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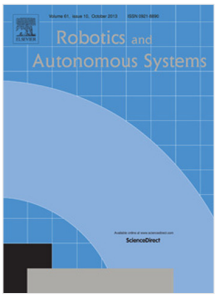

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Camera Relative Pose Estimation for Visual Servoing using Quaternions

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Abstract

We present a novel approach to estimate the rotation and translation between two camera views from a minimum of five matched points in the images. Our approach simultaneously recovers the 3D structure of the points up to a common scale factor, and is immune to a variety of problems that plague existing methods that are based on the Euclidean homography or Essential matrix. Methods based on homography only function when feature points are coplanar in 3D space. Methods based on the Essential matrix often loose accuracy as the translation between two camera views goes to zero or when points are coplanar. By recovering the rotation and translation independently using quaternions, our algorithm eschews the shortcomings of these methods. Moreover, we do not impose any constraints on the 3D configuration of the points (such as coplanar or non-coplanar constraints). Our method is particularly well-suited for Position-Based Visual Servoing (PBVS) applications. Investigations using both simulations and experiments validate the new method . Comparisons between the proposed algorithm and the existing algorithms establish that our algorithm is robust to noise. A Matlab implementation of our algorithm is available online and free.

Keywords: Five point algorithm, camera pose estimation, visual servoing, vision based estimation, relinearization

Supplementary Material

Video of the simulations and experiments is available at https://youtu.be/pxMl537EEdc. The simulation code and the Sphero formation control package can be download from https://goo.gl/QH5qhw.

1. Introduction

Estimating the rotation and translation (i.e., pose) between two camera views using acquired images is called camera pose estimation. Pose estimation has a variety of applications in computer/machine vision, robotics, autonomous vehicles and navigation. For example, in vision-based control and visual odometry, position and orientation of a robot

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