System Description

Camera Series 5000
Video Content Analysis

Introduction
Analysis
Recording
Evaluation
Information about Copyright, Trademarks, Design Patents

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Dallmeier electronic GmbH & Co.KG
Bahnhofstr. 16
93047 Regensburg
Germany

www.dallmeier.com
info@dallmeier.com

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1 General Information

1.1 This Document

This document provides an introductory description of Video Content Analysis on Dallmeier cameras of the series 5000. The first goal is to answer the questions Why is the video analysis performed on the camera and What does the video analysis detect.

Subsequently, the compatibility with SMAVIA recording systems and the necessary settings are taken into account. Finally, the various possibilities for evaluating detected events with the video management software SMAVIA Viewing Client are presented briefly.

The present document includes a general description with exemplary image material. The various possibilities for adapting the video analysis functions to individual requirements are not the subject of this discussion.

1.2 Target Group

The target group of this document is composed of persons who:

- are interested in a general overview of VCA.
- are interested in basic information for the implementation of VCA.
- are interested in basic information for project planning with VCA.

1.3 Contact Persons

Dallmeier
- Norbert Niggemann - Director Software Development
- Günther Frank - Technical Documentation Manager
1.4 Terms

Metadata Additional data that is associated with the video data (e.g. date, time and position of a detected event)

Intrusion Detection Analysis function for detecting the access to a defined area

Line Crossing Analysis function for detecting the crossing of a virtual line

Tamper Detection Analysis function for detecting manipulations on the camera

Object Classification Analysis function for the classification of objects

Face Detection Sub-function of object classification for detecting faces

Motion Detection Recording mode with only stores sequences with motion

SmartFinder Function of the SVC software for the search of stored sequences with motion in a defined area

1.5 Abbreviations

VCA Video Content Analysis

SVC Client software SMAVIA Viewing Client
2 Introduction

The video protection of large buildings, shops and especially public areas such as railway stations, streets and squares usually generates a high volume of data by recording the corresponding video streams. As a result, the evaluation of the recordings becomes more and more time-consuming and thus more personnel-intensive. The cost of video evaluation can be reduced by automatically analyzing the video streams.

Video Content Analysis (VCA) is a technology that automatically analyzes video streams based on motion detection. The aim of this analysis is to obtain useful information about the content of the video streams in order to enable a targeted video evaluation.

The VCA technology provides a broad data base for the targeted search for relevant events. An active alarm function based on this data is not planned.

2.1 Conventional Approach

Dallmeier recording systems have been equipped with VCA technology for several generations. It is used in particular for the Motion Detection recording mode and as a basis for the SmartFinder function.

The analysis of the video streams is done on the recording system. The VCA function analyzes the video stream permanently. It detects sequences with motion as well as their position in the image and provides this information as metadata for further processing.

The detected motion events are used in the Motion Detection recording mode to trigger the recording of the video stream. The recording of sequences without significant activities is avoided. This reduces both the required storage capacity and the time needed for video evaluation.

In addition, all information about a motion event (date, time and position of the movement) is stored in a database. During the evaluation with the client software SMAVIA Viewing Client, the SmartFinder function uses these metadata for the targeted search for sequences with movements in a specific image area. Again, the effort involved in the video evaluation is reduced.
2.2 Progressive Approach

The advanced development of powerful network cameras currently allows the integration of VCA technology directly on the camera. This approach has already been implemented on all Dallmeier 5000 series network cameras.

The integrated VCA technology analyzes the video stream captured by the image sensor before processing and independent of the subsequent compression directly on the camera. It recognizes movements that meet finely adjustable criteria and provides the corresponding metadata for further processing directly on the camera.

In addition to the sophisticated analysis algorithms for motion detection, various analysis functions have been integrated, which recognize events and objects based on the metadata and allow for their classification.

- **Intrusion Detection** - Detection of access to a defined area
- **Line Crossing** - Detection of a virtual line crossing
- **Tamper Detection** - Detection of manipulations on the camera
- **Object Classification** - Classification of objects
- **Face Detection** - Detection of faces

The results of the analysis functions are continuously sent to the recording system as event messages with the corresponding metadata in addition to the recorded video stream.

The appliance uses the received motion events to control the recording of the video stream in the Motion Detection mode. As in the conventional approach, this reduces the effort required for storage and evaluation.

The received motion events are stored in a database with the appropriate metadata for the evaluation with the client software SMAVIA Viewing Client.

Unlike the conventional approach, the metadata includes much more information than just the date, time, and location of the events. Depending on the selected analysis functions, further information such as the object class or event duration allow a very targeted and efficient evaluation of the stored video streams.
2.3 Benefits

The integration of the VCA technology directly on the camera offers substantial benefits in combination with Dallmeier recording systems.

Reduction of utilization

The shift of the computation intensive analysis functions to the camera reduces the utilization of the appliance. Since the parallel analysis of all video streams recorded with Motion Detection is completely eliminated, this memory-saving recording mode can be used for a theoretically unlimited number of video streams.

More information

Powerful network cameras provide sufficient performance for analyzing of the captured video stream. Moreover, enough computing power is available for the parallel use of several analysis functions. In addition to the date, time, and position of events, a variety of information can be obtained from the video stream, such as the object class or event duration.

More efficient evaluation

During the evaluation of the recordings with SMAVIA Viewing Client, the extra information obtained contributes to a very targeted and efficient evaluation. For a good overview, these metadata can be displayed directly in the image (sensorgrid). During the targeted search, the combined filtering of object classes (persons or vehicles) and relevant events (intruding, crossing, manipulating) allows to find the searched sequence quickly. Furthermore, irrelevant events can be excluded due to their short duration (snow filter).
3 Analysis

The VCA technology integrated in the 5000 series cameras analyzes the video stream captured by the image sensor directly on the camera. It detects movements and provides the corresponding metadata for further processing by the analysis functions integrated directly on the camera. These functions detect events and objects and also allow their classification.

- **Intrusion Detection** - Detection of access to a defined area
- **Line Crossing** - Detection of a virtual line crossing
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- **Object Classification** - Classification of objects
- **Face Detection** - Detection of faces

The VCA functions are configured with a web browser over the user interface of the camera. After the global settings for the object detection are carried out, the required analysis functions can be set and activated.

Note the detailed description in the corresponding Configuration documentation.

3.1 Objective

The VCA technology integrated in the 5000 series cameras is designed to detect all potentially relevant events. The acquisition of relatively many non-relevant events is accepted.

The metadata of all events is stored in a database on the recording system, neglecting the required storage space for non-relevant events. An active alarm function based on this data is not provided, interfering false alarms do not occur.

The stored metadata serves as a broad basis for the targeted search for relevant events in the recorded video footage with the function SmartFinder in SMAVIA Viewing Client. Only here, non-relevant events are filtered out by the combination of sophisticated search criteria. This ensures that no important event is overlooked. The number of events discarded by the filters is irrelevant.

Note the versatile range of SEDOR® appliances for applications that require active alarming based on video analysis events.
3.2 General Configuration

The global settings for object detection are made in the Analysis tab.

Abb. 3-1 Global settings

The general settings initially include the definition of the Scene (indoor or outdoor). In addition, the orientation of the camera is set under View and the Installation height can be defined.

Expert settings can be used to refine these basic settings. They allow, for example, the definition of the resolution for video analysis, the persistence of static objects or the sensitivity of the analysis.

Abb. 3-2 Expert settings
The dimensions of the objects relevant for the analysis functions are set in the **Object sizes** section. Detected objects that are too small are discarded and not processed further.

The **Draw object limits** function makes it much easier to estimate the dimensions.

Image areas that are not of interest for the analysis can be marked as **Ignore mask**. This mainly reduces the number of irrelevant events, but also the required computing power on the camera.

Inactive areas can be marked multiple times as a red rectangle or polygon. They are not displayed in the live image or in the recording.
3.3 Intrusion Detection

The Intrusion detection analysis function generates an event when an object enters a freely definable area.

The creation of the defined areas corresponds to the procedure for defining inactive areas. The Mode and Threshold options provide optimized detection results and minimize non-relevant events.

![Abb. 3-5 Active area for intrusion detection](image)

The Mode determines the sensitivity of the function. Besides a balanced mean, the function can be set to Sensitive (priority on the detection of many real events, but increased risk of additional false detection) or Insensitive (priority on avoidance of false detection, but increased risk of undetected events).

The Threshold value determines how much percent of a detected object have to enter the active area to trigger an event.
3.4 Tamper Detection

The Tamper detection function detects abrupt changes to the scene that typically occur when the camera is manipulated by defocusing, twisting, spraying or covering.

An abrupt change to the scene usually also occurs when a light source is switched on or off. The function can distinguish this particular situation from a real manipulation and assign it to a separate event.

3.5 Object Classification

The Object classification function tries to determine whether a detected object is a person or a vehicle and assigns it to the corresponding object type.

The longer an object is analyzed, the more accurate is the assignment of a detected object to a particular type.

A detected object is usually viewed as an Unknown object first. If, for example, a delivery van moves slowly from the side into the scene, the object can then be interpreted as a Person. As the analysis time continues, when the delivery van moves further into the scene, the function will finally select the appropriate Vehicle type.

Note that the class of a detected object can change with the progress of its analysis.
3.6 Face Detection

The Face detection function can be activated as a sub-function of object classification. This function tries to detect a face in a captured object of type Person.

![Object classification and face detection](image)

The Mode determines the sensitivity of the function. Besides a balanced mean, the function can be set to Sensitive (priority on the detection of many real events, but increased risk of additional false detection) or Insensitive (priority on avoidance of false detection, but increased risk of undetected events).

ℹ️ The function detects the presence of a face (Face Detection). The analysis of the manifestation of visible features and the link to the data of a person (Face Recognition) is not supported.
3.7 Line Crossing

The Line Crossing function generates an event when a detected object is crossing a freely definable virtual line.

Only one virtual line can be defined for this analysis function. An existing virtual line is automatically replaced by a new line.

Note that only one virtual line can be defined for the Line Crossing function.
4 Recording

The SMAVIA appliance continuously receives the results of the VCA analysis functions as event messages with the corresponding metadata in addition to the recorded video stream.

The appliance uses the received motion events to control the recording of the video stream in the Motion Detection mode. Furthermore, the received event messages are stored with the corresponding metadata in a database and kept for evaluation with SMAVIA Viewing Client.

Note the detailed description in the corresponding Configuration documentation.

4.1 Compatibility

The functions for storing and providing analysis events and metadata are first integrated into SMAVIA appliances of generation 5. The introduction is planned for the forthcoming firmware version 8.x.11, which will be available for the following appliances:

- IPS 2400 II and IPS 2400
- DMS 2400 II and DMS 2400
- Video NetBox II
- DIS-4/M SRS

The integration into the firmware for generation 6 appliances (IPS 10 000) is provided in a second step. A specific firmware version of the 9.x.x series has not yet been defined.

Note the current information in the corresponding Technical Information.
4.2 Settings

The SMAVIA Appliance recognizes a camera that is equipped with the new VCA technology during the camera test. After deactivating the option Image processing on recorder all the necessary settings for storing and providing analysis events and metadata are made automatically. All other settings, such as the configuration of the Motion Detection recording mode, can be performed as usual.

ℹ️ The appliance automatically makes all necessary settings. Observe the following descriptions in case of manual modification of the settings.

ℹ️ Note the detailed description in the corresponding Configuration documentation.

4.2.1 Image Processing

The camera test can be started after entering the login data with the Test button. If the camera is equipped with the VCA technology, the appliance will release the check box Image processing on recorder and allow for the deactivation of this option. The appliance then uses the analysis data of the camera.

![Camera Configuration](image)

Abb. 4-1  Camera Configuration

ℹ️ The option Image processing on recorder and the analysis data of the camera cannot be used at the same time.
4.2.2 Data Storage

After the deactivation of the option *Image processing on recorder*, the storage of the analysis data in the database is activated automatically. This setting is displayed in the *Recording Settings* dialog in the *Analysis* column by a blue button.

The storage of the analysis data has to be activated in order to enable the evaluation of the analysis results with SMA VIA Viewing Client.

4.2.3 Search Items

In the last step of the automatic configuration, the search items *Movement coordinates* and *Sedor data* are activated for the evaluation with the SMAVIA Viewing Client.

This setting releases the use of the stored analysis data for the client software. In this example, these options are shown in the last two lines.

The search items *Movement coordinates* and *Sedor data* have to be activated in order to enable the evaluation of the analysis results with SMAVIA Viewing Client.
4.3  Operation

SMAVIA appliances, which are equipped with the **LocalViewing** function, allow the evaluation of the recording with a monitor connected directly to the appliance. The function **SmartFinder** for the **search for sequences with movements** is also available.

ℹ️ Note the detailed description in the corresponding document **Operation**.

In the case of a camera that is equipped with the new VCA technology, SmartFinder accesses the event data supplied by the camera and stored in the database. The search for sequences with movements can be carried out as usual.

The search using further data such as **object type** or **event duration** is **not intended for integration in LocalViewing**. The current version of the client software SMAVIA Viewing Client is available for the use of more complex search functions.

ℹ️ Use SMAVIA Viewing Client for complex search functions with data such as object type or event duration.
5 Evaluation

SMAVIA Viewing Client is a client software for the fast and convenient evaluation of SMAVIA Appliances over the Ethernet (LAN/WAN).

SMAVIA Viewing Client allows for the quick and intuitive display of live views and supports the efficient evaluation of recordings. In the most recent version, especially the SmartFinder function has been enhanced for a refined search using VCA metadata.

Note the detailed description in the corresponding documents Configuration and Operation.

The VCA technology integrated in the 5000 series cameras is designed to detect all potentially relevant events. The acquisition of relatively many non-relevant events is accepted.

The metadata of all events is stored in a database on the recording system. An active alarm function based on this data is not provided.

The stored metadata serves as a broad basis for the targeted search for relevant events in the recorded video footage with the function SmartFinder. Only here, non-relevant events are filtered out by the combination of sophisticated search criteria. This ensures that no important event is overlooked. The number of events discarded by the filters is irrelevant.

The VCA technology provides a broad data base for the targeted search for relevant events. An active alarm function based on this data is not provided.

Note the versatile range of SEDOR® appliances for applications that require active alarming based on video analysis events.

5.1 Compatibility

The functions for searching with SmartFinder based on analysis events and metadata are expected to be integrated in version 2.4.18 of SMAVIA Viewing Client.

The integration into the video management software SeMSy® III is planned in a second step. A specific version has not yet been defined.

Note the current information in the corresponding Technical Information.
5.2 Settings

SMAVIA Viewing Client does not have to be configured separately for the search with the SmartFinder function using metadata.

However, it is advisable to activate the display of the sensorgrid in order to visualize the objects captured by the Video Content Analysis during playback.

In addition, the display of the metadata of the shown event can be activated. In this case, the metadata stored for an event is displayed directly in the image during playback.
The **general display of the sensorgrid** and the **display of the metadata** (descriptions) can be activated in the *Program > Configuration* dialog with the corresponding check-box.

![General activation of the sensorgrid](image)

In this case, the sensorgrid remains active after changing the recording system or after restarting SMAVIA Viewing Client.

During playback, the dynamic **display of the sensorgrid** can also be activated and deactivated over the *Image > Show sensor grid* context menu of the playback window.

![Dynamic activation of the sensorgrid](image)

In this case, the sensorgrid is displayed only during the current session. After switching the recording system or after restarting SMAVIA Viewing Client, it is no longer active.

**Note that the display of the sensorgrid is not required for evaluation with SmartFinder.**


5.3 **Operation**

The basic operation of the SmartFinder function remains unchanged. As before, a period can be set and an image area can be defined. After the search, SmartFinder displays a list of all sequences with motion (events) in this area.

![Note the detailed description in the corresponding Operation documentation.](image)

The latest version of SMAVIA Viewing Client now supports a refined search with SmartFinder, using the metadata of an event provided by the Video Content Analysis.

The SmartFinder function can now be restricted to the search for one or more Object types and combined with a Filter for specific events. In addition, the minimum duration of a detected event (tracking duration) can be set with a slider.

![Note that the Object type and Filter options are not displayed, if the camera is not equipped with the VCA technology.](image)

The smart combination of these options allows for the reduction of the displayed events to the relevant minimum.

As a result, only a small number of sequences have to be checked for the occurrence of the actually searched event. This enormously reduces the effort required for evaluation.
Let us consider an abstract and simple problem. We want to know which persons have exceeded the virtual line defined in chapter 3.3 in a certain period of time.

For simplicity, the search is based on the entire image and is not limited to the corresponding image area. In the first step, only the period is set. The search provides more than 500 results.
Since only persons are relevant to our evaluation, we limit the **Object type** accordingly and only receive 67 events.

However, the list still shows all persons who have been detected somewhere in the image. Since we are only interested in crossings of the virtual line, we set the **Filter** to the corresponding **Line crossing** event and receive only 37 events.
We are searching for walking persons and assume that at least 10 seconds are required for the route under consideration. The duration of the object detection (tracking duration), which is set with the slider, excludes further uninteresting events.

Abb. 5-10  SmartFinder and object type / filter / tracking duration with 3 results

In the end, we were able to refine the search so far that only three really interesting events remain. These can be evaluated as usual with the playback functions.

Note that the **Object type** option allows the combination of multiple characteristics with an OR link (find **Person** OR **Vehicle**).

Note that the **Filter** option allows the combination of multiple characteristics with an OR link (find **Intrusion** OR **Crossing**).