

Novel Approach to Dataset Proposal Techniques

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Abstract— There are several approaches how to evaluated effectiveness of Intelligent Video Surveillance System. Functions of the particular tools are described in detail and the qualitative analyse of them has been executed in order to extend current form of the EN 50 132 appendixes, where the specific monitored locations are defined. On the basis of qualitative assessment of these locations the particular tools are assigned to locations in order to increase the efficiency of the whole surveillance system. General Intelligent Video analytics Algorithms evaluation techniques review is contained in the first part of this research paper. Moreover, brief analysis of recent methods and unique evaluation dataset proposal methodology are provided. Finally, detailed procedure of developing dataset annotation is described and applied.

Keywords— Intelligent Video Surveillance System, Evaluation, Algorithms, Annotation techniques, Methodology

I. INTRODUCTION

INTELLIGENT Video Surveillance Systems (IVSS) are dynamically evolving field, probably for their global usefulness within the wide range of real-world applications. Manufacture, traffic regulation or security belongs among typical segments where IVSS are utilized. All of these applications are based on recent possibilities of video analytics functions. Evaluation of semantic factors readable from the scene, an identification and classification of objects, measurement of their particular parameters, are the most often utilized preferences of high quality IVSS [1].

The level of IVSS quality could be evaluated through several specific methods, the most used is mapping [2]. This technique is in principle comparison evaluating between real semantic factor of the particular scene and the information generated by video-analytics algorithm. Several groups of evaluating video sequences were designed in order to increase effectiveness of video analytics algorithms. Moreover, there are relatively great amount of conditions, which should be taken into account by the designer of the system. Probably, one of the most important factors is the photogrammetric calibration of the sensing element, which is in this case surveillance camera. Calibration is defined by its intrinsic and extrinsic parameter. Intrinsic is described as determination of sensing element parameters (focal length, resolution, and frame rate) [3]. On the other hand, the extrinsic calibration disserts on appropriate selection of parameters related to camera position and orientation within the coordinates [4].

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The unique evaluation dataset is proposed within the paper and IVSS evaluation dataset methodology is designed. Firstly, the evaluation technique used is described in detail. In next chapter the annotation design process is explained. The methodology is then proposed as a solution of the problem formulated.

II. ALGORITHM EFFECTIVENESS EVALUATION PROCEDURE

Standardized process of IVSS evaluation, which is utilized in the biggest percentage of evaluation methodologies, is based on relation of evaluation video databases annotations on information generated by Video Content Analysis (VCA) and Video Event Understanding (VEU) algorithms. On the basis of established metrics is possible to evaluate IVSS's intelligent functionality layer. Visualization of this process is illustrated in Fig. 1.

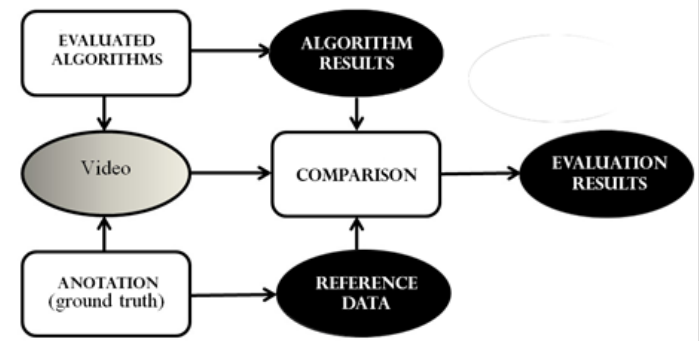


Figure 1: IVSS evaluation procedure

A. Annotation tools

Real parameters descriptions of particular video-sequences are provided through evaluation video-database annotation. The annotation design process should be detailed as much as possible what makes it relatively difficult and time consuming. Description of the object in the scene, its marking through bordering frames is also one of the key goals of annotation. Moreover, adequate parameters have to be assigned to particular objects (velocity, color, position etc.). Description of events which are happening in the scene is necessary for the purposes of VEU evaluation. There are several annotation development methods:

- Manual acquisition (the most used method recently): The annotation is developed by the observer with utilization of adequate tools. This approach is not fully objective, because the annotation created by two observers never produces the same result.
- Semi-automatic acquisition: Basic annotation is realized through standardized analytics algorithms and results are then repressed by human corrector. The final annotation is then developed on the basis on corrected one.

- Detectors and meters utilization: annotation data gathering is realized through detectors and meters. Common is utilization of position detectors, distance detectors or infrared barriers. This approach is very complex, however it is impossible to make data gathering process full automatic. That is why it is necessary to combine it with other techniques mentioned above.

- Video data synthesis: Evaluation video databases are created by utilization of image synthesis or by augmentative reality technology. The annotation is generated continuously within the video sequence acquisition process and it strictly corresponds with real parameters of object located in the scene. Nonetheless, recently it is unusable in real testing [5].

III. EVALUATION VIDEO SEQUENCE DESIGN

Detailed documentation of evaluation video sequence design procedure realization. Main contribution is represented in recommended procedure of evaluation video sequence design. Dataset instrument Video Image Annotation Tool was utilized for annotation acquisition.

Corridor was chosen as a representative scene for evaluation video sequence application. The length of corridor is approximately 10 meters, width 4,5 meters and 3,5 meters high.



Figure 2: Corridor scene

Following action were used as a content of evaluation video sequences:

- individual person crosscut,
- run through the scene,
- run and jump within the scene,
- walk and do up shoelace,
- walk and backpack searching,
- walk and jacket take off,
- walk and telephoning.

All of activities are shot under various conditions:

- day light,
- artificial light.

The axis of movement and camera axis are parallels within all shot actions.

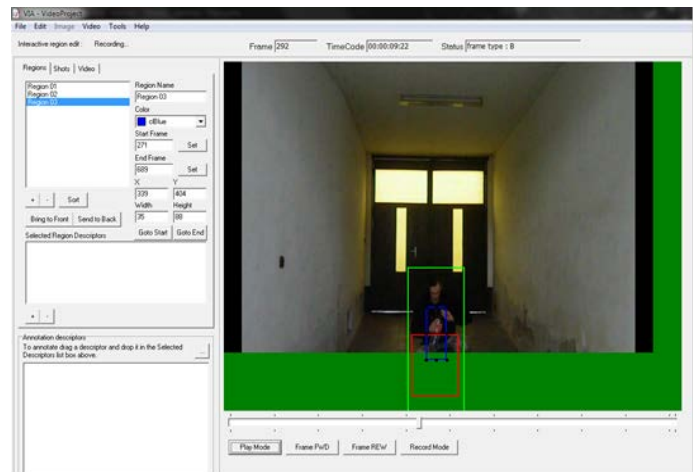


Figure 3: Three objects marked within the VIA tool

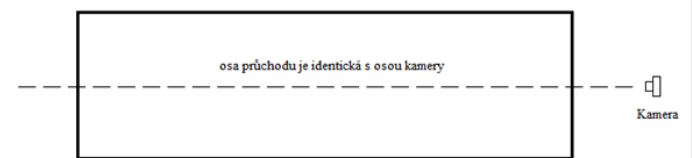


Figure 4: Corridor and camera axis are in one line

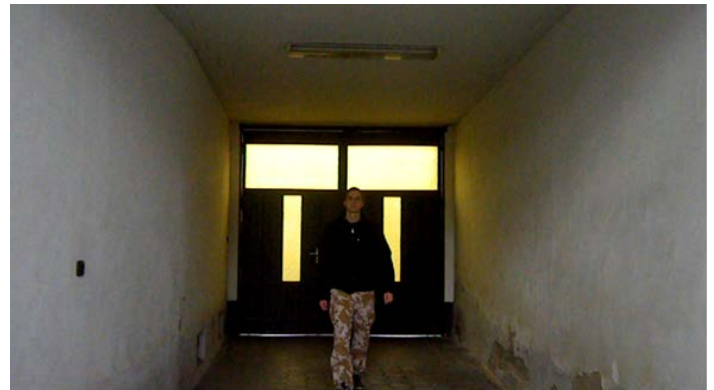


Figure 5: Screenshot from the motion picture walk - daylight

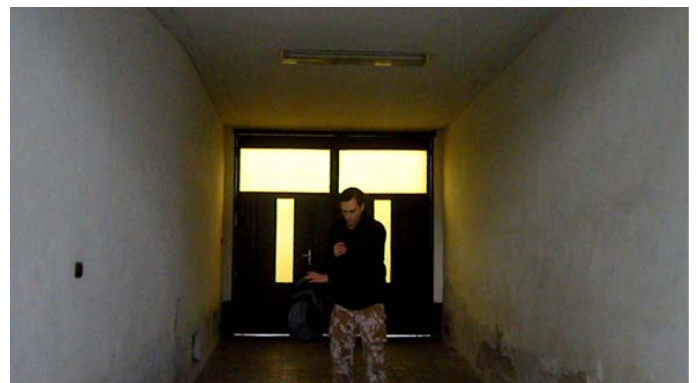


Figure 6: Screenshot of filming the movie backpack - daylight

Another point of making your own movies evaluation is the choice of tools for annotating and their very creation. At present, there is quite a wide range of annotation tools or programs, for example. VIPER Ground Truth Authoring Tool, VATIC Video Annotation Tool (Video Annotation Tool from Irvine, California), ANVIL, CAVIARGUI, Actanno, or such.

ELAN, which is primarily designed for psycholinguistic purposes. These tools are varying degrees of complexity and provide a number of tools for annotation of movies and creating datasets. However, in general we can say that annotating methods are very similar and use the same principles. Selecting a tool for creating annotations is therefore a matter of personal judgment.

However, it is appropriate to assess in advance the requirements of the program on the computer, how to install and its complexity, because it is the point where the above annotation tools differ in a fundamental way. Installation of some programs is complicated and does not take place in the normal way using the installation wizard, but must, for example. Execute Java compiler from the command line (CAVIARGUI), instructions for installing and setting up remote access and account, written for the Linux shell, etc.. Majority of these programs are also JavaScript files that you must have in the present Java Software Development Kits, compiler compiler for Java and others. Therefore, it is suitable to thoroughly read the installation requirements and the course of the program, as such. VATIC installation program is written for the Linux shell, so it is necessary to find suitable equivalents for Windows or another operating system type. In addition, it is necessary to establish an account with which you log in the future. This is required because the video annotations are collected in a database program.

Another major difficulty is the stability of some programs because I have met several times with the fact that the batch file for installation can not be started without any further description of the installation and therefore could not be performed. Stability problems occurred but also in the case that the program is successfully installed. For example. ANVIL program I was able to successfully install, I found that allowed for input video format is MPEG and so I made the video conversion from the original format to AVI MPEG. When recording video in MPEG format, but the program immediately collapsed.

I went through several different programs for annotation, but in all there were problems with stability or installations, which also partly stemmed from the fact that some of these programs are, for example. Already ten years old and below are not supported or updated.

That is why I chose a very simple annotation program VIA 1.0s (Video Image Annotation Tool), but which adequately covers the requirements for creating movies for testing purposes. Installing the program is very simple and the program is run from the exe file, so in this respect surpassed the other programs listed above.

The following lines will briefly describe how the creation of annotations in this program.

Program supports VIA annotation of images and videos in MPEG format. Therefore, it was necessary to videos of the original format convert to MPEG format while maintaining high video quality. From the original video but when I removed the conversion of sound that the resulting file smaller. After recording a video into the program, it is possible to add regions, choose the color and border size of objects, their names, the beginning and the end of the video frame number using the expression, add another closer descriptions etc.. These tools can be seen in Figure 27 on the

left. In the right part of the screen you will find a screen captured video and bordered objects in the scene. Below the screen are buttons for controlling the forward frame (Frame FWD) or reverse (Frame REW), then Play Mode that starts playing videos, and Record Mode. Record Mode is an important feature that needs to be turned on to allow for video playback or stop it at the screen to move the bodies of boundary objects and change their parameters, eg. Size, location, etc.. This movement and change of parameters is recorded and when play video objects are labeled accurately to reflect these changes. When you reach the final shot movie, it is necessary to move by pressing F7 to start the movie and add more objects or modify existing parameters.

Annotation of images and video sequences in MPEG format is supported by VIA tool. Final project is exportable in two formats:

- ANP – its primary format of VIA tool, which contains video and register of all changes in parameters of objects,
- XML – it is possible to record only changes in objects parameters without the video. This format is appropriate for consequent application of evaluation metrics for video sequences from other tools, which also supporting it.

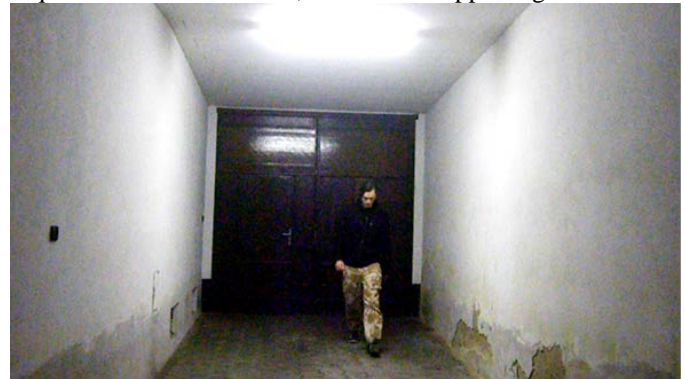


Figure 7: Screenshot of filming a movie tying shoelaces - artificial light




Figure 8: Screenshot of filming the movie walking and calling by mobile phone - artificial light

IV. DATASET DOCUMENTATION

Dataset information

Identifications

Author:	Lukas Gajdusek
Institute:	Faculty of applied informatics, Tomas Bata University in Zlín
Country:	Czech Republic
Year of publication:	2014
Descriptive document:	Appendix 1, extended version
Primal objectives	
Main objectives:	Video sequence design procedure verification.
	Modelling of particular situations within corridor.
	Dataset developing guideline design.
Examples of video sequences:	
	
Context	
Type of scene:	Singular
Lighting conditions:	Day light and Artificial light.
Type of background:	Static scene background.
Number of persons:	One person in the scene.
Number of videos:	Completely 14 videos
Number of simulated actions:	7 different actions
Ground Truth (annotation)	
Available in	AMP and XML format.

V. CONCLUSION

There are many aspects which have influential magnitude on IVSS quality. One of the most recent problems is the most sophisticated level, the intelligence of whole system. A lot of research papers have been solving the problem of the IVSS's intelligence effectiveness, even the quality of whole systems. It is necessary to take this image functional level into account even before the installation of the IVSS and to consider all conditions and circumstances, which have noticeable influence of its functionality. The unique methodology related to preparation of IVSS evaluation dataset is designed in this paper. More detailed description of the process included the necessary appendixes will be provided in extended version.

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