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Abstract—Motion tracking and object recognition often use cameras that are mounted in motion platforms like pan-tilt units, linear tables and even robots. Tracking can be automated by visually servoing the platform’s degrees-of-freedom (DOF) thus keeping the camera’s point-of-view directed at the target. Tracking quick moving targets often demands faster bandwidth platforms. However biology suggests a redundant approach where DOF, like the eye and head, cooperate to direct vision systems and overcome joint limits. This paper illustrates the effectiveness of this concept using a robot-mounted camera.

Keywords: visual-servoing, tracking, biomimetic, redundancy, degrees-of-freedom

1 Introduction

Visual coverage of large areas often demands mounting cameras on motion platforms like booms, gantries, planetary rovers, industrial robots, aircraft and submersibles. Previous work in visually servoing a 5-DOF hybrid gantry robot demonstrated that a coupled coordination of redundant DOF, called partitioning, can track faster moving subjects [4].

Section 2 describes our tracking interests with a camera-carrying gantry along with brief highlights of previous gain-tuning results. Section 2.1 defines the tracking task and DOF coordination using a cost function to optimally tune gains and develops the necessary controller.

2 System Description

Our particular tracking interests are in visually monitoring tools, workpieces or people moving in a large \((3.6 \times 6.4 \times 1.0 \, m^3)\) manufacturing workcell, Figure ??, We thus built a ceiling-mounted Cartesian gantry and attached a 2-DOF pan-tilt unit (PTU) to its end-effector. The gantry’s large inertias limit camera translational velocities but allow the camera to be positioned anywhere in the workcell. By comparison, the PTU only serves a light-weight camera and thus camera orientations are quick but its joint limits constrain what fields-of-view can be obtained. The net effect is a hybrid robot characterized by DOF dynamics, kinematics and redundancy. The PTU can point the camera at the subject and the gantry can maneuver the camera to maintain a desired camera-to-subject depth or achieve line-of-sight if subject occlusion occurs.

Here, 2 copies of the same figure are included and lie side-by-side. Latex only accepts EPS or PS graphics formats. The width can be changed from 3 inches if you wish. For caption, change the text between the french braces. Lastly, give the figure a label so you can reference it later.

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2.1 Cost Function

Notice that whatever number the parent section is, the child subsection will be automatically numbered.

Equation numbers are automatically generated. Label allows easy referencing throughout the paper

\[
X[k+1] = AX[k] + Bu[k]
\] (1)

You can also add an unnumbered equation as follows

\[
\theta_c[k+1] = \theta_c[k] + Tu_p[k]
\]

3 Conclusions and Future Work

For the reference sections, equations figures and bibliographical references consider the following. Section1 described the general problems motivating the research.

References


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*Text in here gets placed in a footnote section. Typically you thank sponsors here, and add the date of the manuscript submission and your address e.g. Drexel University Mechanical Engineering, Robotics & Machine Vision Lab, Philadelphia PA USA 19104 Tel/Fax: 215-895-6396/1478 Email: paul@coe.drexel.edu