Abstract

The thesis mainly deals with the correspondence problem encountered in stereo vision. Both area based and feature based stereo algorithms have been developed. The area based stereo is applied on satellite stereoscopic images. In the process a digital elevation model is developed for SPOT stereoscopic images using correlation function as a tool for matching.

For the feature based stereo a new algorithm is proposed for stereoscopic matching. This algorithm is basically an extension of Marr-Poggio and Grimson's approach (MPG) for solving the stereoscopic problem. As edges are the criterion for the invariances between the stereo images, the detection of edges is carefully handled. The images are first filtered by a low pass (LP) filter to eliminate noise and then a single Laplacian of Gaussian (LoG) filter of suitable kernel–size is applied to find the edge-maps. A fully automated algorithm for designing image specific two-dimensional IIR recursive filters with an approximately linear phase has been developed. Complete separability of the magnitude and phase generating transfer functions is assumed. An extension of the Chebyshev filter design algorithm has been used to design the magnitude transfer function and a specifiable number of allpass sections equalize the group delay. Symbolic computation routines have been used with the proposed algorithm to reduce algebraic computational burden. Lowpass filters of low orders have been realized and applied on laboratory condition images using an easy recursive reconstruction algorithm.

The two images are matched by a new stereo algorithm. This algorithm is new in the sense that after being processed by the LP and LoG filters, the images are set to new distinct patterns and then a modified version of Grimson's matching algorithm is applied. Figural continuity test is also carried out but in a different way. The disparities obtained are more accurate than that in MPG's algorithm. The computational complexities and the dynamic memory requirement are also less.

A robust corner detection algorithm is also developed for matching of corners by the theory of complex moments. The corners are found from an edge-map which is itself robust in nature. The gaps are filled up for disambiguation in finding of corners. Corner is defined

very rigidly so that all major corners of an image can be found. The algorithm is fully automated and can be applied to any type of images without redefining any parameters. Actual noisy images are tested and good results are obtained.

For an approximate epipolar registration of stereo images the transformation between the images can be approximated from affine one to a rotational and translational one. This property can be used to find the point of correspondences of stereo images in conjunction with complex moments which are themselves rotational invariant. Corners are chosen as features and around them an intensity kernel is defined and complex moments are calculated. Then the correspondence points are found from similar corners by finding the L_2 norm of the invariances between the two images. From the matched points the respective affine model of the images are created.