A Study on Autonomous Vehicle Guidance for Person Following by 2D Human Image Analysis and 3D Computer Vision Techniques

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ABSTRACT

An intelligent vision-based vehicle system for person following by distance measurement, human detection and following, as well as interaction with humans in indoor environments is proposed. A vehicle with wireless control and a web camera is used as a test bed. A robot arm is equipped on the vehicle to hold the camera at a higher position and is used to change the orientation of the camera. First, a method for computing the distance between a person and the vehicle for different people heights is proposed by the use of learned data of a reference person. Next, a human face detection technique is proposed, which uses a skin-colored model adapting to luminance changes. Besides, a technique of area tracking for human following using images only including part of clothes is proposed, which is based on the concept of shape circumscribing. Furthermore, because the intensity is non-uniform in the real environment, also proposed is a progressive face detection method which uses blocks with sizes varying from 320×240 to 40×30 until the system detects the human face. To follow a target person who turns fast at a corner in a narrow path, a technique of using crossroad points and the image information taken by the robot arm to search the disappearing person is proposed. For avoiding hitting the wall, the vehicle is also enabled to adjust its orientation for monitoring the surrounding when it follows the

person. In addition, techniques for intelligent interaction with humans to provide more intelligent services are also proposed, which can be employed to detect the facing direction and the hand movement of a person. Good experimental results show the flexibility and feasibility of the proposed methods for the application of indoor person following.