Contest Abstract: MonoVision Indoor Positioning

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ABSTRACT

Inspired by the success of visual odometry (VO) methods in mobile robotics, we propose an infrastructure-free VO-based method for indoor localization. The starting position is estimated by making use of a number of stored keyframes with known locations. The position of the user is then estimated online by fusing the inertial data with the VO data using a Rao-Blackwellized particle filter. Additionally, magnetic field and WiFi fingerprints may be used to improve the performance.

1. INTRODUCTION

The proposed localization system is based on hardware available on most smartphone platforms: IMU, camera, WiFi RSSI data and magnetic field sensors. The backbone of the system is a fast visual odometry algorithm which provides real-time translation and rotation information. These data are fused with the output of the phone's inertial measurement unit (IMU) that includes accelerometer, magnetometer and gyroscope. In addition, WiFi RSSI may also be used, along with fingerprints of the geo-magnetic field in the location of interest.

2. SYSTEM DESCRIPTION AND OPERATION

Our system consists of an Android smartphone equipped with a wide-angle lens adapter. To obtain an initial pose estimate (ie. to provide information regarding the positioning of the device with respect to a global co-ordinate frame), a number of keyframes are stored along with their locations. The system then estimates relative motion using a monocular visual odomotery algorithm, operating with the camera tilted towards the ground. The smartphone's IMU provides acceleration, angular speed, and orientation information which is used to estimate features on the ground plane and resolve the projective scale ambiguity of the monocular visual odometry. Furthermore, the IMU data are fused with the output of the VO algorithm using a Rao-Blackwellized particle filter for realtime sequential Bayesian estimation of the position. The particle filter also provisions for the use of WiFi and Geo-Magnetic fingerprints to improve the location estimate.

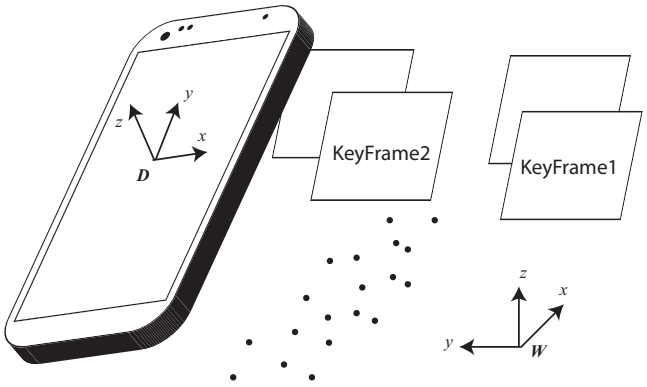

Figure 1: Figure showing the features extracted from the images along with the key-frames used for registering against the global co-ordinate frame.

3. DEPLOYMENT REQUIREMENTS

The system requires no external hardware deployment, only the software running on the user's smartphone.

4. CONCLUSIONS

An indoor positioning system is proposed which is based on monocular VO. The system makes full use of the available sensors by fusing the IMU data with the VO and fingerprinting data (if available) to obtain an accurate estimate of the user's position.

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