ABSTRACT

A methodology based on feature correspondences in 3-D world coordinate space has been proposed to determine the 3-D motion parameters and noise-free structural information of objects from a sequence of stereo views. This method has the significant advantage over the single-sensor tracking of objects in the sense that, stereo provides direct and more accurate values of the 3-D coordinates of feature points. It is shown that direct correspondences in 3-D domain provides a good measure for estimating noise level and makes the method computational less intensive. The method also provides the flexibility of handling occlusion or multiple object motion.

Preprocessing algorithms are provided to track projections of moving objects on the image planes and generate feature correspondences. Once the direct correspondences of features in 3-D domain has been established, the constraints of rigid body movement has been used to estimate the level of noise contamination in feature positions. At the next stage, a scheme is suggested to determine the motion parameters of a moving object in 3-D space. The motion parameters are evaluated to a greater accuracy even in the presence of noise. Effect of noise, number of point correspondences, parameters of the system setup, object motion and structure on the results are studied. Occlusion is solved using displacement directions and the developed rigid body relations of features as the criteria. Finally, an effort is made to determine the noise-free 3-D structural information of a moving object, in terms of its true or actual 3-D feature positions. The input at this stage of the work are the noisy feature correspondences and the values of the

motion parameters of objects. Results are shown extensively on various simulated data of noisy feature correspondences and also on a few real-world dynamic stereo data based on laboratory generated scenes.

KEY WORDS

Dynamic Scene Analysis, Dynamic Stereo, Rotation Parameters, Translation Parameters, Feature / Point Correspondence, Matched_Stereo_Sequence_Features (MSSF), Displacement vector, Rigidity, Deformity, Gaussian Noise, Standard deviation, Noise Handling Scheme, Less noisy features, Relative Error, Figure of Merit, Least Square method, Occlusion, Noise Free Structure, Noise Polyhedron, Noisy Window, Tracking, Edge detection, Corner Detection, Thinning, Template Matching.