Research on Passenger Recognition System Based on Video Image Processing in Railway Passenger Station

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Abstract. The major railway passenger hub for the safety of the passengers bears important social responsibility in a video surveillance system; using digital image processing techniques to identify the passenger is a hot issue of domestic research currently. In this paper, digital image processing technology used MATLAB programming system developed by each module design and system integration. Proposed passenger identification system is designed to identify the real-time passenger number, density and velocity inside the station, and to determine the level of traffic safety situation. This system has good practical value.

Introduction

Video monitoring technology at present domestic is researched in lots of institutes, in other countries, intelligent video surveillance systems research started earlier. Intelligent video surveillance analysis technology in European countries has been amply augmented. There have some technical research companies and institutions devoted to surveillance video analysis, formed a relatively mature product and applied to security engineering systems successfully [1-3].

This thesis achieves passenger real-time observation and automatic identification effectively, which is on the basis of the station video surveillance system and through the use of modern techniques, so it can presents real-time passenger security status information and publish safety warning information for the safety monitoring department and reduce pedestrian congestion accident and enhance the management capacity of railway passenger safety. Video image processing and analysis by the use of video surveillance systems inside the station and passenger flow intelligent recognition and related theory is be researched, in order to achieve traffic moving target detection and traffic related parameters identification, as well as the system development and function realization.

The Algorithm for Railway Passenger Flow Image Recognition

Intelligent video surveillance system must be able to detect video images of the target in real-time, which can then be the associated intelligence analyzed. Moving targets separated from the context which is change real-time quickly and accurately. And the further analysis and image processing can be done[4-5], the relevant attributes and features information and accurate identification of moving objects can be obtained, not only the basis decision analysis for the managers can be provided, but also intelligent management and control systems can be obtained. The motion objects detection algorithms include optical flow, inter-frame subtraction method and background subtraction method. In this paper, the main task is to achieve recognition within the pedestrian stops, considering the special nature of the scene inside the station and combining traffic analysis, along with the comparison of the characteristics and advantages and disadvantages of each algorithm, and decide what appropriate background model and updating algorithms to take, so the detection of pedestrians moving target can be achieved. Some issues such as the amount of calculating, interference and

background updates can be addressed by the use of the characteristics of inter-frame difference and optical flow method [6-7].

There are two major steps in background reconstruction process, background extraction and background updates [8]. It is basically impossible to obtain the pure background image because of the continuous flow, And in monitoring sites for passengers, the light changes with the time of day, the surveillance video background huge changes will ensue. If the background changed, original background cannot be reused; otherwise it will affect the accuracy of passenger flow image recognition. And therefore the background needs to be updated. For the above two issues, in this paper an adaptive background modeling method has been taken. There are two aspects of the adaptive means. Firstly, the background is updated automatically, and the secondly, do not require a sample as a model training background frame input.

Background Extraction. It is difficult to obtain free movement of passenger background directly through the continuous road. In this paper, a series of passenger flow images by the mean of superposition average can obtain relatively realistic background image. The N-frame images are superimposed and then will take the mean value as the initial background image.

Background Update. Firstly put the whole passenger image into m×n small squares, calculating the mean and variance of the pixels and then can determine whether or not this little box can be used as background blocks, if in any one region around four areas in a small box the prospect be covered, it can be concluded that this little box prospects has been covered. It is also necessary to treat the detected image by the mean of gray scale compensation firstly. it is necessary to build a complex model of constancy for accurate face gray gradation compensation, taking into account of the high level application examples, namely the statistical requires traffic detection in real-time.

Median Filter Algorithm. Median filter is employed in this paper. It was used to smooth images. Median filter is an effective suppression of image noise and improve the signal-to-noise ratio of non-linear filtering technique. Firstly, it is to determine a template, 3 × 3 or 5 × 5 is selected in generally. The template here means that there is a specific length or shape of the neighborhood of a point, that the pixel value in the middle of the window by the value of each pixel value within the window instead. Assuming x_{ij} represents of the gray value of each point in the digital image, the filter window is A, two-dimensional median filter may represent [9] as: $y_{ij} = Med\{x_{ij}\}$

Morphological Processing. In the process of obtaining differential binary image, it is easy make some pixel belongs to the background had been wrongly detected as foreground objects caused by the influence of noise, but also the prospect of the target pixel will be erroneously detected as background points. This will make the difference passenger binary image appear some isolated points and hollow problems within the target. In order to eliminate these effects, differential binary images for some passenger obtained need to be treated. In this article morphological processing is applied. Basic operation of mathematical morphology is dilation, corrosion, opening and closing operation. Dilation and corrosion is the basic operation [10].

Designs and Implementation of Railway Passenger Flow Image Recognition System

The key Technology of The Research and Functional Goals. A lot of MATLAB image processing technologies used in this system: such as graying, binarization, image background modeling, morphological operations etc. and the traffic information obtained by the connectivity analysis finally and then complete the traffic statistics. The monitor system of passenger flow in Railway hub monitor in waiting hall, channels, platforms and other places in real-time. The sequence images be analyzed and processed and the pedestrian in the image to be identified [11-12]. In this way whether the crowded scene or dangerous can be determined, and according to the identified the results in response to different levels of alert. Railway staff can take the appropriate alert levels according to appropriate emergency measures. The purpose of reducing the accident rate can be achieved, thus the safety of rail transport will greatly improve.

The Implementation of Passenger Flow Image Recognition System. Traffic monitoring system consists of four interlinked components: display, digital hard disk recorders, cameras and alarm

equipment. Traffic monitors system capture down the passenger image through the CCD camera, and then the sequence of moving images is transmitted to the computer processed in real-time. This design includes an image capture system, pretreatment, background extraction, target detection, post-processing, passenger demographics, and several other parts. Image recognition process is system initialization (including set system parameter, select the initial background, etc), Image acquisition (read traffic image information from the storage device), image preprocessing, target detection (including background modeling, background update, the background field, de-noising, passenger demographics image and morphological processing.

Pre-processing of Flow Image. Usually in the actual application, the original image acquired is not perfect, for example the image quality is not high because of noise, light and other reasons, so the relevant preprocessing for passenger image need to be done. The image preprocessing technology in this paper is mainly gray-scale transformation. The results in gray scale conversion process shown in Figure 1.

Passenger Image Target Detection Study. To get the target image after background modeling and background update, passenger background images can be subtracted from the current frame. Because of the impact of environmental and input conversion device, the collected images may contain a wide variety of noise and other defects in image quality in the process of de-noising and morphological processing. In order to eliminate noise and interference of passenger images, strengthening useful information to make the image easier to identify, reducing the noises is the important step in image processing, median filter was used for de-noising. Using a two-dimensional median filter for de-noising after the difference image obtained. The results of median filtering shown in Figure 2.

Fig.1 An original image and gray scale images

Fig.2 Median filtering the image

Then the passenger image should be morphological processed, morphological process achieved good effect in removing noise, which is of great importance to increase accuracy of traffic image. In the process, the etching operation in MATLAB function was used.

Fig.3 images before and after corrosion

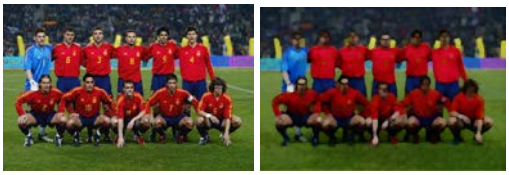

Fig.4 images before and after opening operation

The target traffic image is more accurate after de-noising. Morphological filtering is geometrical structure of the area of the filter, that is to say a noise block, if a little determination condition meet the requirements, you can remove all the noise of the entire region, therefore the quality of morphological filtering can be guaranteed, the noise can be removal relatively clean, and good image detail can be kept, but the appropriate structural elements need to be selected in morphological processing in order to achieve a satisfactory filtering effect. The complementarities of these two methods are helpful to further improve image quality.

Statistics and Image Recognition Results. A more precise image of the target passenger is obtained through subsequent background modeling and de-noising etc. and then statistical read traffic images can be achieved by marking the number of connected components, the still images which include the result of the number of passenger flow after a number of columns of image processing and image recognition operation. The current state of traffic congestion can obtained according to the calculated results and the simulation results or experience contrast, a corresponding warning level signals will ensue.

Conclusion

Passenger identification system is designed according to the existing technology and the existing system equipment conditions. This article has carried on the design of railway passenger traffic identification system based on digital image processing technology, the identification of design of automatic identification system identification has been completed based on MATLAB, the current traffic congestion state can be learned through the recognition system, a corresponding level of early warning signals will ensue. To further improve the accuracy and applicability of target detection, on the one hand, further adjustment and improvement of the installation position, angle and clarity of the camera need to be done, in order to adapt to the characteristics of the traffic video detection. On the other hand, more different intersection images at different times of the site need to be collected, in order to verify the applicability of target detection algorithm and improve algorithm.

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