

ACTIVITYDETECTION 3.1

Configuration

Revision 1

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Document history

Revision	Date	Comment
1	15/10/19	First revision for version 3.1

Target public

This document is written for the person in charge of configuration of the ActivityDetection application in version 3.1. It describes in detail the different settings used on installing and setting this analysis application.

Get technical support

You can ask your questions or post your comments and suggestions to ACIC at the following address: support@acic.eu. Don't forget to detail the information on the product you own (version number) and your details so that we can reply to you.

Warnings

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Table of contents

1	Introduction	4
1.1	Principles.....	4
1.2	Quick start-up.....	4
2	Configuration.....	9
2.1	General concepts	10
2.2	Defining the analytics context.....	12
2.2.1	General attributes of the context.....	12
2.2.2	Reference plane calibration	12
2.2.3	The detection's masking regions	15
2.2.4	PTZ markers	15
2.3	Adding a detection rule	16
2.3.1	Defining a region.....	16
2.3.2	Defining a line	16
2.3.3	Defining an object class	17
2.3.4	Defining a detection rule	18
2.4	Other parameters	20
2.4.1	Global settings	20
2.4.2	Event generation.....	21
2.4.3	Display settings.....	22
3	PTZ case.....	25
4	Conclusion.....	26

1 Introduction

ActivityDetection is an image analysis application for surveillance of perimeters or secure areas. It provides several types of detection rules, covering all automatic camera surveillance issues: presence in a region, crossing of virtual lines, stationary detection.

This application is implemented on several media, in a server for the analysis of several video streams or directly in a camera (the "Edge" version).

This document describes ActivityDetection's configuration interface, starting off with a quick start procedure.

1.1 Principles

Configuration of ActivityDetection requires at least two different stages:

- configuration of the operational context
- definition of the detection rules

With the context, we specify the type of camera and images, the calibration data and any non-detection regions or PTZ markers.

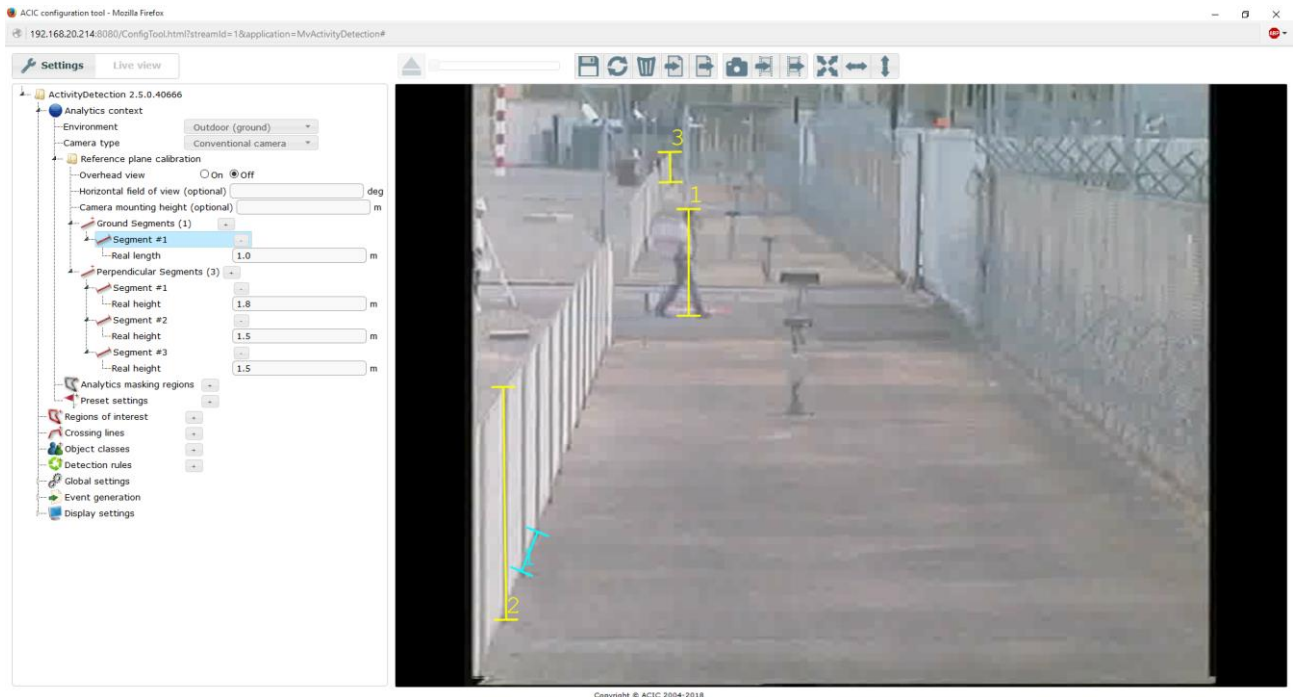
In terms of detection, with ActivityDetection we can specify up to 8 rules from among:

- presence in a region
- crossing of a line
- sequential crossing of several lines
- stationary detection
- motion detection

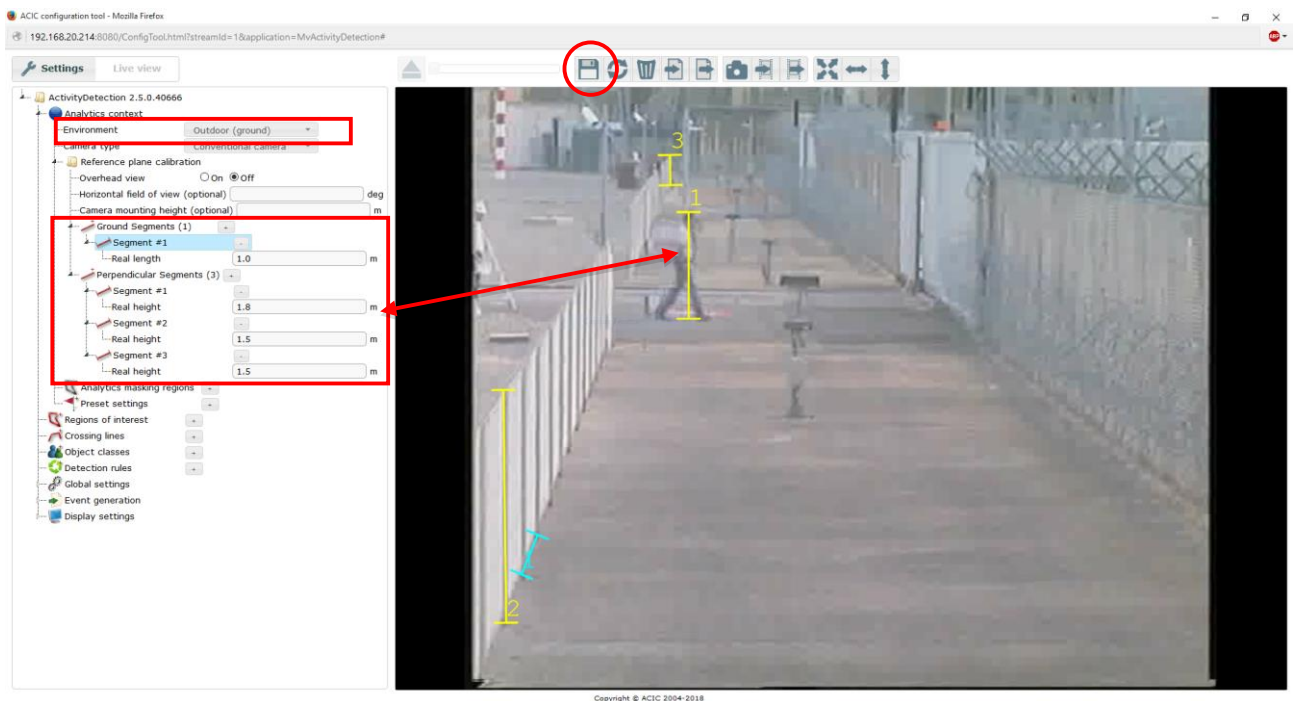
Each rule referring to a region, one or several lines and an object class (person, car, etc.). Finally, general settings are proposed for the detection sensitivity, the event type or the level of details of the graphics outputs.

1.2 Quick start-up

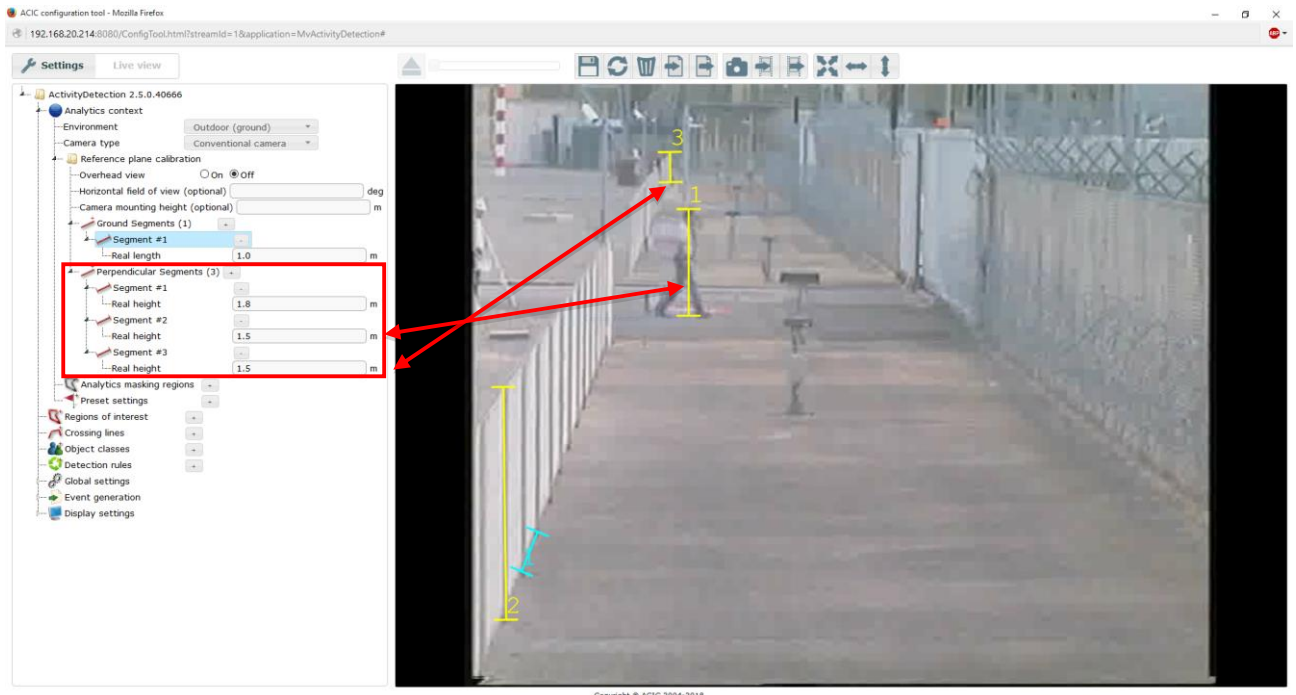
Below, we detail the minimum number of operations required to start up ActivityDetection 3.1 for a simple detection scenario. In the following screen shots, we show how to enter a minimal configuration using the user interface.



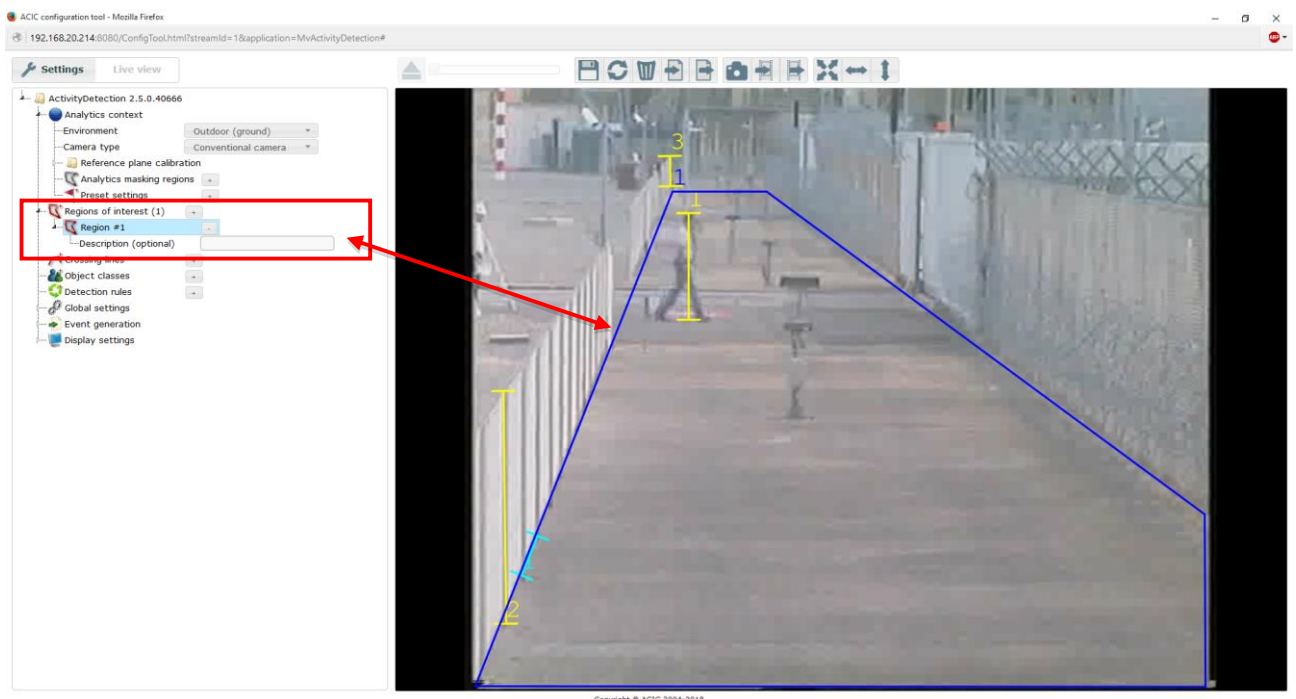
On the initial booting of the interface, the configuration is blank. All parameters are presented in a tree on the left, the current video image is on the right.



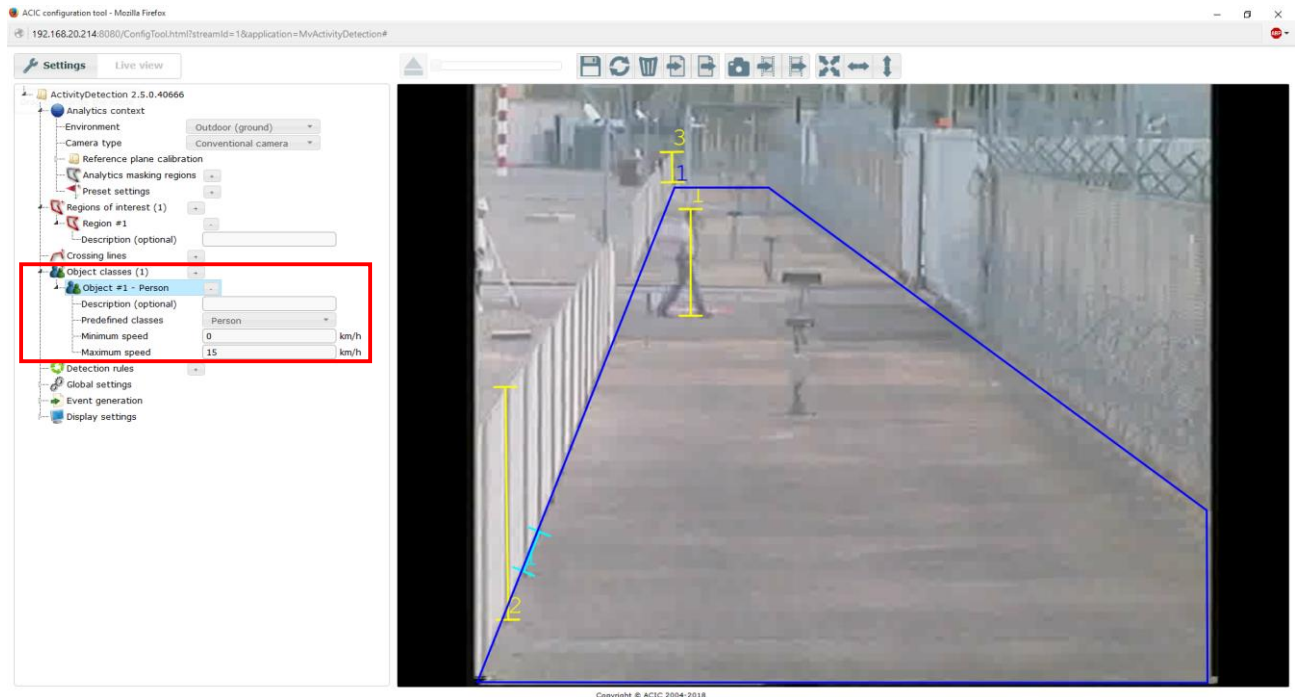
In the « **Analytics context** » group, select an outdoor environment (« **Outdoor** ») and enter the first calibration segment representing, for example, a height of approximately 1.8m for the person. Double-click on the « **Perpendicular Segments** » group to add an element. Then trace in the image a segment, perpendicular to the ground plane and of the size of a person (for example). Modify the real size of this segment in the « **Real height** » region, as necessary. In the top band, the diskette icon allows to save the changes.



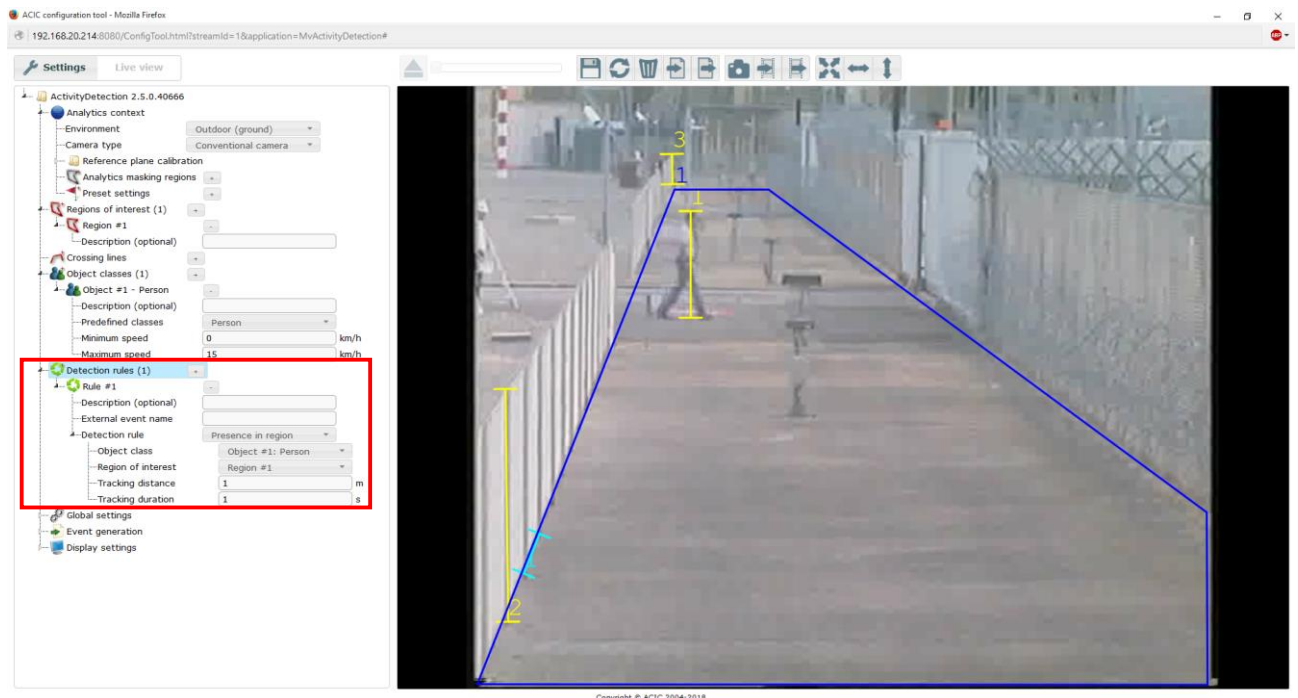
Entry of a second and third segment for the calibration, for example on the same person or the fence but in another position in the image (so that the analysis takes the perspective effect correctly into account). The real height of each segment must be entered. With these three segments, the reference plane is calibrated.



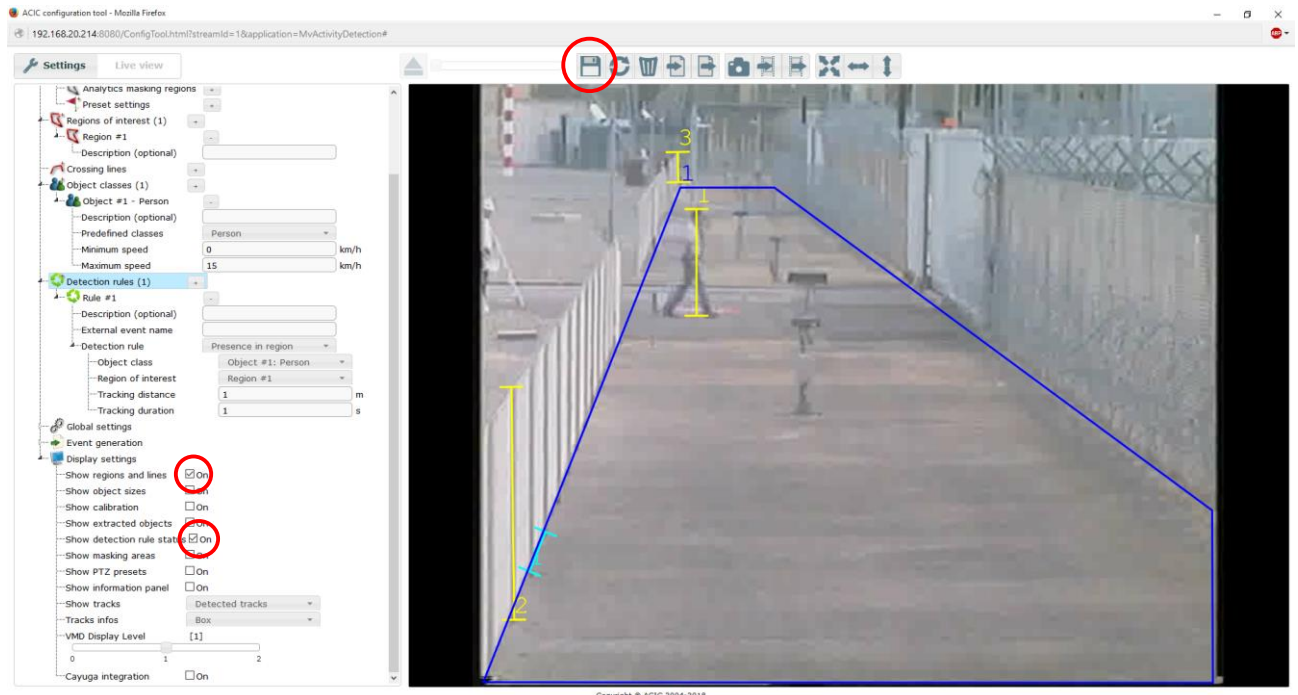
Defining a region of interest. The aim is to detect intrusion into the site by a person. Like the segments, double-clicking on « **Regions of interest** » will create a new region. Trace any polygon in the image by clicking for all the peaks and finish by double-clicking on the last point.



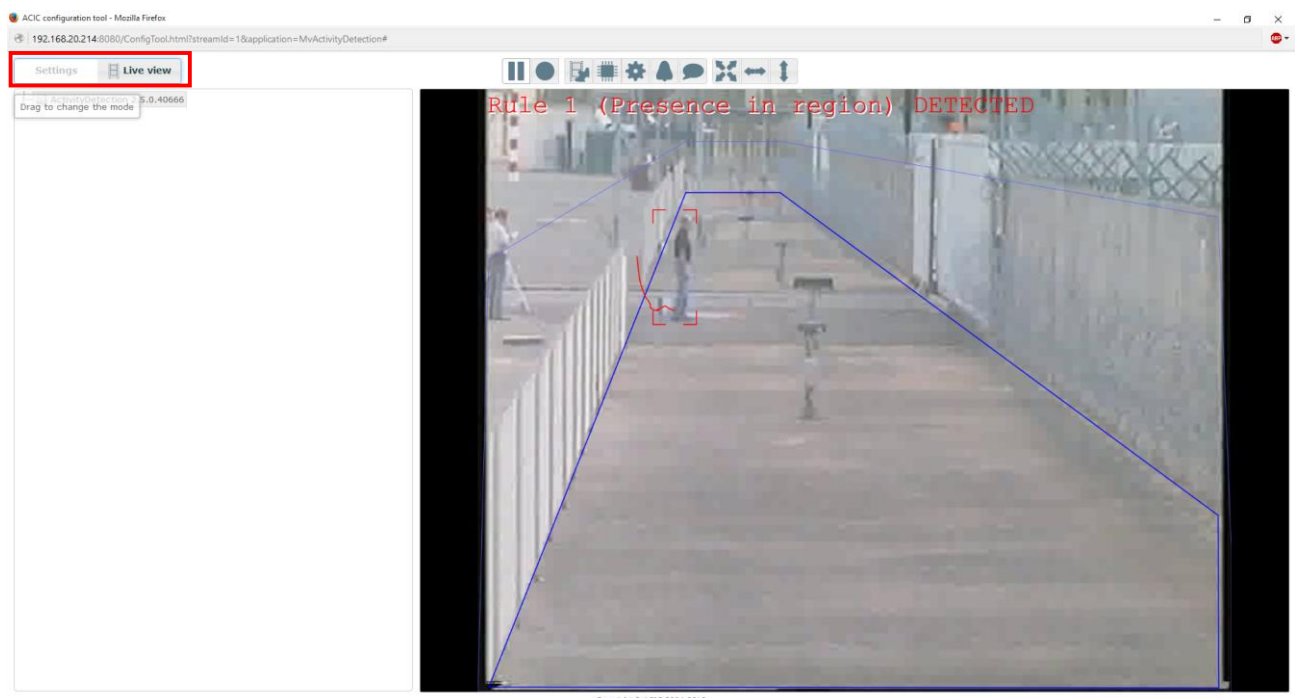
Now create an object class corresponding to a person, to give the detection a subject. Double-click on « **Object classes** ». The default class is « **Person** ». The minimum and maximum speeds are set by default for a person.



You can now create the detection rule by double-clicking on « **Detection rules** ». By default, the « **Presence in region** » is the function we want to obtain. The subject of the rule is object class 1 (« **Object class** ») and the detection region is also the first (« **Region of interest** »), previously defined. Tracking distance and duration can remain to the default values.



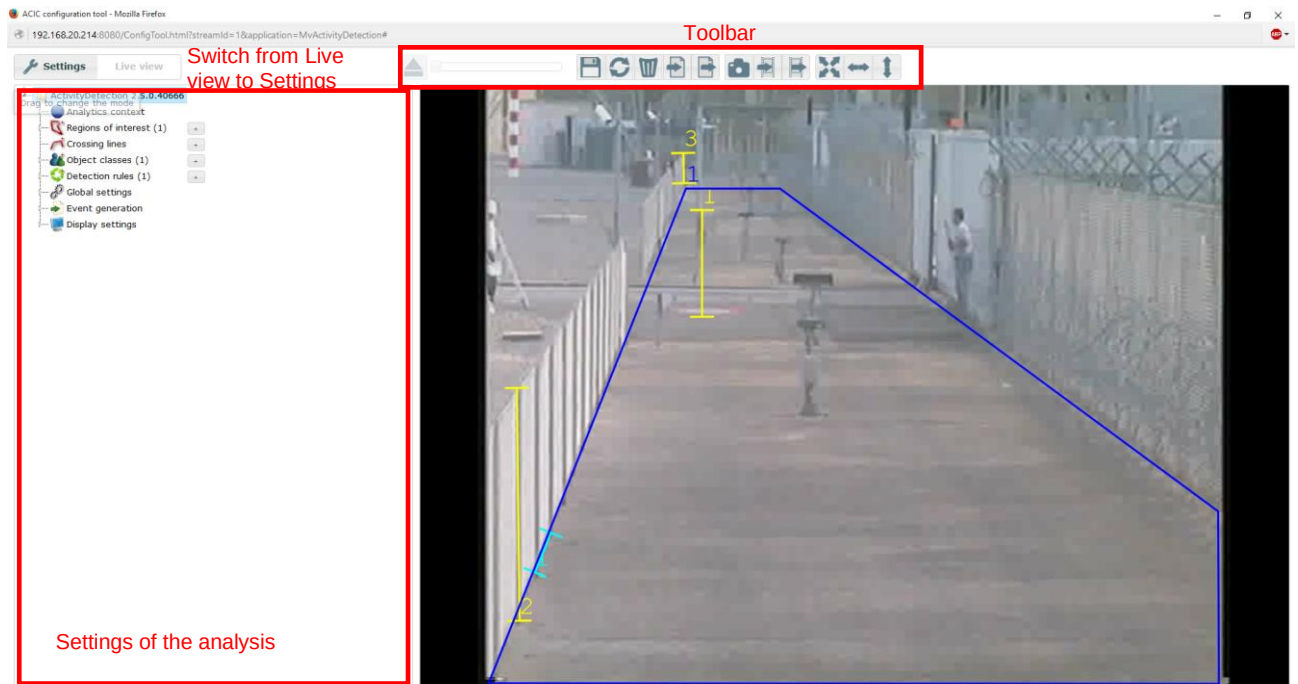
Finally, the « **Show regions and lines** » and « **Show detection rule status** » options have been ticked in the « **Display settings** » section. This will provide us with the drawing of the region and the detection when the video is displayed with superimposed graphics (in a VMS for example). Click on the disk to confirm and save this configuration, which is active immediately.



Switch on **Live View** to view the live analysis with its display. Note the drawing of the detection region and the indication of the detection rule status.

2 Configuration

The **ActivityDetection** configuration is created using an HTML5 web user interface. A modern web browser with good HTML5 support is required (recommended: Chrome or Firefox).










Initial presentation of the configuration interface. The different settings are displayed in the tree on the left, the camera image on the right. The geometric primitives (polygons, lines) will be drawn on the image, the numerical and textual settings will be entered in the tree.

A valid configuration is composed by defining the reference plane calibration and at least one detection rule.








2.1 General concepts

On the top of the window, a toolbar allows rapid access to useful functions. The toolbar displayed depends on the current view: **Live view** or **Settings**.


LIVE VIEW ICONS

	Pause / Play: pause/resume live video
	Record a video clip
	Show analytics: display/hide analytics overlays
	Show CPU info: display/hide the CPU/RAM gage
	Show system info: display/hide the system information panel
	Show sprites / logo
	Fit to screen / width / height: Adjust the image size in the configuration interface.

SETTINGS VIEW ICONS

	Save configuration: save and apply the current analytics configuration
	Reload configuration: reload the stored analytics configuration
	Empty configuration: load a blank analytics configuration
	Import / export configuration: import or export the analytics configuration from or to a file
	Refresh scene: refresh the camera image
	Import / export image: import an image into the configuration tool or export the current camera view to a file
	Fit to screen / width / height: Adjust the image size in the configuration interface.

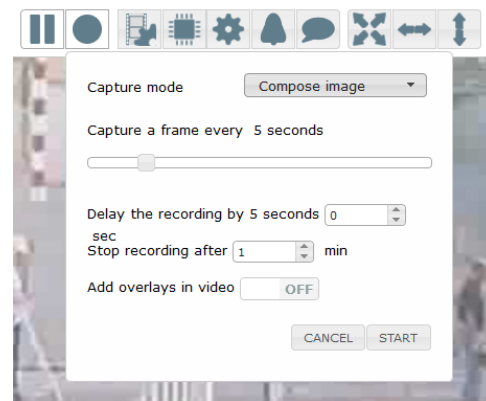
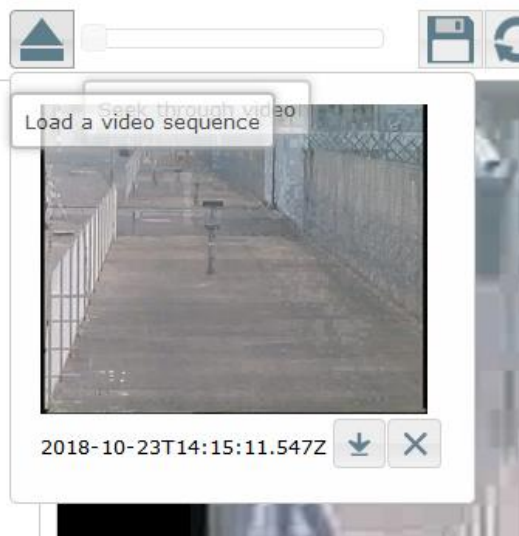


The configuration will only be saved and applied after a click on the  icon.

Sequence record and playback

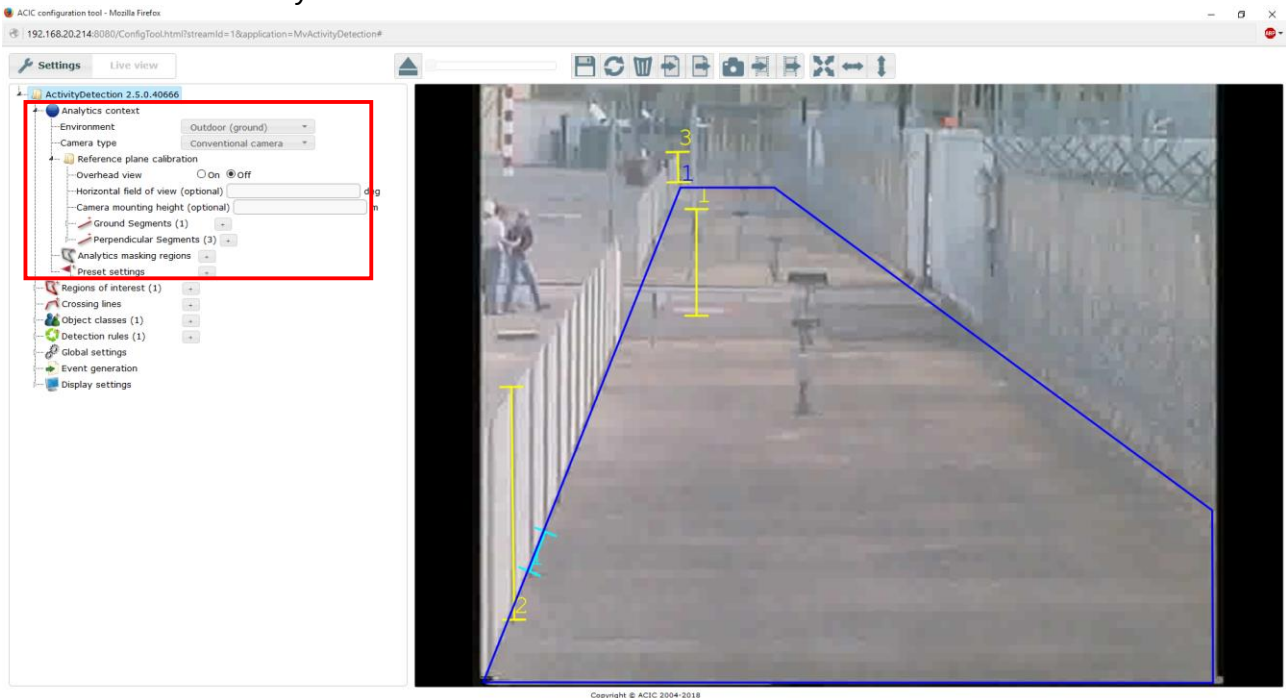
It is possible to record short video clips or composed images directly in the configuration interface. It can then be used to configure the analytics.

- In the **Live view**, click on the record button to display the different option of recording.
- Record a sequence with someone walking in the field of view.
- In the **Settings view**, click on the **Load a video sequence** to load the recordings, you can then navigate through the video and configure the analytics on it.



2.2 Defining the analytics context

The analytics (or analysis) context settings ("**Analytics context**") report on the environment and on the scene viewed by the camera.



The context settings section of the analysis.

2.2.1 General attributes of the context

The "**Environment**" gives the type of scene to be analysed, from among "**Indoor**", "**Outdoor (ground)**", "**Outdoor water environment**" or mixed (outdoor with ground and water). This choice may influence certain internal settings of the analysis.

Next, we find the camera type, in "**Conventional**", "**Day/Night**" or "**Thermal**".

2.2.2 Reference plane calibration

The reference plane calibration is used to correctly estimate the real size and movement of the objects. It is required for the analysis to work correctly and must be filled carefully.

First, select "**Overhead view**" if the camera looks at the scene from above, at maximum 20° from the vertical axis.



Examples of overhead views

If the “**Horizontal field of view**” or “**Camera mounting height**” are known, fill the parameters. If these values are unknown, it is important to leave the field(s) blank. But when a fixed focal lens is used (common with thermal cameras), the field of view is generally known, thus it is recommended to enter that value in the “**Horizontal field of view**” parameter.

The field of view is expressed in degrees and the mounting height in meters.

To understand the position and the attributes of the camera, relatively to the ground reference plane (that's what we call a camera calibration), at least 3 segments of known size must be set.

Two set of segments are available:

- segment on the ground plane, the “**Ground segments**”, are good to mark out features on the ground.
- segment perpendicular to the ground plane, the “**Perpendicular segments**”, are used to indicate object, person or feature placed vertically.

At least 4 segments must be entered to complete a good calibration. For each one, the real (world) size in meter is required in the “**Real size**” parameter (for example 1.80 meters for a person, 2.20 m. height for a fence, 2.8 m. width for a garage door...). Ideally, you should draw ground and perpendicular segments to ensure a good calibration (e.g one ground and 3 perpendicular).



For this overhead view, three segments have been drawn on the ground, with known dimensions (2 and 2.2 meters).



View with deep perspective, 4 perpendicular segments showing the people heights, approximately 1.7 and 1.8 meters.



Overhead view with mixed segments: the door's heights (2.1 meters perpendicular segments) and the widths (1.5 meters ground segments).

To display a 3D grid on the live view, check "**Show calibration**" on the display settings section. Calculated attributes of the camera (the field of view, the mounting height and the tilt angle) will also be displayed.

It is important to check if the information displayed match the view:

- The calibration grid is composed of squares of 2x2m projected on the ground.
- The calibration segments are displayed with the errors in meters made by the calibration model (in brackets). Errors bigger than 30cm must be checked.
- The horizon line in yellow appears if the horizon is visible in the view. If there is a horizon line but the horizon is not visible (eg. the yellow line is on the ground), the calibration needs to be verified.



Live display with calibration information

2.2.3 The detection's masking regions

Sometimes it is useful to be able to cancel all detection in one of the regions of the image. The "**Analytics masking regions**" section enables up to 8 independent masking polygons to be defined. No object extraction will take place in these regions.

2.2.4 PTZ markers

For the automatic control of PTZ preset, in the "**Preset Settings (markers)**" section we can enter up to 8 positions in the image. On detection, the marker number nearest to the subject will be selected and a specific event, **AcPTZPreset_i** will be generated (with i the index of the marker). When the subject moves from one marker to another, new events are fired. The event generated can be used in a VMS to control a PTZ camera to a specific preset.

2.3 Adding a detection rule

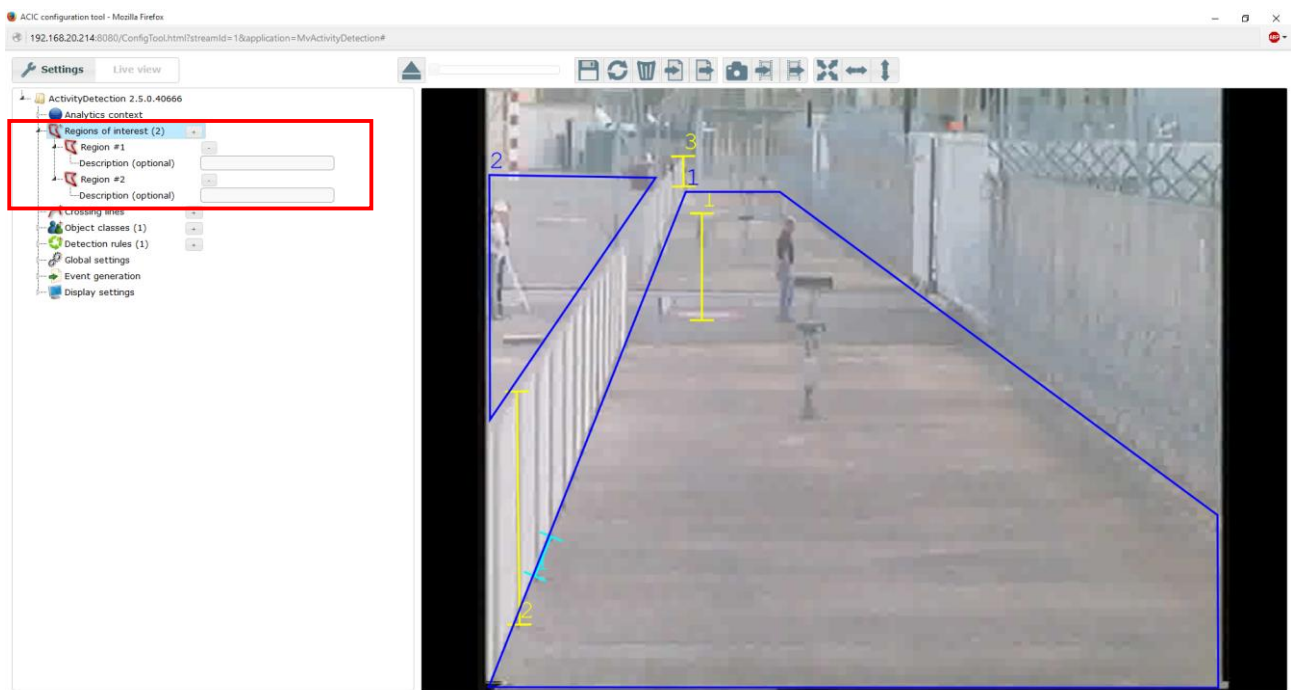
Detection rules define the behaviour of the analysis. They determine the detection conditions. Up to 8 rules can be defined from among the following types:

- detection of presence in a region ("**Presence in region**")
- detection of the crossing of a line ("**Line crossing**")
- detection of the sequential crossing of several lines ("**Multiple lines crossing**")
- stationary detection ("**Stationary detection**")
- motion detection ("**Motion detection**")

Each rule is associated with a region or line definition and an object class (the subject of the detection). Settings related to each rule control the triggering of the detection.

2.3.1 Defining a region

Up to 8 regions can be defined in the « **Regions of interest** » section. These are polygons traced on the ground plane, on which the objects to be detected move.

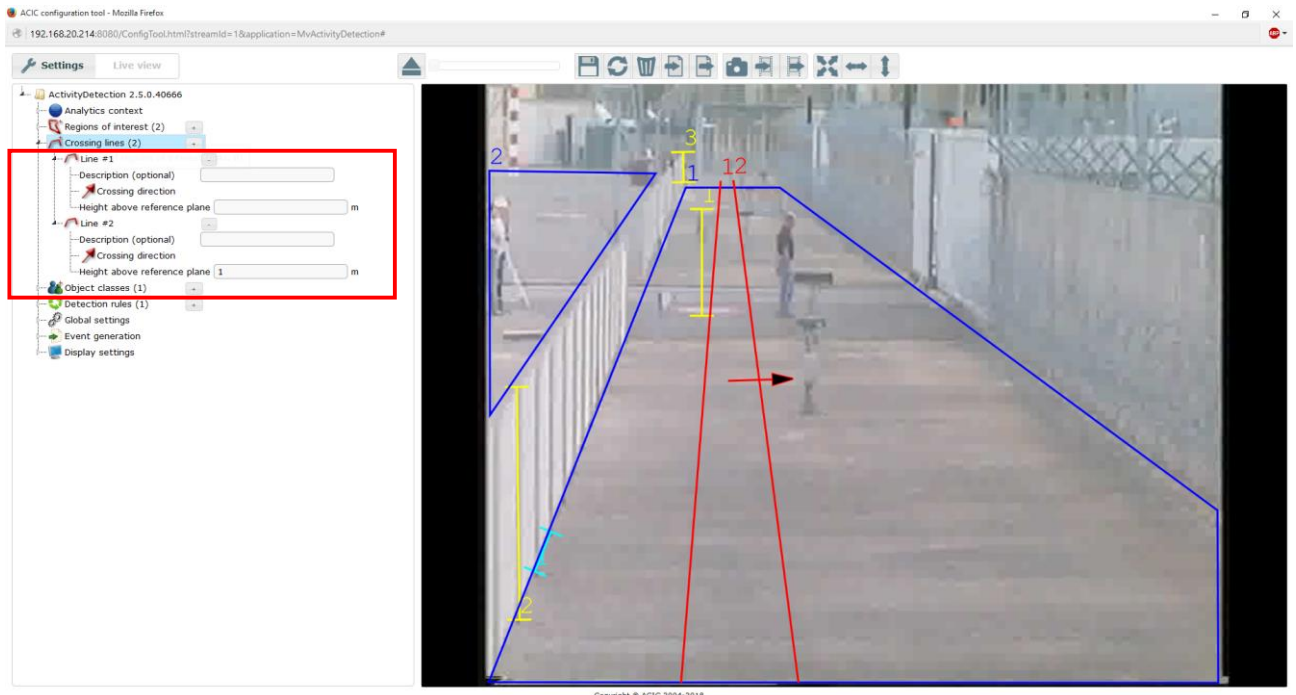


Two regions defined: one in the sterile corridor, one outside. The polygons on the ground are the ones that define the detection regions.

A free "**Description**" can be given for each region, that description will be added to the event parameter in case of detection.

2.3.2 Defining a line

Up to 8 crossing lines can be defined in the "**Crossing lines**" section. These broken lines can be traced on the ground plane or above it. In the case of a line placed at height (on the top of a fence, for example) the "**Height above reference plane**" setting must be filled with the height in meters. Optionally, a crossing direction can be entered.



*Defining 2 crossing lines. The first « **Line #1** » is on the ground, the second « **Line #2** » is at a height of 1 meter and has a direction.*

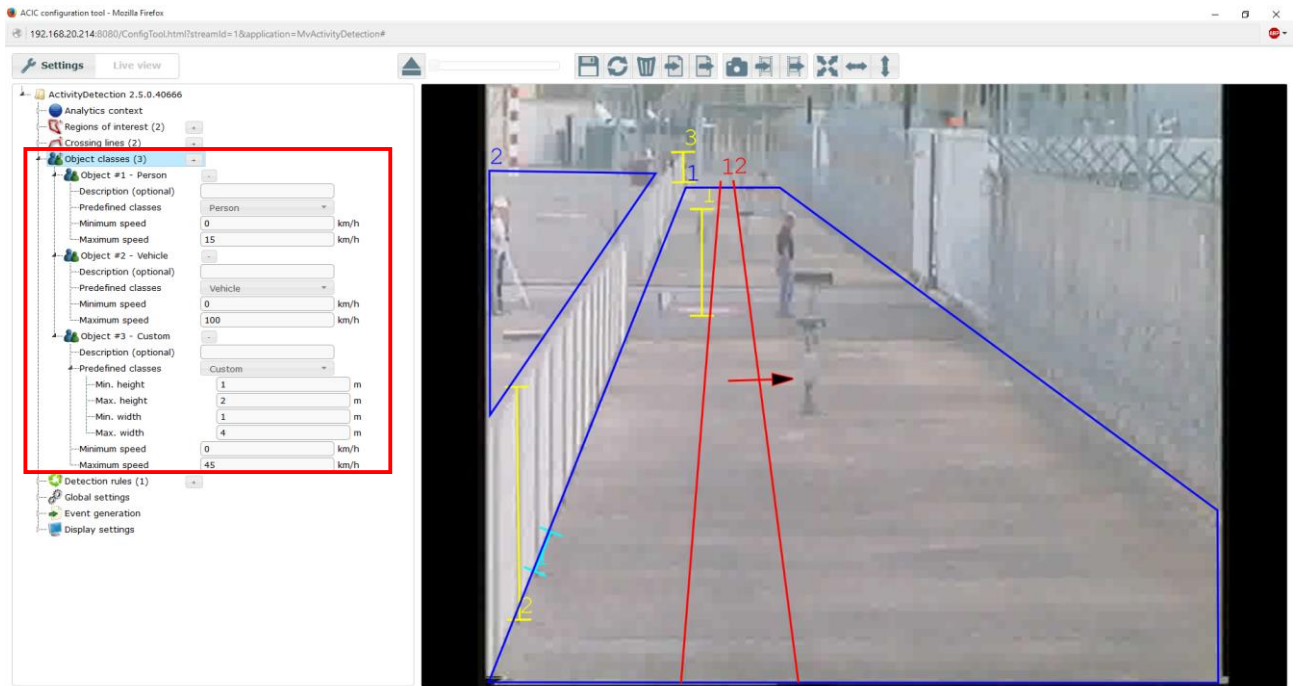
2.3.3 Defining an object class

The subject of the detection, i.e. the type of object that will trigger a rule, is defined in the "**Object classes**" section. Up to 4 different object classes can be entered, from among: a person or vehicle or a customised class ("**Custom**"). For each class, the minimum and maximum admissible speeds are predefined.

For the customised class ("**Custom**"), the minimum and maximum dimensions of the objects of the class must be entered.

The predefined classes **Person** and **Vehicle** have the following dimensions:

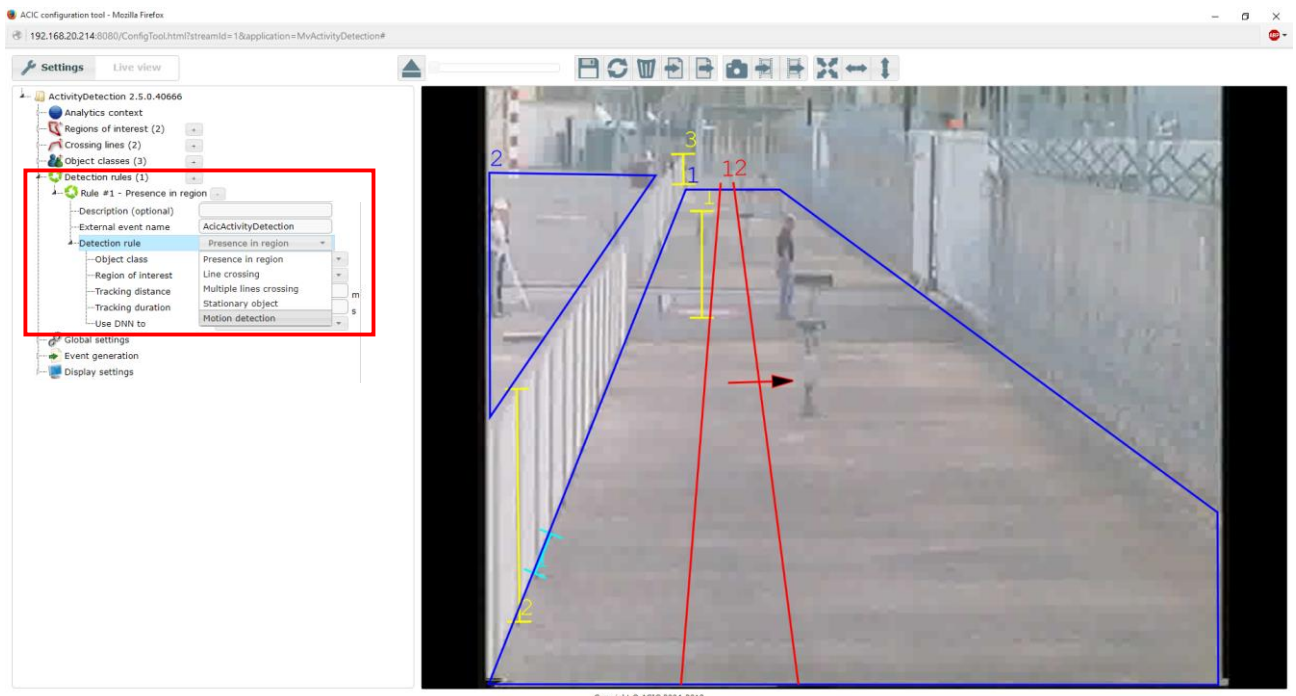
- Person: width [0.3 1.4]m – height [1.1 2.4]m
- Vehicle: width [1.41 15]m – height [1 3.5]m



Three object classes have been defined: the first to detect persons, the second for vehicles and the third for objects with heights between 1m and 2m and width between 1m and 4m. Speed ranges are specified for each class.

2.3.4 Defining a detection rule

The rules define the detection conditions in accordance with the regions, lines and object classes. Up to 8 rules can be defined.



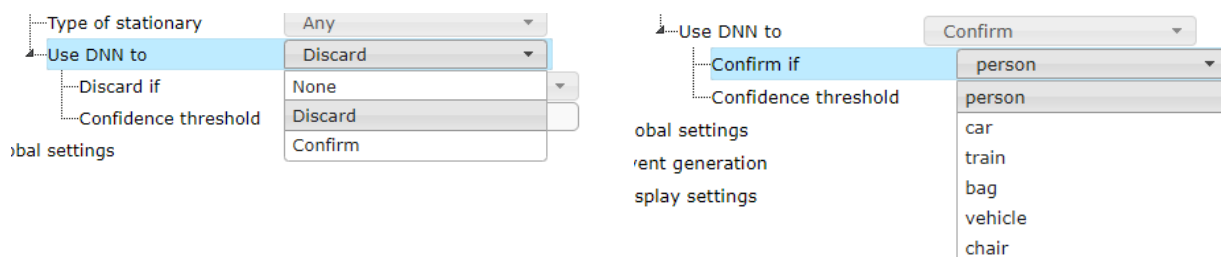
The detection rules are chosen from among: presence in region, single or multiple line crossing, stationary detection and motion detection.

Each rule will reference, by its index, an object class and a region or line(s). Five types of detection are possible:

- detection of presence in a region ("**Presence in region**"). The detection is effective when an object of the given class enters the given region. The "**Tracking distance/duration**" settings determine the detection conditions: the object needs to have been observed during the mentioned time and have travelled at least the distance entered.
- detection of the crossing of a line ("**Line crossing**"). The detection is effective when an object of the given class crosses the given line. If a crossing direction is associated with the line, the object must be crossed in this direction. The tracking duration and distance settings determine the minimum conditions the object must satisfy to trigger the rule. The "**One way crossing**" trigger force the object to cross the line in the required direction without any previous crossing (meaning, crossing the line in the wrong way forbids any further detection).
- detection of the sequential crossing of several lines ("**Multiple lines crossing**") The principle is the same as for single line crossing, except that a set of lines (min. 2, max. 4) must be crossed in the set order "**First**", "**Second**", "**Third**" and "**Fourth**". "**One way crossing**" also apply as in the Line crossing rule.
- stationary detection ("**Stationary detection**"). This rule will detect the appearance or disappearance of a stationary object in a region of the image. The object must be stationary for at least the time set in "Stationary duration" or an object constituting part of the scene's background must be removed for at least this time to trigger a detection. The type of stationary detection (appearance or disappearance) can be selected in the ("**Type of stationary**") setting. The maximum value for the duration is 1 minute due to software limitations. Check the StillnessDetection application for higher admissible durations. It is possible to define how long the detection must remain active with the "**Keep detection for**" parameter.
- motion detection ("**Motion detection**"). This rule performs in one region of the image (and not a region on the ground) a motion detection controlled by two settings, space sensitivity and time sensitivity. Space sensitivity, expressed as a percentage of the image's height, conditions the size of the objects. The time sensitivity gives the motion's minimum observation time for a detection to occur.

An optional "**External event name**" can be set. That name will be used by VMS integration to trigger specific event. By default, ActivityDetection use event names like AcicActivityDetection, AcicCrossingDetection or AcicStationaryDetection. With the external event name, it is possible to define a custom event name, per rule, and that name will appear in the VMS.

Finally, for each rule, it is possible to confirm or discard the detection with the help of a AI classifier (Artificial Intelligence based on Deep Neural Networks). This classifier will tell if the target is of the class selected (person, vehicle, bag, ...). It is useful in complex scenarios to reduce false alarms.



The image shows two configuration panels for DNN classification. The left panel has a 'Type of stationary' dropdown set to 'Any'. Below it, the 'Use DNN to' dropdown is set to 'Discard'. Under 'Discard if', there is a 'Confidence threshold' dropdown set to 'Discard' and a 'Confirm' button. The right panel has a 'Use DNN to' dropdown set to 'Confirm'. Below it, the 'Confirm if' dropdown is set to 'person'. Under 'Confidence threshold', there is a dropdown set to 'person' and a list of object classes: car, train, bag, vehicle, and chair.

Example with Stationary detection

Let's imagine a scenario where one wants to detect abandoned bags (luggage, backpack, handbag, ...), but not boxes or chairs for example. To do so, select "**Use DNN to**" confirm if **bag**. That way, the software will pre-detect any stationary object (within the sizes defined in the object class) and then ask the DNN classifier to confirm the detection *only* if it classifies the pre-detected

object as a bag. Any pre-detected object that are not classified as a bag will not trigger the detection.

The classes that are available are the following:

- person
- car
- train (tramway, metro)
- bag (backpack, handbag, suitcase)
- vehicle (car, motorcycle, bus, truck)
- chair (for testing purposes)

More classes can be added for specific scenarios, please ask ACIC for its feasibility.

A “**Confidence threshold**” allows to define the confidence of the classification of the object (1 means 100% sure).

Important note: for the best performances, the use of the AI classifier requires a GPU. At the moment, the use of the classifier is suitable with visible camera only.

Please refer to the documentation related to the analytics server interface to see how to configure the AI module (ACIC_MvConfigTool_EN_rev7).

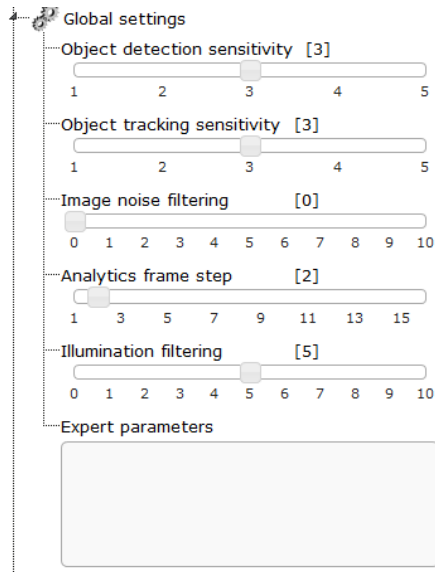
2.4 Other parameters

The “**Global settings**”, “**Event Generation**” and “**Display settings**” sections set out the general settings for controlling detection, event generation and display.

2.4.1 Global settings

Two settings can be used to adjust the detection sensitivity. The first, “**Object detection sensitivity**”, affects the analysis' capacity to extract moving objects. This setting controls the separation of the scene's background (static) and its foreground (dynamic). The higher the value, the more sensitive the analysis to light differences (gray shading in the image). Increase if contrast is too low.

The “**Object tracking sensitivity**” setting influences the capacity to track the extracted objects. This factor affects the association of the objects with each other to form tracks. A high value will favor tracking of objects, even if their shapes vary significantly over time. Increase if potential occlusions along the target's path or if tracking is not consistent enough.



Global settings

Object detection sensitivity [3]

Object tracking sensitivity [3]

Image noise filtering [0]

Analytics frame step [2]

Illumination filtering [5]

Expert parameters

General settings with their default value.

The two next settings affect the analysis: the reduction of the image's noise ("**Image noise filtering**"), if the images are very noisy and "**Analytics frame step**" for not processing all the images. Those two parameters are not available in the Edge version of the application.

The last setting allows to filter illumination changes ("**Illumination filtering**"). That filter removes local or global illumination artifacts and thus reduce the false alarm rate. Choose 0 to disable the filter, a value of 5 is conservative and a good compromise. Values above 5 may be required on specific conditions but affect significantly the detection performances. That filter is effective on visible and thermal imaging.

The "**Expert parameters**" text area is reserved for specific configurations.

2.4.2 Event generation

On detection, two types of event can be generated: as soon as one rule is satisfied or for each object that has led to a detection. In the former case, several objects that simultaneously trigger a rule would lead to one event only. In the latter, all objects would produce an event.

The "**Inter event duration**" setting is to avoid sending events that are too close together. It gives the minimum time permitted between two events, in seconds.

The "**Repeat event**" setting allows to periodically send an event as long as a detection lasts. If set to zero, there is no repetition, otherwise it will repeat the initial event every n seconds until the end of the detection.



Event generation

Event mode: Event per rule

Inter-event duration: 1 s

Repeat event: 0 s

The section of parameters controlling detection event generation.

The names of the various possible events in ActivityDetection are as follows:

- AcicActivityDetection for detection of presence in a region
- AcicCrossingDetection for crossing of a single virtual line
- AcicMultipleCrossingDetection for crossing of several virtual lines
- AcicStationaryDetection for detection of stationary object
- AcicMotionDetection for motion detection
- AcicPTZPreset_[1..8] for PTZ markers 1..8 activation

If the “**External event name**” is defined for a rule, it will override the default event name listed above.

The events come with parameters indicating the type of rule, the region's index, its description, the track ID, etc.

Here is a non-limited list of event parameters (more parameters can be added in the future):

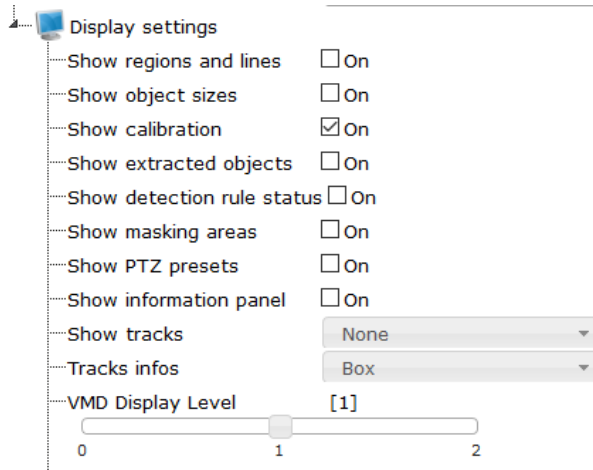
- *ruleType*: the rule that produce the event, with value in "Presence in region", "Line crossing", "Multiple lines crossing", "Stationary object" or "Motion detection"
- *ruleDescription*: the description field of the rule, if defined in the configuration
- *ruleIndex*: the index of the rule (starting at 1)
- *objectType*: the object type associated to the rule, with value in "Person", "Vehicle" or "Custom"
- *objectDescription*: the description field of the object type, if defined in the configuration
- *roiDescription*: the description field of the region, if defined in the configuration
- *roiIndex*: the index of the region (starting at 1)
- *lineDescription*: the description field of the crossing line, if defined in the configuration
- *lineIndex*: the index of the crossing line (starting at 1)
- *lineIndexes*: the list of the crossing line associated to a multi-line crossing rule. Each index is separated by a comma
- *stationaryType*: the stationary type for a stationary rule, with value in "Any", "Abandoned object (appearance)" or "Removed object (disappearance)"
- *external_event_name*: the event external name if defined in the configuration

If the “**Event mode**” is set to “**Event per track**” instead of “**Event per rule**”, additional parameters can be added to the event:

- *trackID*: a unique ID for the track producing the event (unsigned integer)
- *trackBbox*: the normalized coordinate of the object bounding box (for an explanation about the normalized coordinate system, refer to the ACIC Generic API document)
- *trackCoord*: the global positioning coordinates (WGS84 standard), if the camera is correctly calibrated and his global coordinate known.

2.4.3 Display settings

The “**Display settings**” section lists the different display decoration options. These are graphics elements that get overlaid on the video, in the case of display in a VMS, in the video flow from the analysis, in a dynamic web page...



Display settings

- Show regions and lines ☐ On
- Show object sizes ☐ On
- Show calibration ☒ On
- Show extracted objects ☐ On
- Show detection rule status ☐ On
- Show masking areas ☐ On
- Show PTZ presets ☐ On
- Show information panel ☐ On
- Show tracks
- Tracks infos
- VMD Display Level

0 1 2

The display options are:

- the configuration's regions and lines ("**Show regions and lines**")
- the minimum and maximum sizes of the objects ("**Show object sizes**")
- the calibration grid and camera attributes ("**Show calibration**")
- all the extracted objects ("**Show extracted objects**") seen by the analytics
- the status of each detection rule ("**Show detection rule status**")
- the detection's masking areas ("**Show masking area**")
- the PTZ presets ("**Show PTZ presets**")
- various technical information ("**Show information panel**")
- the objects being tracked with 4 levels of detail ("**Show tracks**" - details on the next page):
 - None
 - Detected tracks
 - Detected and confirmed tracks
 - All tracks
- the information about the tracks ("**Track infos**" - details on the next page):
 - Box
 - Box with icons
 - Box with text
- the motion detection display level ("**VMD display level**"):
 0. no information
 1. only motion detection status (ON/OFF)
 2. motion detection histogram

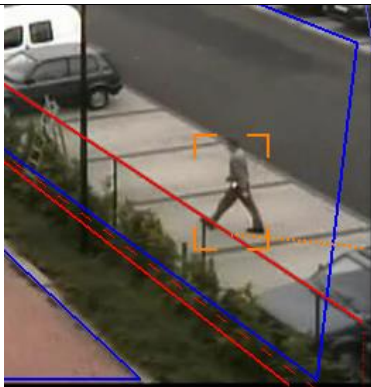
By default, region/lines and detection status are activated. **Show tracks** is on Detected tracks to show only the detected object. That's the minimum set-up for an informative view of the video analytics current status.

Example of combinations for the "**Show**" and "**Tracks infos**" parameters:



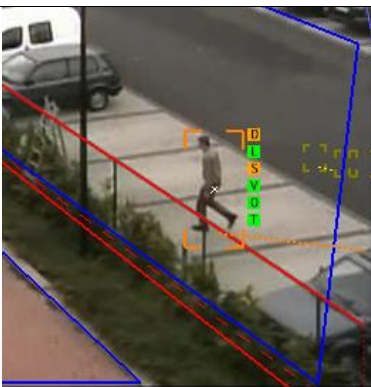
Detected tracks with Box

Only detected tracks are displayed, with bounding box and trajectory.



Detected and confirmed tracks with Box

Detected tracks (in red) and pre-detected tracks (in orange) are displayed. Pre-detected means that the object has the right characteristics of the target (speed, size) but has not triggered any rule yet.

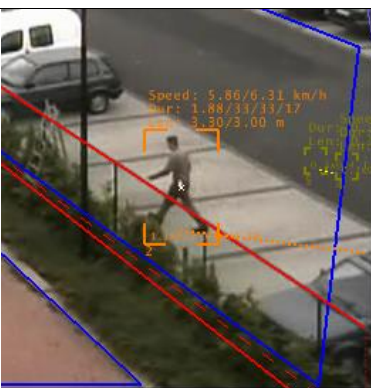


All tracks with Box and icons

All tracks with colored triggers are displayed. Triggers show the status of detection criteria in 3 colors: **not satisfied**, **pre-detected** or **satisfied**.

The criteria are

- **D** for duration, if the track duration matches the tracking duration expressed in the rule definition
- **L** for length, if the track length matches the tracking distance expressed in the rule definition
- **S** for size, if the object matches the width/height expressed in object class definition
- **V** for velocity, if the track matches the speed expressed in object class definition
- **O** for observation, if the track has enough observation (internal threshold)
- **T** for texture, if the object is not considered as an illumination artifact, relative to "Illumination filter" global parameter

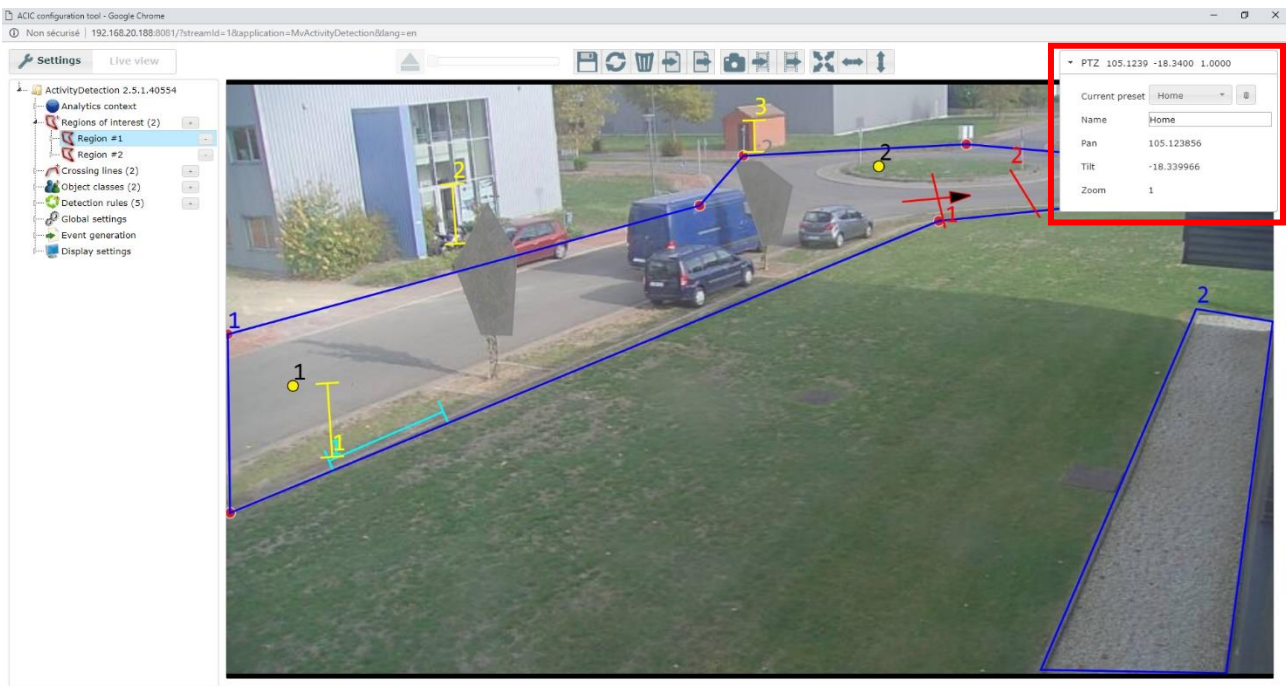


All tracks with Box and text

All tracks with textual information, for track length, duration, speed, object size and texture.

3 PTZ case

If the camera being configured is detected as having PTZ (Pan Tilt Zoom) capabilities, it is possible to configure different contexts for each preset position. A toolbar to select the configuration of a specific position will appear in the interface.



The toolbar to handle configurations of different preset positions

The toolbar is composed of an editable drop-down list containing the existing preset configurations and a delete button. Clicking on an element of the list will load the corresponding configuration and the reference image (the view for this preset) attached to it.

If there isn't any configuration for the current preset position, the interface will automatically add a new entry in the list, called "**New position**" by default. You can then configure the view as you normally would (see the previous sections) and edit the name for this configuration. Upon saving, the new entry will appear in the drop-down list and the corresponding view will be saved.

Once the setup of a position is done and if you want to configure another one, you can move the camera to the desired preset and then click on the refresh button in the interface. It will load the new view and an empty setup to start the configuration of this preset.

When the camera switches to a preset, ActivityDetection will automatically search if a matching configuration exists and if so, load it as the new context to be analyzed. If no configuration is found, analysis will be disabled until a configuration is done for this position or the camera moves again.

4 Conclusion

This document sets out the ActivityDetection application's configuration principle. With up to 8 detection rules definable, it offers a range of possibilities and performs most of the functions of an autonomous surveillance system.

ACIC provides practical training and technical support for the installation and the set-up of ActivityDetection. Other documents are also available on subjects such as:

- integration of the ACIC video analysis with most VMS on the market
- user guide for Edge or Server implementation of ActivityDetection
- the compatible camera list
- SDK for integration of the ACIC analytics and third-party systems

For any queries, contact ACIC at support@acic.eu.