DEMO: Human Presence Detection Service for Production Equipment Workplace using Surveillance Cameras

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Abstract—**The demo shows our pilot implementation of the human presence detection service. The service is applied for monitoring a production (manufacturing) equipment workplace using surveillance cameras. Presence of the operator (personnel) nearby the production equipment unit is detected in the continuous mode as well as evaluated for distance metrics. The machine vision methods are used for the human detection in video data from cameras surrounding the equipment. The video data analysis methods also evaluate location metrics of the operator in respect to the distance between the operator and equipment units.**

Pilot Service Implementation

In modern production companies and manufactories, high-tech and expensive equipment and materials are used. Despite the developed automation of production, equipment requires high-quality service and human management. As a result, the task arises of monitoring the location of personnel and their actions in order to prevent negative consequences and identify the causes of equipment malfunctions.

One of the control methods is visual observation using cameras. Unlike mechanical surveillance tools (locks, sensors), cameras allow you to view a wider area and control non-standard situations. The traditional approach is to record the video stream and its long-term storage, but it has its inconvenience. Firstly, with the help of recordings it is impossible to prevent emergencies, and secondly, identifying the causes of the accident requires painstaking viewing of a large number of records.

Machine vision comes to the rescue. Special software can help to recognize the required objects in the video stream. As part of the project, a service is developed to monitor the actions of the operator. The service collects video streams from several cameras and analyzes in order to identify a person technically and the operator in a manufacturing process and also determine the location.

The work of the service is based on the mechanism of events: when a person appears in the frame, the event "person came" is formed, and when a person leaves the surveillance zone, the event "person left" is formed. Because since the operator can be in different places around the machine, it is necessary to obtain such events from several cameras and the formation of summary events "a person is" if one or more cameras saw a person, and "no person" if all cameras do not see people.

When a person enters the surveillance zone of the camera, the process of determining the location of the person starts. The example uses the rangefinder function to determine the distance from a person to the camera and the function of getting into the area. As soon as a person is at a certain distance and in the required area the event "person at the object" is created. These events can be used to determine possible unauthorized access, for example, to an electrical cabinet.

As part of the demonstration we used the following technical devices and records:

- 2 IP-cameras with different focal length: Hikvision DS-2CD2143G0-IS (2.8 mm), Hikvision DS-2CD2123G0-IS (4 mm);

- Imitation videos simulating the real situation of the operator being near the machine(electrical cabinet);

- Video processing with OpenCV face detection [1] using Haar cascade filter [2] and algorithms to calculate distance to the face of the operator;

- Pre-trained neural network based on TensorFlow [3] for recognizing a person by its silhouette;

- Web technologies: php, laravel (backend), gentelella, bootstrap (frontend), nodejs server based on socket.io and express;

- Database MongoDB for events storage;

- Message broker RabbitMQ for message exchange;

- Python 3.7 programming language with libraries for the implementation of the basic video processing modules and interaction with the above technologies.

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technology for smart data collection, mining, and interaction with surrounding sources). The work is implemented within the Government Program of Flagship University Development for Petrozavodsk State University (PetrSU) in 2017-2021.

REFERENCES

[1]   K. Pulli, A. Baksheev, K. Kornyakov, and V. Eruhimov, "Real-time computer vision with opencv," *Communications of the ACM*, vol. 55, no. 6, pp. 61–69, 2012.

[2]   S. Soo, "Object detection using haar-cascade classifier," *Institute of Computer Science, University of Tartu*, pp. 1–12, 2014.

[3]   M. Abadi, A. Agarwal, P. Barham, E. Brevdo, Z. Chen, C. Citro, G. S. Corrado, A. Davis, J. Dean, M. Devin *et al.*, "Tensorflow: Large-scale machine learning on heterogeneous distributed systems," *arXiv preprint arXiv:1603.04467*, 2016.