Human Identification System Based on Spatial and Temporal Features in the Video Surveillance System
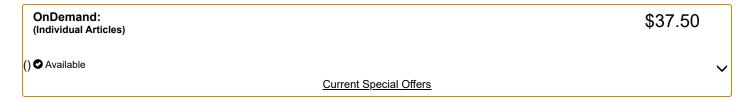
Sanjeevkumar Angadi, Suvarna Nandyal

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Abstract

Human identification is the most significant topic in the bioinformatics field. Various human gait identification methods are available to identify humans, but detecting the objects based on the human gait is still a challenging task in the video surveillance system. Thus, an effective hybrid Bayesian approach is proposed for identifying the humans. The proposed hybrid Bayesian approach involves two stages as follows: the first stage is the human identification based on the object features, and the second stage is the human identification based on the spatial features. Initially, the videos are fed into the first stage, where the object detection is performed using the Viola Jones algorithm. Once the objects are detected, the feature extraction process is carried out by using a hierarchical skeleton to effectively extract the selective features. The object skeleton provides an effective and intuitive abstraction, which offers object recognition and object matching. The Bayesian network is adapted in the object-based features to identify humans. In the spatial-based human identification stage, only the spatial features are extracted and are passed into the gait-based Bayesian network to identify the humans. Finally, the resulted output is obtained using the fuzzy holoentropy for identifying the humans. The experimentation of the proposed hybrid Bayesian approach is performed using the dataset named UCF-Crime, and the performance is evaluated by considering the average value of the metrics, namely F1-score, precision, and recall which acquired 0.8820, 0.8770, and 0.9203, respectively.

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Top

1. Introduction

Video surveillance is one of the significant research areas in the field of the computer community. Due to the incompetence of the monitoring system, the research area in the field of video surveillance is increased as the inexpensiveness of the image sensors along with the lack of computing power availability as it is difficult to identify the humans. Applications, like semantic video indexing,

human action recognition, and event detection are introduced to fully or partially perform the automatic task in the surveillance. These applications require tracking algorithm and motion detection system to offer better functionality in the recognition capability system (Gutchess, et al., 2001). The video surveillance system allowed to enter the age in the digital format is one of the major applications of the same. Rather than using other data, digital video data is allowed to use the same path freely using the digital surveillance system. The technological growth is adaptively increased in the digital system, due to the advancement of telecommunications, storage, and data compression. The usage of the digital video system in theharmful environment increases the law enforcement capability, to take the proper actions under various circumstances (Chang and Huang, 2004). Tracking and extracting the image sequences (Daga, et al., 2011; Thomas & Rangachar, 2018) from the human figure results a key challenge in the field of video indexing and video surveillance. Identifying the person involves the following stages, such as tracking, detection, classification, and human gait identification (Havasi, et al., 2007). The video surveillance identification method is increased in identifying the surveillance, and the application involves computer vision, and pattern recognition to verify the identity of the person (Kim, et al., 2012).

One of the significant technologies in the digital surveillance system to prevent diversified and intelligent crime is human identification technology. Human identification technology is mainly focussed on studying the height, gait, color, and face recognition of humans. Due to the external factors, like light, image distortion, and the object distance, this technology attains better performance under the camera environment in the digital surveillance system (Moon and Pan, 2010). The human identification performs many functions, which allows identifying the crime person or even warning the system to prevent the crime by performing the access control mechanism. Based on the properties and the operating functions, the biometric is used in the surveillance system to identify the person. Due to the rapid growth of the Closed-Circuit Television (CCTV) cameras, identifying the individual using gait is increased in the research community (Qi, 2017). However, the inability to identify the objects due to the environmental problems and the poor camera vision leads a major challenge in the surveillance system. In most of the crime scene cases, the crimes cover their faces by using hats or masks. When the face is not properly masked or when the hat is not worn, then the camera observes only the back head or the side face of the crime. Thus, gait-based identification system is mostly used to solve the above problems, where the human gait is the biometric signature, which is measured from the person, whereas the other signature uses the people's attention (Batchuluun et al., 2018).

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