Conditions for segmentation of motion with affine fundamental matrix

Abstract

Various computer vision applications involve recovery and estimation of multiple motions from images of dynamic scenes. The exact nature of objects' motions and the camera parameters are often not known a priori and therefore, the most general motion model (the fundamental matrix) is applied. Although the estimation of a fundamental matrix and its use for motion segmentation are well understood, the conditions governing the feasibility of segmentation for different types of motions are yet to be discovered. In this paper, we study the feasibility of separating a motion (of a rigid 3D object) with affine fundamental matrix in a dynamic scene from another similar motion (unwanted motion).We show that successful segmentation of the target motion depends on the difference between rotation angles and translational directions, the location of points belonging to the unwanted motion, the magnitude of the unwanted translation viewed by a particular camera and the level of noise. Extensive set of controlled experiments using synthetic images were conducted to show the validity of the proposed constraints. The similarity between the experimental results and the theoretical analysis verifies the conditions for segmentation of motion with affine fundamental matrix. These results are important for practitioners designing solutions for computer vision problems.