COUNTING PEOPLE IN PUBLIC BUILDINGS BY VIDEO SURVEILLANCE DATA

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In the event of an emergency in public buildings, it is important for rescue services to know how many people were in the incident area. For example, the analysis of rubble and ruins in which victims may be located must be carried out with high speed and special precautions. When rescue operations are completed and there are no

more people under the rubble or in the fire zone, other technical means can be used with less urgency and caution. This work is devoted to solving the problem of recognition and pairwise identification of incoming and outgoing people according to CCTV cameras at the inputs and outputs.

The algorithm has the following components:

- detection - detection of people in the image;
- tracking - matching several consecutive images in order to determine the path of people
- counting incoming and outgoing;
- combining entry and exit events in pairs to obtain information about those who are in the building.

It is assumed that the detection operation, in contrast to tracking, is expensive in terms of computing resources. In this regard, it is proposed that the detection operation be performed once in N frames, where N is selected empirically based on information about the computing power allocated for the algorithm. The rest of the frames will use tracking.

The task of counting is solved using the results of recognition and tracking. To begin with, an imaginary line l is drawn, when the object crosses it, one of the counters ("Objects in", "Objects out") will increase. The location of this line depends on the location and visibility of the camera and is unique for each. We place the investigated image in the coordinate system so that the image borders are parallel to the coordinate axes. For simplicity, we assume that the line l is parallel to the OX axis. As a result of detection, the object in the image is defined as a rectangle. The coordinates of the object will be called the center of such rectangle. The rule by which an object is considered to be one that has crossed the line l can be determined in various ways. Below we state one that in our experiments proved to be better than the rest. Due to the continuity of movement, we will assume that the object crossed the line l if it was defined on two sides of line l on two consecutive images. In this case, by the sign of the increment of the y coordinate of the object, you can determine whether the object has entered or exited.

It is proposed to detect objects using a neural network, in particular, MobileNet [1] has shown itself quite well. At the same time, due to the features of the CCTV camera, it may be necessary to retrain the neural network using Transfer Learning [2].

As a tracking algorithm in our studies, we used a combination of the centroid method [3] and the correlation method [4]. One of the areas for further research is the development and use of a single algorithm.

Conclusions. In the course of work, a method for counting objects was developed. Its essence is the use of detection and tracking, on the basis of which the

action of the object and its location are determined. From this, a conclusion is drawn about increasing counters (“Objects in”, “ Objects in ”).

Literature

1. MobileNets: Efficient Convolutional Neural Networks for Mobile Vision Applications / Andrew G. Howard Menglong Zhu Bo Chen Dmitry Kalenichenko Weijun Wang Tobias Weyand Marco Andreetto Hartwig Adam, 17 Apr 2017
2. Transfer Learning / Qiang Yang, Hong Kong University of Science and Technology , Yu Zhang, Hong Kong University of Science and Technology , Wenyuan Dai, 4Paradigm Co., Ltd., Sinno Jialin Pan, Nanyang Technological University, Singapore, January 2020. - 380p
3. An algorithm for centroid-based tracking of moving objects / Jacinto C. Nascimento, IST, Lisboa, Portugal, Arnaldo J. Abrantes, ISEL, Lissabon, Porugal, Jarge S. Marques, IST/ISR, Lisboa, Portugal, 1999. - 3308p
4. Moving Object Detection and Tracking based on Correlation and Wavelet Transform techniques to optimize processing time / Dr. Manoj S. Nagmode, Mrs. Aditi. S. Jahagirdar, Mr. Atul L. Borkar, Mr. Dhaval S. Pimplaskar MIT College of Engineering, Pune, India , January 2013.