Person Identification Using Top-View Image with Depth Information

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ABSTRACT

In this paper, the authors describe a novel image-based person identification task. Traditional face-based person identification methods have a low tolerance for occluded situation, such as overlapping of people in an image. The authors focus on an image from an overhead camera. The authors utilize depth information for the identification task. By using depth information, the authors can capture the precise person's area and rich information for the identification task as compared with popular RGB cameras. The authors apply four features extracted from images based on depth information to the identification method; (1) estimated body height, (2) estimated body dimensions, (3) estimated body size and (4) depth histogram. In the experiment, the authors evaluated two situations; (a) standing in front of a door and (b) touching a doorknob. The identification accuracy rates are 94.4% and 91.4% on the two situations. The authors obtained the high accuracy by the proposed method.

Keywords: Computer Vision, Depth Information, Identification Tasks, Person Identification, Top-View Images

INTRODUCTION

Person identification is one of the most important tasks in computer vision. One approach to identify a person using a computer is based on analysis of captured images from a camera. Many researchers have studied image-based person identification methods, such as fingerprint recognition (Jain et al., 1997), iris recognition (Wildes, 1997) and gait recognition (Kale et al., 2004). The most famous approach of them is to use face information (Zhao et al., 2003). Kanade (1973) has proposed a method using face feature points, such as nose and eyes. The CLAFIC method (Watanabe & Pakvasa, 1973) and the EigenFace method (Turk & Pentland, 1991)
1991) are also famous approaches using face information. These methods need a face image for the identification process. However, face images are not always captured correctly from a camera. For example, in a traffic-choked situation, the face of a target person might be occluded by other persons.

Here we focus on an overhead camera. By using the overhead camera, the problem of occluded images is solved. Figure 1 shows an example of the occlusion problem and the solution with an overhead camera. In addition, a privacy issue is reduced because the camera does not capture the face image. Furthermore, the restriction of the location of a camera is reduced because the camera does not need to capture the person’s face. Figure 2 shows the installation location in our method. We focus on the situation that people stop in front of a door. We handle two situations; (1) standing in front of a door and (2) touching a doorknob. The standing situation occurs in such environments as the front of an automatic door and in an elevator. The touching situation occurs to open a door.

On the other hand, information from overhead camera is not always enough. The lack of information for the identification method leads to the decrease of the accuracy. In this paper, we introduce depth information to the task. The captured image in Figure 2 includes the depth information. The color values denote the distance from the overhead camera. Our method extracts four features from each image; (1) body height, (2) body dimensions, (3) body size and (4) depth histogram. We apply the four features into the AdaBoost algorithm.

**RELATED WORK**

Snidaro et al. (2005) have reported a method for tracking and counting people from multiple top-view cameras placed at different locations. Uchida et al. (2009) have reported a method for recognizing people at elevator lobby, using an overhead camera. The purpose of their study is to count people and recognize wheelchairs. Onishi and Yoda (2010) have proposed a visualization system of customer flows using top-view images. The purposes of these studies were counting and tracking of people although they handled top-view images. Yuan et al. (2011) have proposed a pedestrian detection method using a top-view camera for people counting. They selected the best suitable classifier from several classifiers for the task on the basis of a head candidate location. The purpose of our method is to identify a person in an image. Iwashita and Stoica (2009) have proposed a gait recognition method using overhead images. They focused on shadow images for the gait recognition. We use four features such as

![Figure 1. The occlusion problem and the solution](image_url)
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