motion model.[2]

The Lucas–Kanade registration algorithm,[3] is a famous area-based method, which is the basis of many other methods.[4,5] Their approach is based on a Taylor series approximation of the images. The motion parameters are the unknowns in the approximation, and they can be computed from the set of equations that can be derived from this approximation. As Taylor series only give a good approximation for small offsets, these registration methods are generally applied iteratively using a Gaussian pyramid. Vandewalle *et al.*[6] used a frequency-based registration method, where at first, the rotation parameters are estimated from a radial projection of the absolute values of the Fourier transform image. A simple one-dimensional correlation can be performed to compute the rotation angle from the projections for two images. Then, shifts are estimated from the linear phase difference between the rotation corrected images.

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