A new method for solving 6D Image-Based Visual Servoing with virtual composite camera model

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Abstract:
This paper presents a new formulation to the open problem of 6D Image-Based Visual Servoing (IBVS). The main goal is to control the pose of an object using visual information from stereo cameras. In this article we introduce a novel image feature representation based on virtual orthogonal cameras to map 6D Cartesian poses to 6D visual poses defined in a Virtual Visual space (Image space). This new model is used to compute a full-rank Image Jacobian matrix (J_{img}), which overcomes several common problems exhibited by the classical image Jacobians, e.g., Image space singularities and local minima. This Jacobian is a fundamental key for a Image-Based control design, where a stereo camera system can be used to drive a robot manipulator. The properties of the proposed visual model are validated analytically, in simulation and in a real robot.

Stichworte:
Jacobian matrices; image representation; manipulators; pose estimation; robot vision; stereo image processing; visual servoing; 6D image-based visual servoing; IBVS; image Jacobian matrix; image feature representation; object pose control; robot manipulator; stereo