Human Identification and Detection of Suspicious Incidents Based on Outfit Colors: Image Processing Approach in CCTV Videos

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Abstract : CCTV (Closed-Circuit-Television) Surveillance System is being used in public places over decades and a large variety of data is being produced every moment. However, most of the CCTV data is stored in isolation without having integrity. As a result, identification of the behavior of suspicious people along with their location has become strenuous. This research was conducted to acquire more accurate and reliable timely information from the CCTV video records. The implemented system can identify human objects in public places based on outfit colors. Inter-process communication technologies were used to implement the CCTV camera network to track people in the premises. The research was conducted in three stages and in the first stage human objects were filtered from other movable objects available in public places. In the second stage people were uniquely identified based on their outfit colors and in the third stage an individual was continuously tracked in the CCTV network. A face detection algorithm was implemented using cascade classifier based on the training model to detect human objects. HAAR feature based two-dimensional convolution operator was introduced to identify features of the human face such as region of eyes, region of nose and bridge of the nose based on darkness and lightness of facial area. In the second stage outfit colors of human objects were analyzed by dividing the area into upper left, upper right, lower left, lower right of the body. Mean color, mod color and standard deviation of each area were extracted as crucial factors to uniquely identify human object using histogram based approach. Color based measurements were written in to XML files and separate directories were maintained to store XML files related to each camera according to time stamp. As the third stage of the approach, inter-process communication techniques were used to implement an acknowledgement based CCTV camera network to continuously track individuals in a network of cameras. Real time analysis of XML files generated in each camera can determine the path of individual to monitor full activity sequence. Higher efficiency was achieved by sending and receiving acknowledgments only among adjacent cameras. Suspicious incidents such as a person staying in a sensitive area for a longer period or a person disappeared from the camera coverage can be detected in this approach. The system was tested for 150 people with the accuracy level of 82%. However, this approach was unable to produce expected results in the presence of group of people wearing similar type of outfits. This approach can be applied to any existing camera network without changing the physical arrangement of CCTV cameras. The study of human identification and suspicious incident detection using outfit color analysis can achieve higher level of accuracy and the project will be continued by integrating motion and gait feature analysis techniques to derive more information from CCTV videos.

Keywords : CCTV surveillance, human detection and identification, image processing, inter-process communication, security, suspicious detection