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Implementation of Tracking of a Moving Object Based on Camshift Approach with a UAV

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Abstract

In this paper, a report is presented on the findings of a study conducted on evaluating AR.Drone performance for computer vision applications. Object tracking is a challenging problem because of tracked object motion and its size changes in the scene, illumination changes and egomotion. An approach that is able to cope with those problems using an unmanned air vehicle was applied. Unmanned air vehicle has been an increasing field of research in both civilian and military applications. Among its different models, quadrotors have advantages such as high maneuverability and moving in three directions. The unmanned air vehicle used in this paper is AR.Drone. The application is implemented using version 2.4.9 of OpenCV library with C programming language in Visual Studio 2010 environment and is capable of tracking moving objects by using the front camera of AR.Drone with resolution of 640x360 and at a frame rate of 30 fps. Object tracking process is carried on independently from the distance between AR.Drone and the tracked object. Experimental results testify that object tracking is carried out successfully with AR.Drone which is a mobile platform despite of change in object's size in the scene and of illumination.

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1. Introduction

Object tracking can be described as the process of estimating the trajectory of an object over time as the object moves around a scene. It is bearing significance in the realm of computer vision due to the proliferation of high

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powered computers and the increasing need for automated surveillance systems and is widely used for applications such as human-machine interface, vehicle navigation, automated surveillance, motion-based recognition, video indexing, robotics and traffic monitoring. A large number of those applications need to have reliable tracking methods that meet real-time constraints and are complex and challenging regarding changes of movement of the object, scene illumination, scale and appearance and occlusion. Tracking results can be influenced by variation of one of these parameters. In order to overcome those mentioned challenges and many others in object tracking many approaches have been proposed [1]. In a tracking application, target object can be described as anything that is interesting for analysis. To give examples, person walking on a street, flying vehicle in the air, cars on a road, face in motion, etc. Object tracking approaches can mainly be classified with point, kernel and silhouette tracking techniques. Selecting the right feature plays a crucial role in the object tracking system. One can simplify the tracking problem by imposing on the motion and appearance of object. Mostly all tracking algorithms suppose the object motion to be smooth. Object motion can be further constrained to be of constant velocity or constant acceleration based on priori information. Prior knowledge about the number and the size of the objects can also be utilized to reduce the complexity of the problem. Some algorithms assume prior knowledge about the object appearance or shape, texture, color, etc. Many tracking algorithms generally use a combination of these features and have been developed and proposed. For example, KLT, the kalman filter [2], meanshift [3,4] and Camshift [5].

The rest of this paper is organized as follows: in section two, we briefly describe the principle methods of commanding and retrieving information from AR.Drone. In section three object tracking system is presented. Section four summarizes our work and draw outlines of prospective further improvements.

2. Hardware Platform

AR.Drone is a commercially available quadrotor which has been increasingly used in education and research area due to its low cost, robustness to crashes, safety and reliability for both indoor and outdoor applications. It is constructed of plastics, carbon fiber, battery, four BLCD motors, equipped with 6 degree of freedom inertial measurement unit, 3 axis gyroscope and accelerometer, control board with ultrasonic sensors and two cameras. Users can directly set the yaw, pitch, roll, vertical speed and control board can adjust return motor speed to match state requirements. It can achieve speed of more than 5 m/s for a continuous flight of 15 minutes.

Fig. 1. AR. Drone

AR.Drone is controlled by ARM Cortex A8 processor whose CPU clock speed has 1GHz with 1GB DDR2 RAM at 200MHz. It provides a console via ad-hoc wireless network to control the AR.Drone using Ipad/Iphone or Android devices. Thanks to the supplied open-source Software Development Kid, several control parameters of flight can be set via its Application Programming Interface which also provides access to the data of sensors and images from the cameras[6,7].

3. Object Tracking System

The goal of an object tracking system is simply to know where the object constantly is in the image. Object tracking is composed of two steps: firstly tracked object is selected and afterwards Camshift algorithm is processed.

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