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Virtual environment modeling from images for telerobotics applications

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Abstract

An implementation of a technique for virtual object and environment modeling of real world scenes based only on their captured images by CCD sensors is presented. This technique exploits the stereovision principle in order to estimate the 3D location of objects. A procedure has been added enabling an automatic insertion of modelled objects for visualiation into a CAD package of comercial robot simulation software.

Taking into account the issues involved in automatic modeling of virtual environments based on images, a human interaction has been enabled for directing the software towards meaningful features perceived into images.

Successful applications have been performed concerning the telerobotics domain, particularily for facilitating virtual reality building, use of augmented reality and model-based teleprogramming.

Key words: *Virtual object modelling, Virtual reality, Teleprogramming, Stereovision, Simulation*

1. Introduction

Geometric objects modelling, visualisation and simulation are of a paramount interest in telerobotics applications where usually the remote environments are unknown and/or unmodelled. For a decade, many oriented telerobotics applications involving virtual reality have been performed in various domains such as telemanufacturing (Haindl and Kittler, 2001; Zaatri and Brussel, 1997; Tel and Toth, 2000; Niu *et al*., 2006), telemedicine (Timofeev *et al*., 2007), and space missions (Yang *et al*., 2005; Li *et al*., 2008).

However, the automation construction of virtual object models based on their captured images by means of remote CCD cameras and their automatic insertion into a CAD package for simulation purposes is still a very challenging task.

In effect, building virtual object models of real world based on their images requires the use of the stereovision technique. This technique leads to solve the well known correspondance problem which deals with the matching of corresponding points of a same object in two or more images.

Many techniques attempt to solve this difficult problem but with limited success (Shirai, 1987). Usually, the input of the correspondence solver software (stereo-algorithm) is the stereo image pair (right and left images). The software is, in principle, designed to automatically produce a disparity map for systematically matching all the

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