Video Analytics

with MOBOTIX MOVE Cameras

BeyondHumanVision

MOBOTIX MOVE

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Before You Start

This section contains the following information:

Support

MOBOTIX Support

If you need technical support, please contact your MOBOTIX dealer. If your dealer cannot help you, he will contact the support channel to get an answer for you as quickly as possible.

If you have internet access, you can open the MOBOTIX help desk to find additional information and software updates.

Please visit **www.mobotix.com > Support > Help Desk**.

MOBOTIX eCampus

The MOBOTIX eCampus is a complete e-learning platform. It lets you decide when and where you want to view and process your training seminar content. Simply open the site in your browser and select the desired training seminar.

Please visit **www.mobotix.com/ecampus-mobotix**.

MOBOTIX Community

The MOBOTIX community is another valuable source of information. MOBOTIX staff and other users are sharing their information, and so can you.

Please visit **community.mobotix.com**.

Safety Notes

- This camera must be installed by qualified personnel and the installation should conform to all local codes.
- This product must not be used in locations exposed to the dangers of explosion.
- Do not use this product in a dusty environment.
- Protect this product from moisture or water entering the housing.
- Install this product as outlined in this document. A faulty installation can damage the product!
- Do not replace batteries of the camera. If a battery is replaced by an incorrect type, the battery can explode.
- This equipment is not suitable for use in locations where children are likely to be present.
- External power supplies must comply with the Limited Power Source (LPS) requirements and share the same power specifications with the camera.
- When using a power adapter, the power cord shall be connected to a socket-outlet with proper ground connection.
- To comply with the requirements of EN 50130-4 regarding the power supply of alarm systems for 24/7 operation, it is highly recommended to use an uninterruptible power supply (UPS) for backing up the power supply of this product.

Legal Notes

Legal Aspects of Video and Sound Recording

You must comply with all data protection regulations for video and sound monitoring when using MOBOTIX AG products. Depending on national laws and the installation location of the cameras, the recording of video and sound data may be subject to special documentation or it may be prohibited. All users of MOBOTIX products are therefore required to familiarize themselves with all applicable regulations and to comply with these laws. MOBOTIX AG is not liable for any illegal use of its products.

Declaration of Conformity

The products of MOBOTIX AG are certified according to the applicable regulations of the EC and other countries. You can find the declarations of conformity for the products of MOBOTIX AG on www.mobotix.com under **Support > Download Center > Marketing & Documentation >**

Certificates & Declarations of Conformity.

RoHS Declaration

The products of MOBOTIX AG are in full compliance with European Unions Restrictions of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (RoHS Directive 2011/65/EC) as far as they are subject to these regulations (for the RoHS Declaration of MOBOTIX, please see www.-mobotix.com, **Support > Download Center > Marketing & Documentation > Brochures & Guides > Certificates**).

Disposal

Electrical and electronic products contain many valuable materials. For this reason, we recommend that you dispose of MOBOTIX products at the end of their service life in accordance with all legal requirements and regulations (or deposit these products at a municipal collection center). MOBOTIX products must not be disposed of in household waste! If the product contains a battery, please dispose of the battery separately (the corresponding product manuals contain specific directions if the product contains a battery).

Disclaimer

MOBOTIX AG does not assume any responsibility for damages, which are the result of improper use or failure to comply to the manuals or the applicable rules and regulations. Our General Terms and Conditions apply. You can download the current version of the **General Terms and Conditions** from our website at www.mobotix.com by clicking on the corresponding link at the bottom of every page.

It is the User's responsibility to comply with all applicable local, state, national and foreign laws, rules, treaties and regulations in connection with the use of the Software and Product, including those related to data privacy, the Health Insurance Portability and Accountability Act of 1996 (HIPPA), international communications and the transmission of technical or personal data.

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Overview

This section contains the following information:

Introduction

The Video Analytics (VA) is provided with intelligent detection system for surveillance network camera. With advanced image processing algorithms, especially for people / vehicle counting, it is an optimal solution for a variety of applications, such as moving object recognition and tracking. Besides, the diversity of VA functions offers thorough monitoring almost in any kind of circumstances or environment.

Key Features

- Abandoned Object
- Intrusion Detection
- Camera Sabotage
- Wrong Direction
- Loitering Detection
- Object Counting
- Object Removal
- Stopped Vehicle
- Face Detection
- Face Recognition
- License Plate Recognition

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Video Analytics

This section contains the following information:

Standard Settings

The standard settings for video analytics behavior includes zone settings and behavior settings.

Zone Settings

Some analytics behaviors require zone setting. A zone is where users want to monitor and check whether there is intrusion, object misplaced / removed, etc. A zone can be set by a polygon or line. When setting a zone-based analytic behavior, select a zone-drawing tool and click in the video pane to draw the zone.

The definition of each zone drawing tools is as below:

Zone Drawing Tools	Definition
 Box	Detection zones. Define a region of interest. Objects in the defined zone will trigger alarm if the objects move in the same direction as defined.
 Polygon	
 Line	Detection zones. Set lines when objects cross and move in the same direction as defined which triggers alarm.
 Exclude Zone Box Tool	Set zones in which objects will be ignored.
 Exclude Zone Polygon Tool	
 Object Size Filter	Set the minimum and maximum size of objects. To prevent incorrect detection object setting, the short side of Max Object Size must be longer than any side of Min Object Size.

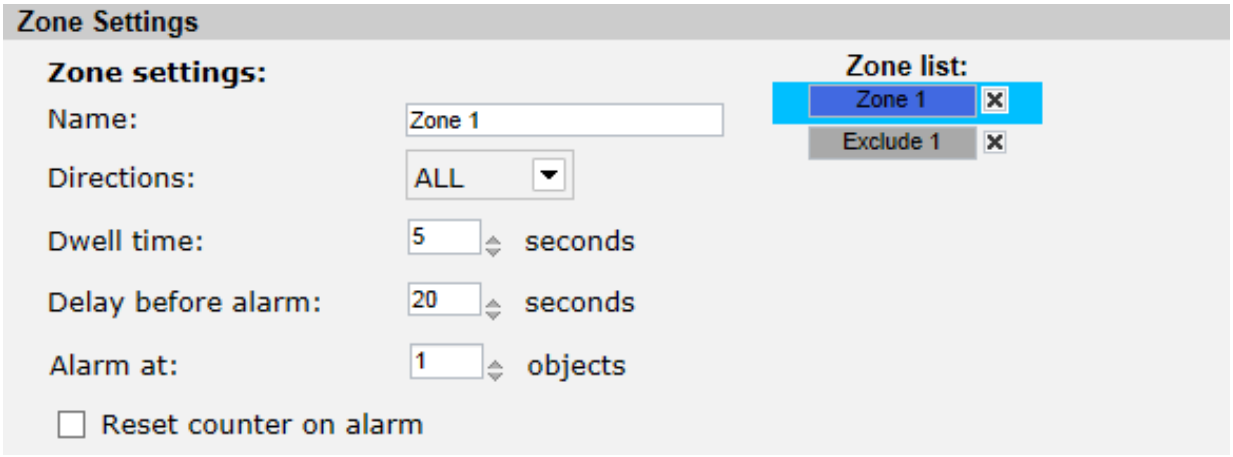
NOTE!
Zone drawing tools will vary by different analytics behaviors.

NOTE!
The amount of detection zones is 8. A warning message window is displayed when the amount of zones exceeds 8.

Behavior Settings

Here is to set the definition of an event and what actions to take when an event occurs. The following describes the definition of each setting item.

Zone Settings

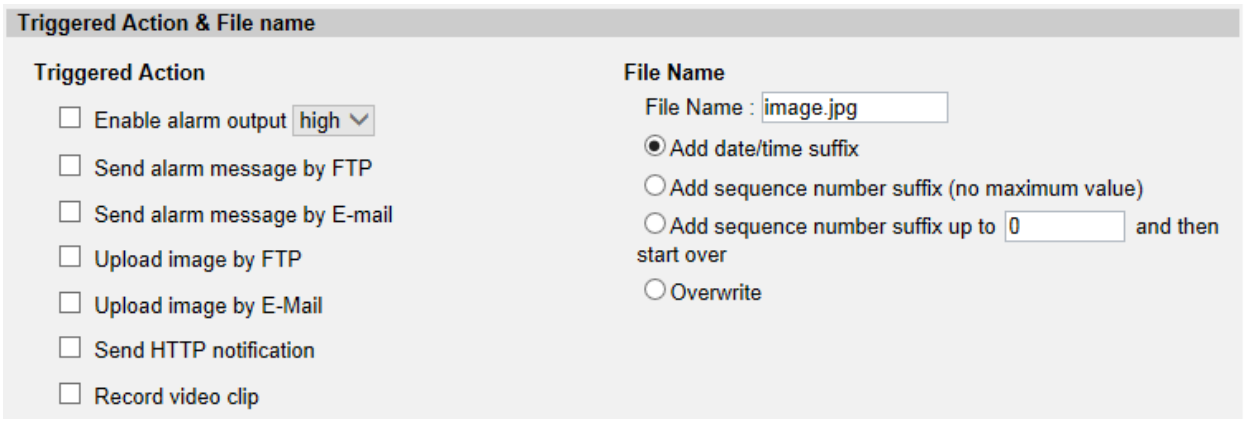


- Name: Name of the detection zone.
- Directions: Set the direction of motion the camera should track. Alarms will only be triggered when the camera detects motion in the specified direction.
- Dwell time: Set the amount of time that an alarm continues when the alarm is triggered. Dwell time ranges from 1 to 1000 seconds. Default is 5 seconds.
- Delay before alarm: Define the amount of time that the defined behavior lasts before an alarm is triggered. The time range is 20 to 1800 seconds. Default is 30 seconds.
- Alarm at: Set the amount of objects to trigger the alarm. When the number of the counted objects reaches to the setting number, the alarm will be triggered.
- Reset counter on alarm: Check or un-check to reset or keep object counting.

  Zone setting items will vary by the analytics behavior being configured.

Triggered Action (Multi-option)

You can specify alarm actions when an event occurs. All options are listed as follows.



- Enable Alarm Output: Select the item to enable alarm relay output.
- Send Message by FTP/E-Mail: The administrator can select whether to send an alarm message by FTP and/or E-mail when an alarm is triggered.
- Upload Image by FTP: You can assign an FTP site and configure various parameters. When the alarm is triggered, event images will be uploaded to the appointed FTP site.
- Upload Image by E-Mail: You can assign an E-mail address and configure various parameters. When the alarm input is triggered, event images will be sent to the appointed E-mail address.
- Send HTTP Notification: Check this item and select the destination HTTP address. Then specify the parameters for event notifications by **Alarm** triggered. When an alarm is triggered, the HTTP notification will be sent to the specified HTTP server.
- Record Video Clip: Check this item and select a video recording storage type, **SD Card** or **NAS** (Network-Attached Storage). The alarm-triggered recording will be saved into microSD/SDXC card or the NAS.

File Name

Enter a file name in the blank, e.g. image.jpg. The file name format of the uploaded image can be set in this section. Please select the one that meets the requirements.

- Add date/time suffix
  - File name: imageYYMMDD_HHNNSS_XX.jpg
  - Y: Year, M: Month, D: Day
  - H: Hour, N: Minute, S: Second
  - X: Sequence Number
- Add sequence number suffix (no maximum value)
  - File name: imageXXXXXXX.jpg
  - X: Sequence Number

- Add sequence number suffix up to # and then start over
  - File Name: imageXX.jpg
  - X: Sequence Number
    The file name suffix will end at the number being set. For example, if the setting is up to “10”, the file name will start from 00, end at 10, and then start all over again.
- Overwrite: The original image in the FTP site will be overwritten by the new uploaded file with a static file name.

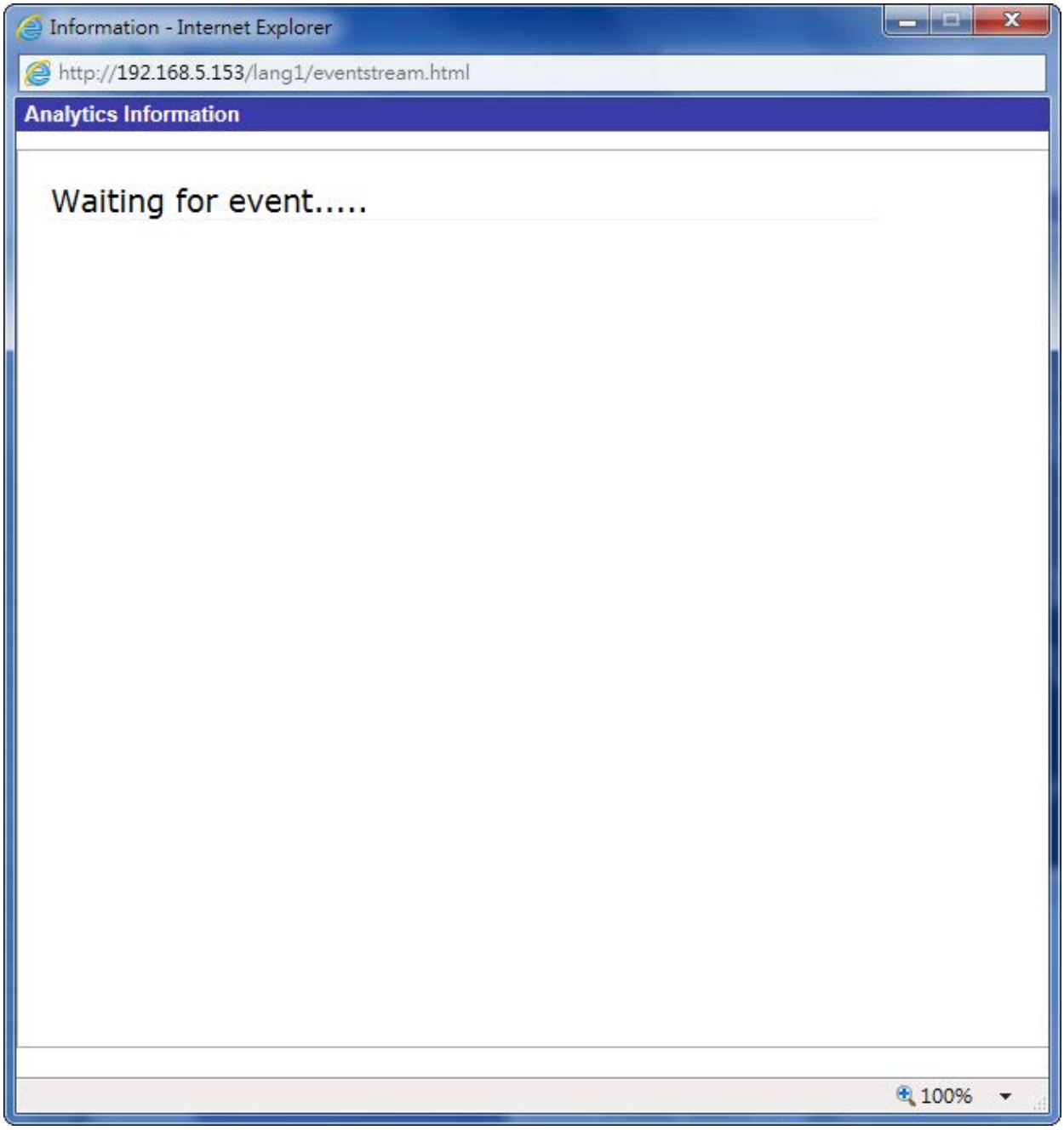
Click on **Save** to apply and store the settings.

Show Analytics Info

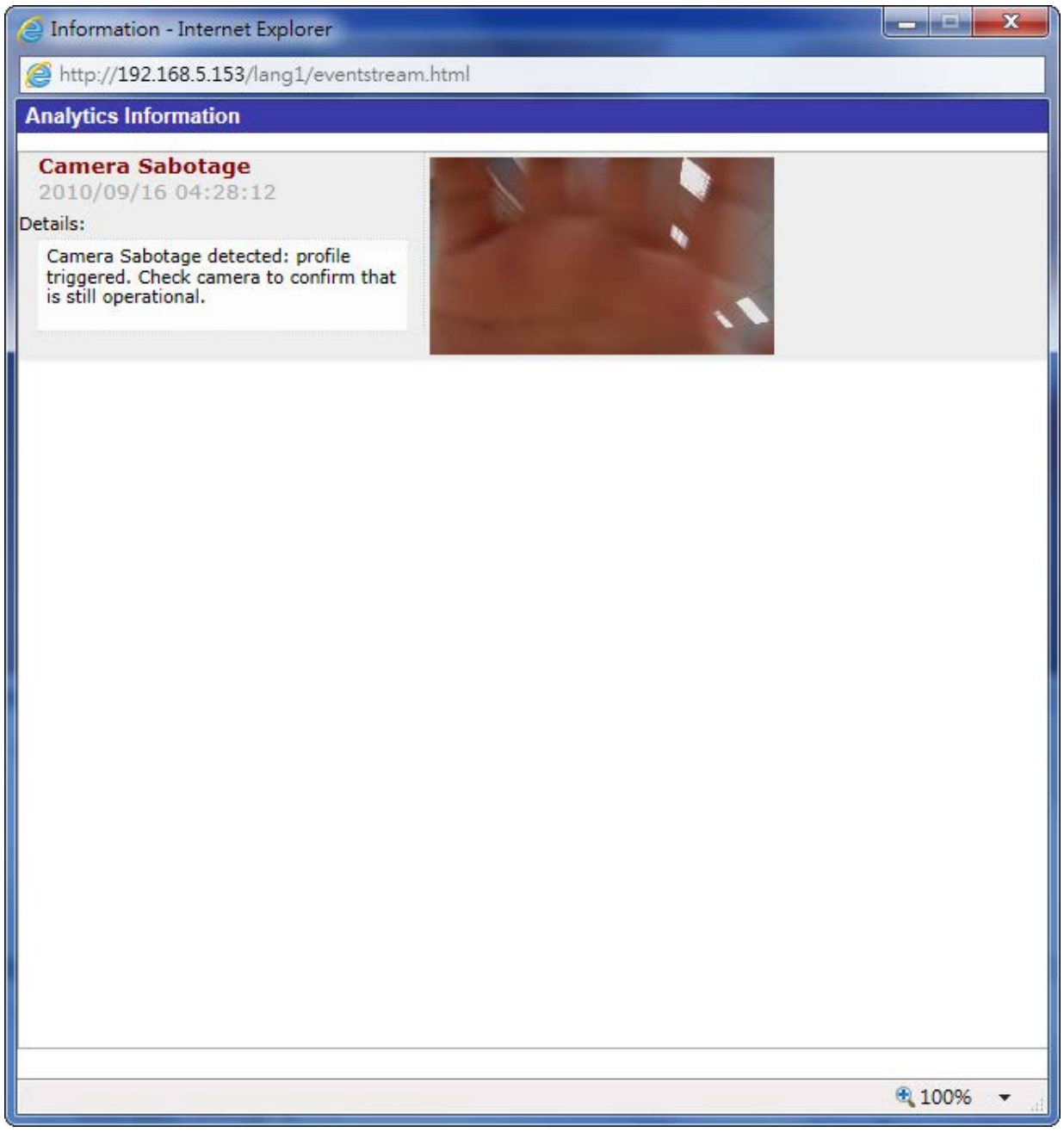
Click Show Analytics Info and the “Analytics Information” window will pop up. Whenever an event occurs, “Analytics Information” will update and post the occurring event to notify users.

NOTE!
For MJPEG format to show the snapshot of the occurring event. Go to **Streaming > Video** and set to **MJPEG**.

When no event occurs, the “Analytics Information” window is displayed as below.



When an event occurs, the related information and the snapshot is updated in this window as shown below.

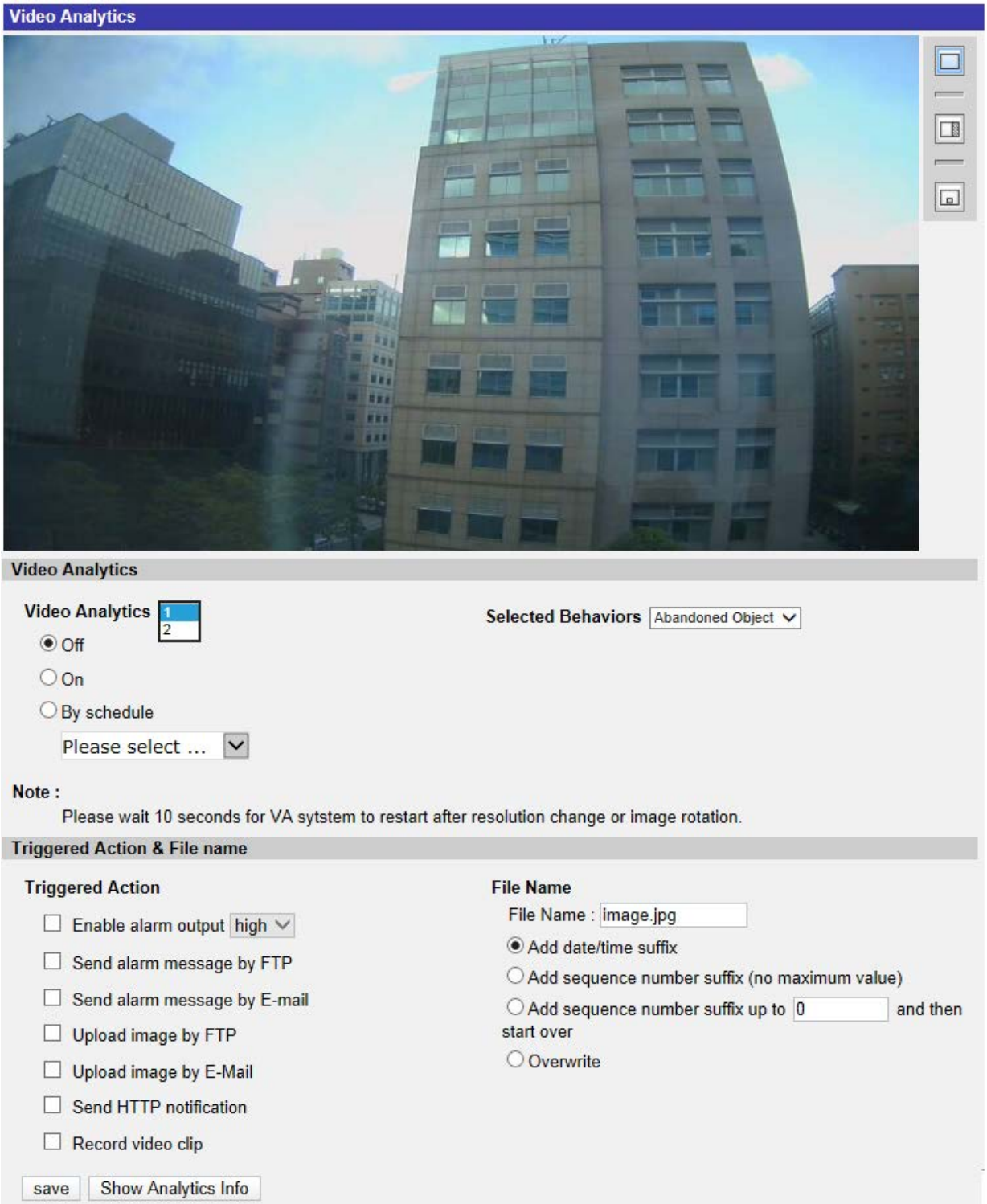


Video Analytics Functions

The following video analytics functions are provided for users to implement:

- **Abandoned Object**
- **Intrusion Detection**
- **Camera Sabotage**
- **Wrong Direction**

- **Loitering Detection**
- **Object Counting**
- **Object Removal**
- **Stopped Vehicle**
- **Face Detection**
- **Face Recognition**
- **License Plate Recognition**



Abandoned Object

Abandoned Object detects objects placed within a defined zone and triggers an alarm if objects remain in the zone longer than the user-defined time allows.

Installation requirements

Suggested target size (pixel)	50 x 50 ~ 500 x 500 (@ 1080p)
Camera mounting height	The suggested installation height is 3 to 5 m. The actual installation height may vary depending on the size of the object.
Camera mounting height	Make sure the object size is within the acceptable target size range. Real detection range depends on sensor dimension, object size, lens focal length
Suggested environment illumination (lux)	To have optimal performance, stable and adequate lighting is necessary. We recommend minimum 300 lux as suitable lighting level.

Scene Requirements

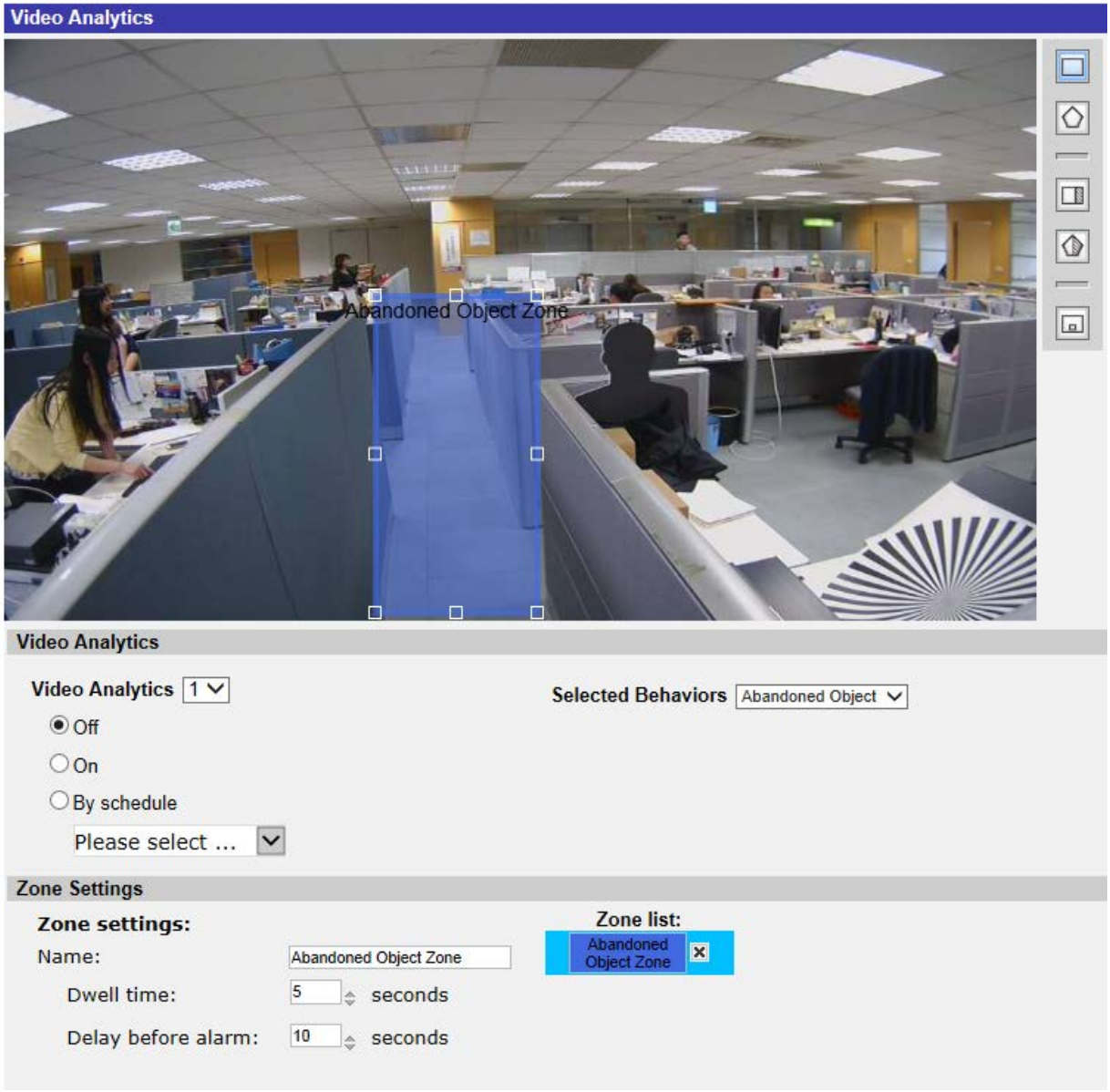
- Stationary or slow-moving irrelevant objects won't stay in the scene for a long time.
- The background should be simple and plain.
- Monitoring zones should be placed in relatively stable areas if the background is a dynamic scenario.
- "Swinging objects" (e.g., tall grass, tree leaves in the wind, and sliding doors etc.) or distraction that leads to the continuous modification of the images (moving pixels) in the zone area might reduce the performance.
- Severe illumination changes (e.g., turn on/off light) or camera tampering might trigger false alarm.

Configuration

The following steps introduce how to configure this function.

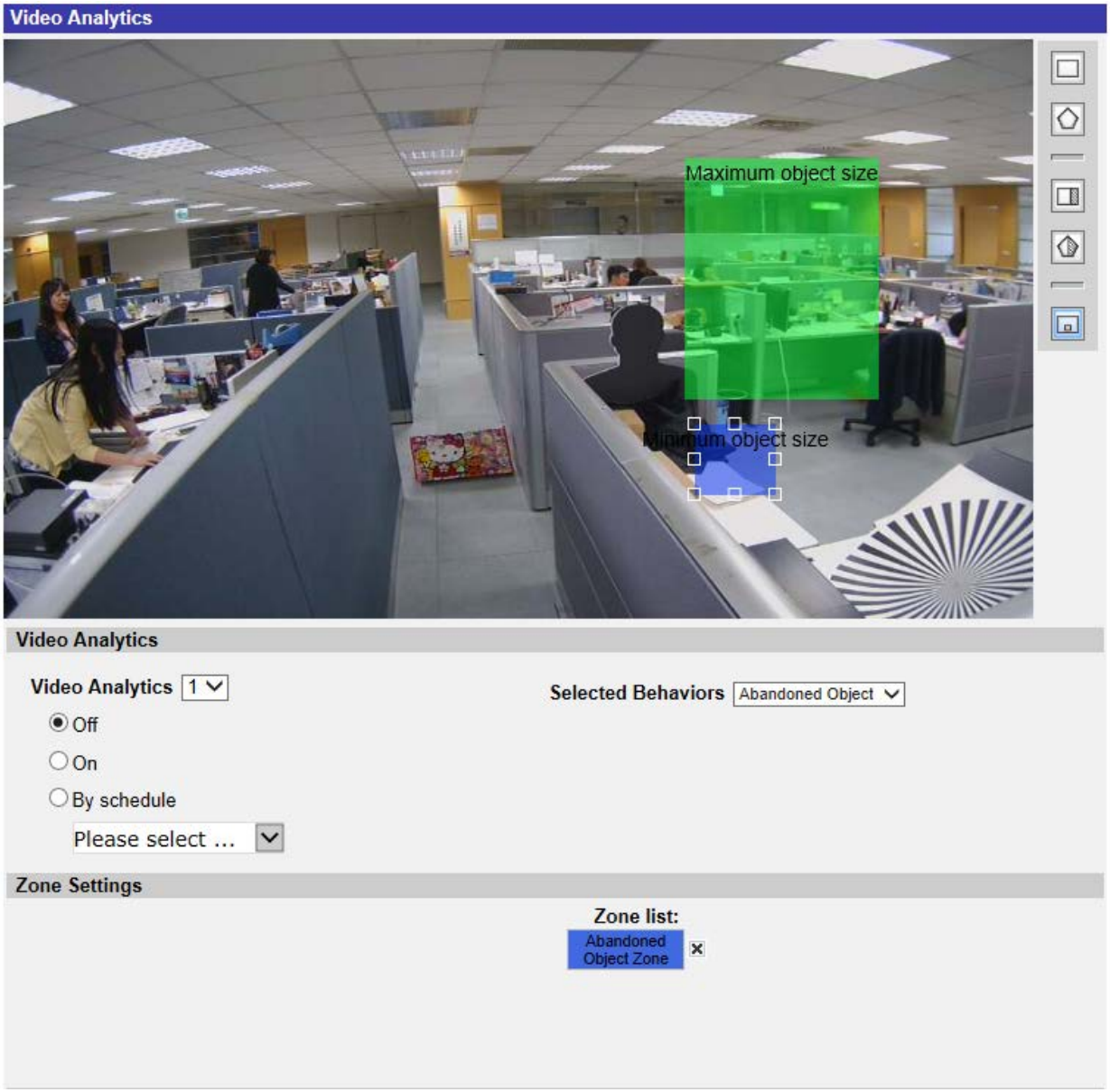
1. Select this behavior as “VA1” or “VA2” from “Video Analytics”.
2. Select **Abandoned Object** from “Selected Behaviors”.

3. Click ▭ / ⬠ and draw a zone of interest.



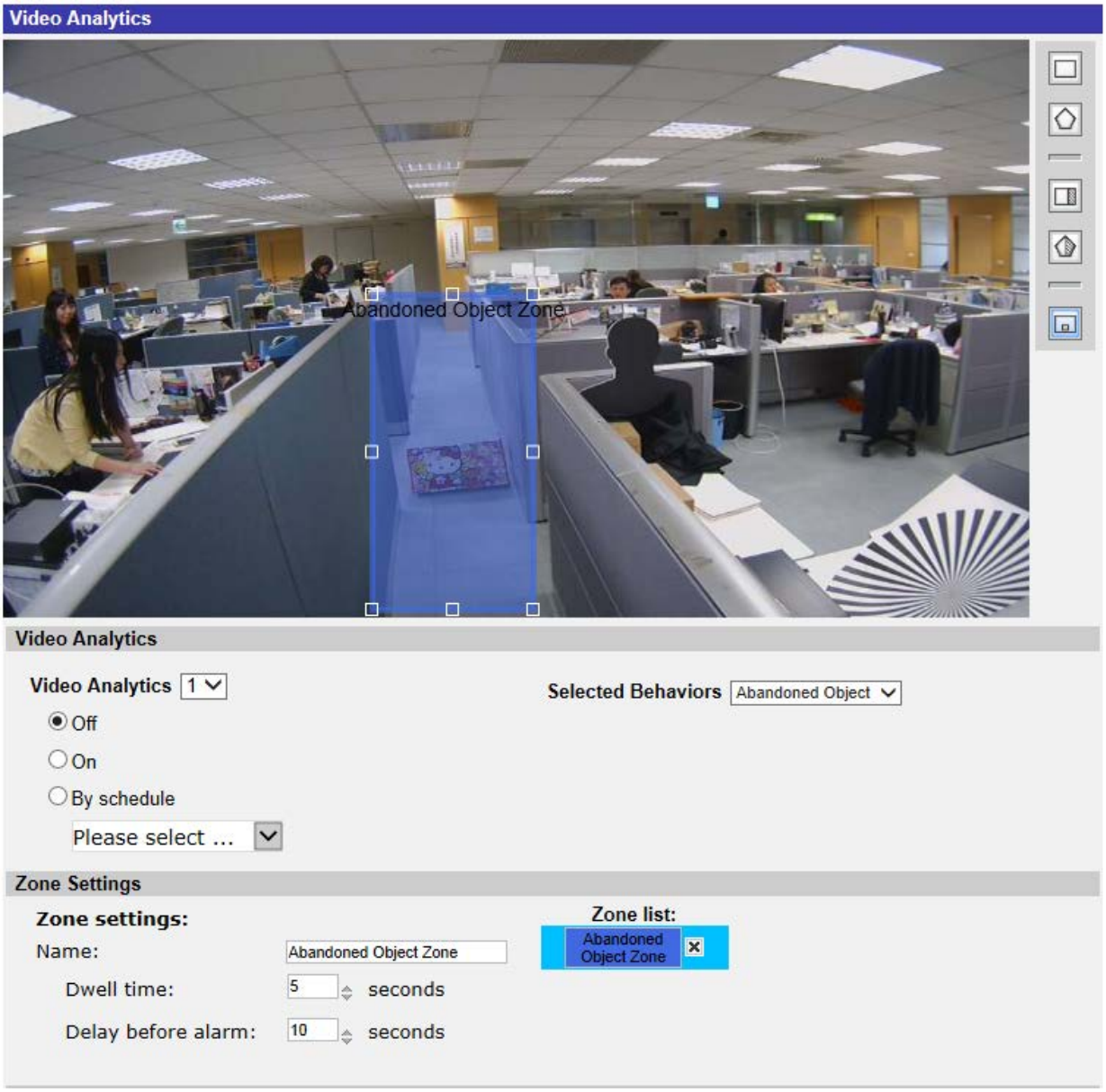
4. Name the zone; setup “Dwell time” and “Delay before alarm.”

5. Click and define the minimum and maximum size of objects.



6. If needed, click / to draw areas that objects will be ignored.
7. Setup what behaviors to take when an event occurs under “Triggered Action & File name” section.
8. Click save to apply the setting.

When an unknown object is left in the defined zone over the specified time, the camera will trigger the alarm and/or send notification to users according to what behaviors users previously set.



Intrusion Detection

“Intrusion Detection” detects and tracks objects that enter the user-defined zone of a scene which triggers an alarm. It is suitable for both indoor and outdoor applications to track a few moving objects in uncrowded areas. Note that the behavior will gradually adapt the change of the monitoring environments like snow, fog, wind, and rain.

Installation Requirements

Minimum target size (pixel)	Human: 50 x 135 pixels (@1080p) Car: 70 x 70 pixels (@1080p)

Suggested environment illumination (lux)	To have optimal performance, stable and adequate lighting is necessary. We recommend minimum 300 lux as suitable lighting level.

Below are installation parameters for common scenario with 1080p, focal length 3.6 mm camera.

Camera mounting height	The suggested mounting height is 3 to 5 m
Camera tilt angle	30°
Yaw angle	**Human:** Front (0°), Side (90°), Back (180°) are all detectable. However to detect side view, shorter detection distance is required. **Vehicle:** Front (0°), Side (45°/ 90°), Back (180°) are all detectable. However for yaw angle other than front view (0°) requires shorter detection distance.
Detection range	Make sure the object size is within the acceptable target size range. The actual detection range depends on sensor dimension, object size and lens focal length.

Scene Requirements

- There should be sufficient dissimilarity between the object and the background in order to make the object to stand out from the scene.
- Postures other than upright position (e.g., crawling, crouching) would reduce the accuracy of human detection.
- For all the object type, object overlap needs to be prevented. Otherwise the object trajectory might be mixed and reduce accuracy.
- Occlusion would have negative effect on the detection result.
- Below are occlusion tolerance test result based on 2MP pixels cameras, full wide zoom (focal length = 3.6 mm), mounting on 3 meter high wall with tilt angle 30°.

Human (detection distance 3.2 meter)

1. Front view (Yaw angle: 0°)
    - From top to bottom: up to 15% occlusion is detectable (head is occluded)
    - From bottom to top: up to 50% occlusion is detectable
    - From side (left to right/ right to left): up to 25% occlusion is detectable

Car (detection distance 5.9 meter)

1. Front view (Yaw angle: 0°)
    - From top to bottom: up to 50% occlusion is detectable
    - From bottom to top: up to 25% occlusion is detectable
    - From side (left to right/ right to left): up to 33% occlusion is detectable
2. Side view (Yaw angle: 45°)
    - From side (from car head): up to 33% occlusion is detectable
3. Side view (Yaw angle: 90°)
    - From top to bottom: up to 33% occlusion is detectable
    - From bottom to top: up to 33% occlusion is detectable
    - From side (from car head): up to 33% occlusion is detectable
4. Back view (Yaw angle: 180°)
    - From top to bottom: up to 33% occlusion is detectable
    - From bottom to top: up to 33% occlusion is detectable
    - From side (left to right/ right to left): up to 33% occlusion is detectable.

Front view (Yaw angle: 0°):

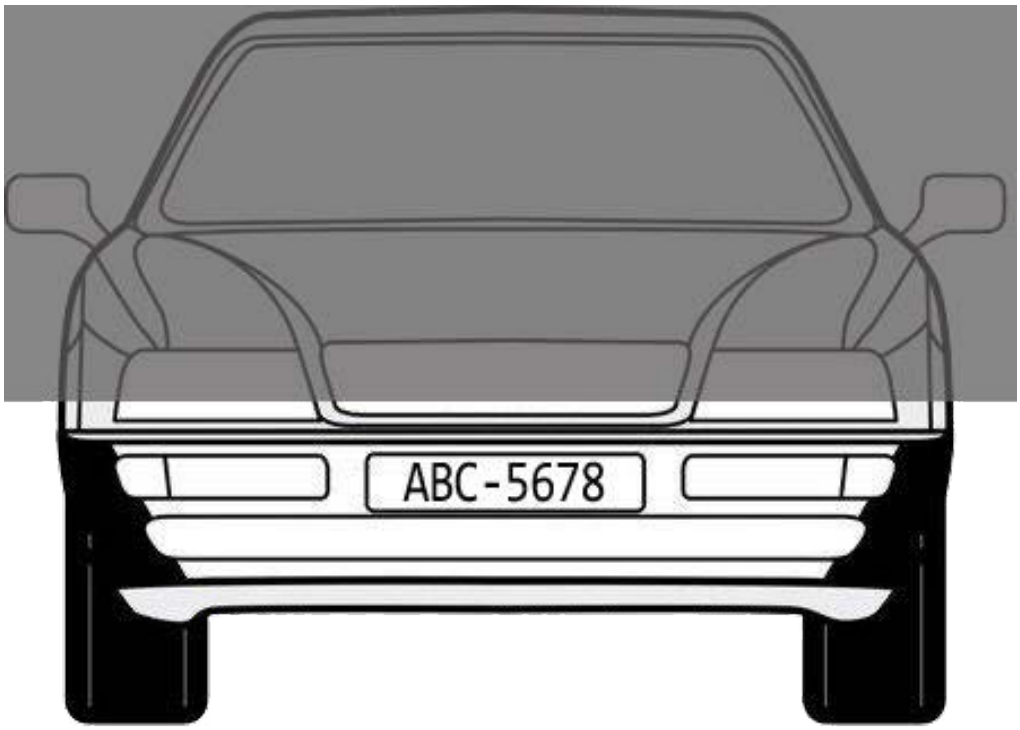


Fig. 1: The detectable degree of occlusion is up to 50% (from top to bottom).

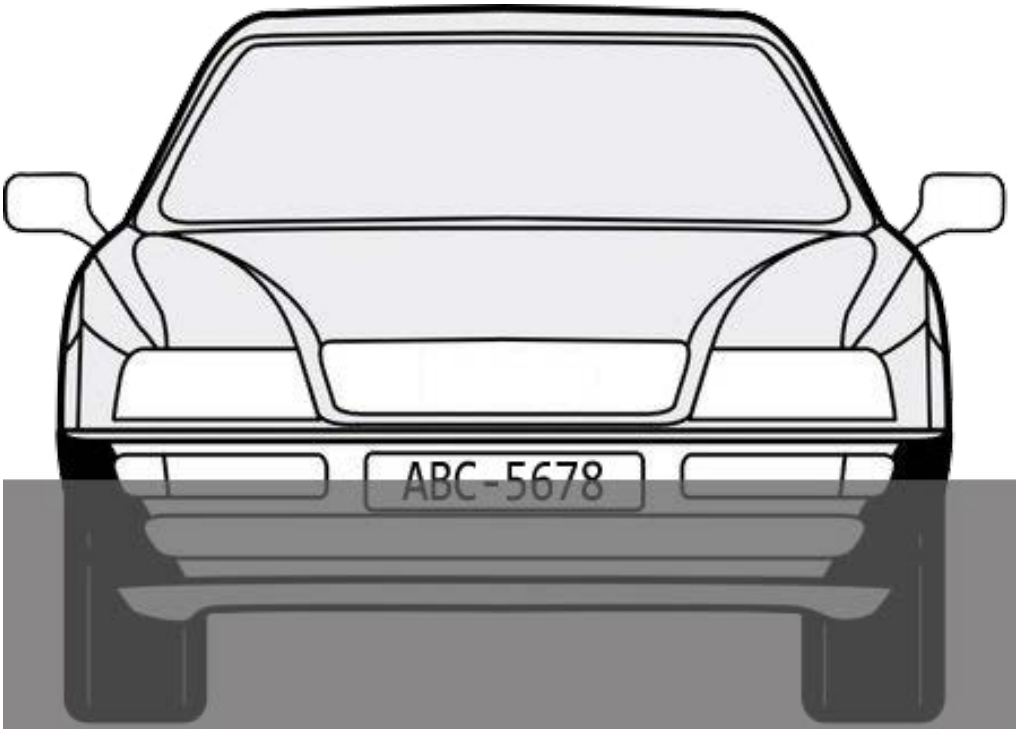


Fig. 2: The detectable degree of occlusion is up to 25% (from bottom to top).

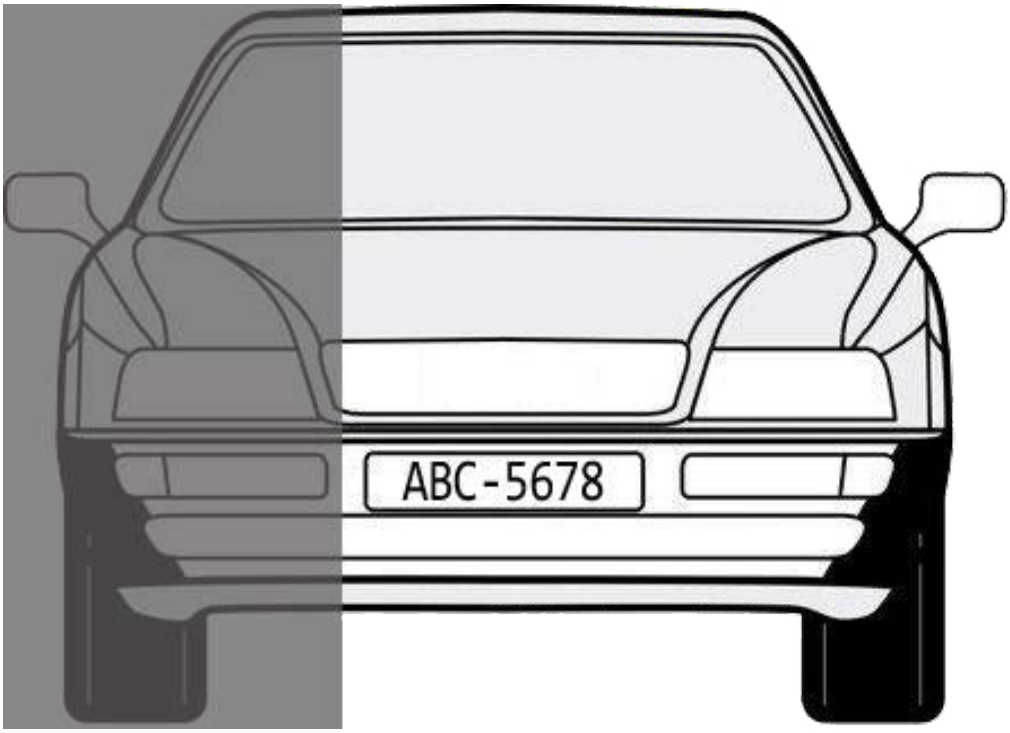


Fig. 3: The detectable degree of occlusion is up to 33% (from left to right/ right to left).

Configuration

Refer to the following to configure this function.

1. From **Video Analytics**, select *VA1* or *VA2*.
2. From **Selected Behaviors**, select *Intrusion Detection*.
3. Click  and draw a zone of interest.
4. Click  and set the maximum / minimum size of the objects.
5. Select the **Direction** to filter objects for directions or select *ALL*.
6. Enter a different name for the zone, if desired.
7. Set the **Dwell time**.
8. Setup what behaviors to take when an event occurs in the **Triggered Action & File name** section.
9. Click  to apply the setting.

When an unknown object enters the defined zone in a certain direction, the camera will trigger the alarm or send a notification according to the selected behaviors.

Camera Sabotage

“Camera Sabotage” detects contrast changes in the field of view, and triggers an alarm if the camera lens is obstructed by spray paint, a cloth, or if it is covered with a lens cap. Moreover, any unauthorized repositioning of the camera will also trigger an alarm.

Installation Requirements

Suggested target size (pixel)	Not relevant
Camera mounting height	No limitation for installation height
Suggested environment illumination (lux)	Minimum environment illumination is 10 lux.

Scene Requirements

- There should be an obvious change before and after the camera is tampered.
- Sudden illumination changes might trigger false alarm.
- Constant scene changes might trigger false alarm.

Configuration

1. Select this behavior as “VA1” or “VA2” from “Video Analytics”.
2. Select **Camera Sabotage** from “Selected Behaviors”.

3. Setup **Sensitivity**, **Dwell Time** and **Delay Before Alarm**.
4. Step 4: Setup what behaviors to take when an event occurs under “Triggered Action & File name” section.
5. Step 5: Click save to apply the setting.

When an unknown deliberately damages e.g. the camera lens, the camera will trigger the alarm and / or send notification to users according to what behaviors users previously set.

Wrong Direction

“Wrong Direction” generates an alarm in a high traffic area when a person or object moves in a specific direction. The ideal applications for this behavior include airports, entrances/exits, and fences.

Installation Requirements

Minimum target size (pixel)	Human: 50 x 135 pixels (@1080p) Car: 70 x 70 pixels (@1080p)
Suggested environment illumination (lux)	To have optimal performance, stable and adequate lighting is necessary. We recommend minimum 300 lux as suitable lighting level.

Below are installation parameters for common scenario with 1080p, focal length 3.6 mm camera.

Camera mounting height	The suggested mounting height is 3 to 5 m
Camera tilt angle	30°
Yaw angle	**Human:** Front (0°), Side (90°), Back (180°) are all detectable. However to detect side view, shorter detection distance is required. **Vehicle:** Front (0°), Side (45°/ 90°), Back (180°) are all detectable. However for yaw angle other than front view (0°) requires shorter detection distance.
Detection range	Make sure the object size is within the acceptable target size range. The actual detection range depends on sensor dimension, object size and lens focal length.

Scene Requirements

- The monitored object should occupy at least 500x500 pixels of the camera scene.
- It is preferred that the target object has clear feature. For example, people wearing plaid/ striped/ polka dot shirt are more likely to be detected than people wearing plain shirt.
- The range of motion that the object move across should take at least 500x500 pixels of the screen within 1 second.
- Below are occlusion tolerance test result based on 2MP pixels cameras, full wide zoom (focal length = 3.6 mm), mounting on 3 meter high wall with tilt angle 30°.

Human (detection distance 3.2 meter)

1. Front view (Yaw angle: 0°)
    - From top to bottom: up to 15% occlusion is detectable (head is occluded)
    - From bottom to top: up to 50% occlusion is detectable
    - From side (left to right/ right to left): up to 25% occlusion is detectable

Car (detection distance 5.9 meter)

1. Front view (Yaw angle: 0°)
    - From top to bottom: up to 50% occlusion is detectable
    - From bottom to top: up to 25% occlusion is detectable
    - From side (left to right/ right to left): up to 33% occlusion is detectable
2. Side view (Yaw angle: 45°)
    - From side (from car head): up to 33% occlusion is detectable
3. Side view (Yaw angle: 90°)
    - From top to bottom: up to 33% occlusion is detectable
    - From bottom to top: up to 33% occlusion is detectable
    - From side (from car head): up to 33% occlusion is detectable
4. Back view (Yaw angle: 180°)
    - From top to bottom: up to 33% occlusion is detectable
    - From bottom to top: up to 33% occlusion is detectable
    - From side (left to right/ right to left): up to 33% occlusion is detectable.

Front view (Yaw angle: 0°):

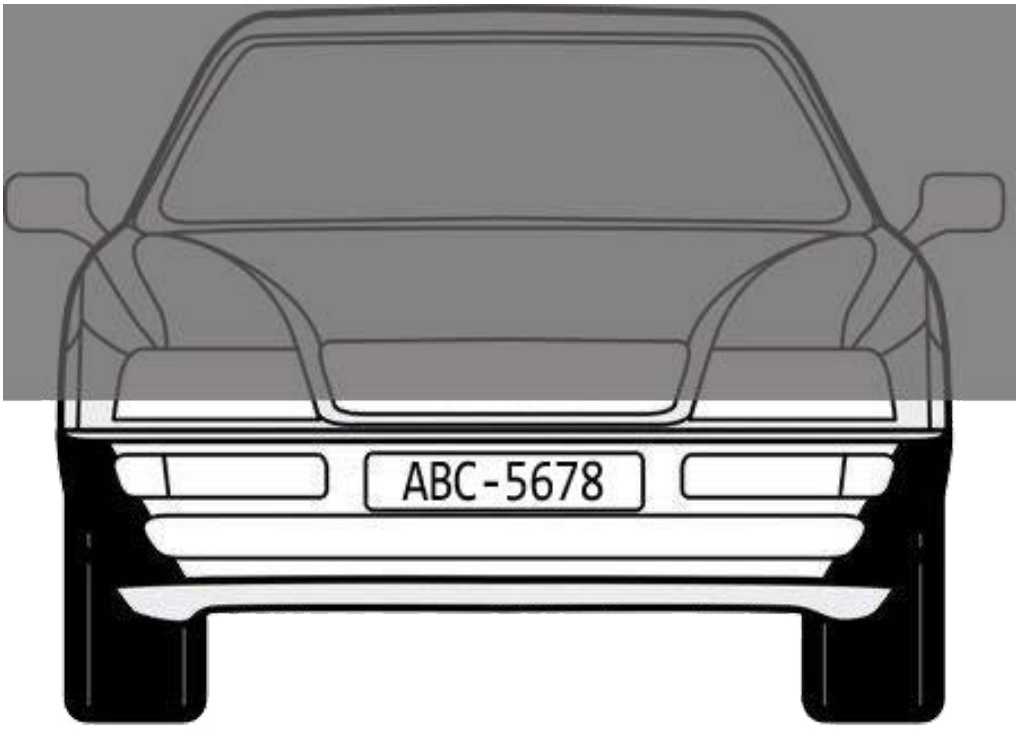


Fig. 4: The detectable degree of occlusion is up to 50% (from top to bottom).

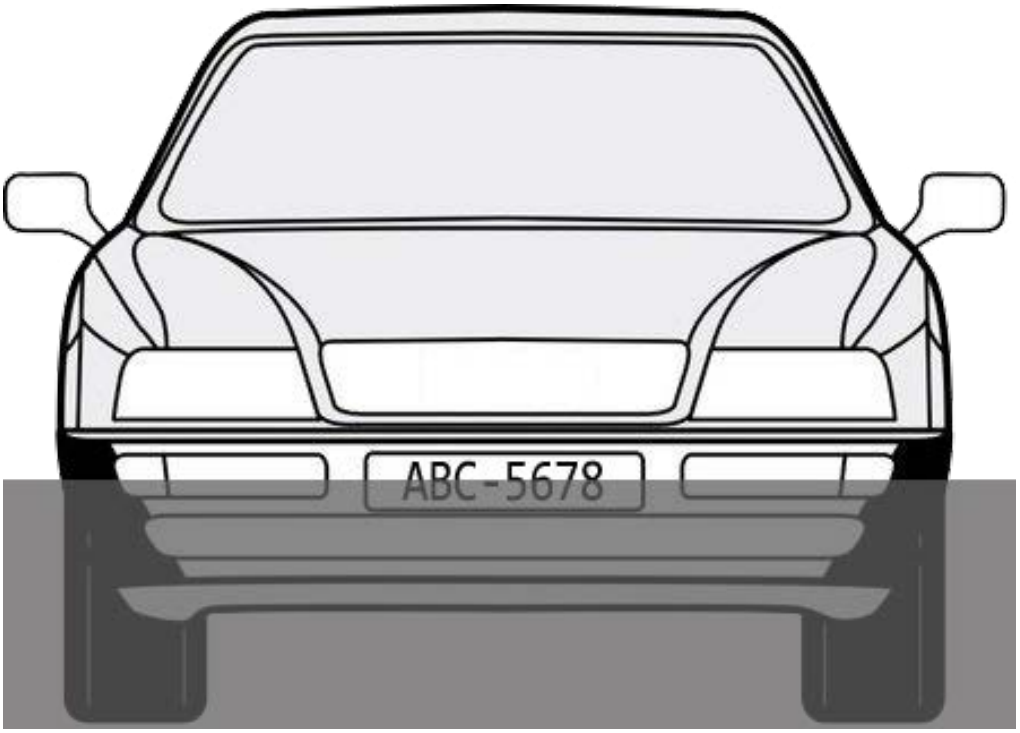


Fig. 5: The detectable degree of occlusion is up to 25% (from bottom to top).

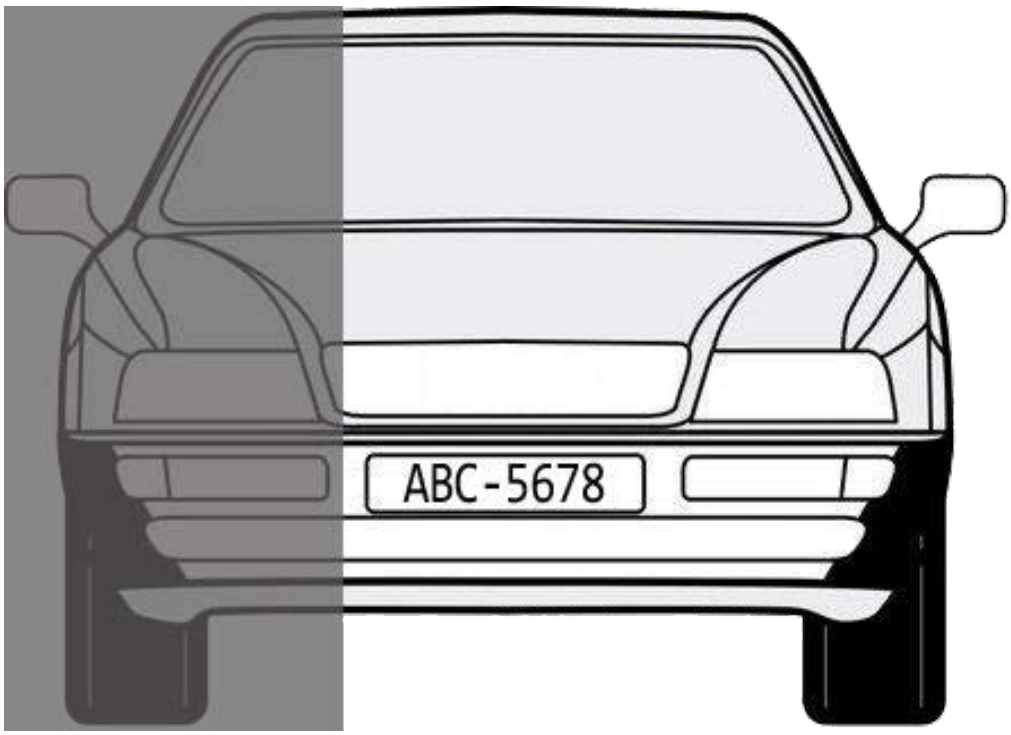


Fig. 6: The detectable degree of occlusion is up to 33% (from left to right/ right to left).

Configuration

1. Select this behavior as “VA1” or “VA2” from “Video Analytics”.
2. Select **Wrong Direction** from “Selected Behaviors”.
3. Click ▭ or ⬠ and draw a zone of interest.
4. Name the zone and setup “Dwell time.”
5. Assign the direction that is wished to forbid entering.

   Take the snapshot above as example, direction is set ➔, meaning the alarm will be triggered when a person goes this direction ➔. There will be no alarm when the person goes this direction ➔ (as below) or any direction other than ➔.
6. Setup what behaviors to take when an event occurs under “Triggered Action & File name” section.
7. Click save to apply the setting.

If any person / object moves in the direction set as the defined zone, the camera will trigger the alarm and / or send notification to users according to what behaviors users previously set.

Loitering Detection

“Loitering Detection” identifies people or vehicles that stay and loiter in a defined zone longer than the user-defined time. This behavior is more effective in real-time notification of suspicious behavior around ATMs, stairwells and school grounds.

Installation Requirements

Minimum target size (pixel)	Human: 50 x 135 pixels (@1080p) Car: 70 x 70 pixels (@1080p)
Suggested environment illumination (lux)	To have optimal performance, stable and adequate lighting is necessary. We recommend minimum 300 lux as suitable lighting level.

Below are installation parameters for common scenario with 1080p, focal length 3.6 mm camera.

Camera mounting height	The suggested mounting height is 3 to 5 m
Camera tilt angle	30°
Yaw angle	**Human:** Front (0°), Side (90°), Back (180°) are all detectable. However to detect side view, shorter detection distance is required. **Vehicle:** Front (0°), Side (45°/ 90°), Back (180°) are all detectable. However for yaw angle other than front view (0°) requires shorter detection distance.
Detection range	Make sure the object size is within the acceptable target size range. The actual detection range depends on sensor dimension, object size and lens focal length.

Scene Requirements

- There should be sufficient dissimilarity between the object and the background in order to make the object to stand out from the scene.
- Postures other than upright position (e.g., crawling, crouching) would reduce the accuracy of human detection.
- For all the object type, object overlap needs to be prevented. Otherwise the object trajectory might be mixed and reduce accuracy.
- Occlusion would have negative effect on the detection result.

- Below are occlusion tolerance test result based on 2MP pixels cameras, full wide zoom (focal length = 3.6 mm), mounting on 3 meter high wall with tilt angle 30°.

Human (detection distance 3.2 meter)

1. Front view (Yaw angle: 0°)
    - From top to bottom: up to 15% occlusion is detectable (head is occluded)
    - From bottom to top: up to 50% occlusion is detectable
    - From side (left to right/ right to left): up to 25% occlusion is detectable

Car (detection distance 5.9 meter)

1. Front view (Yaw angle: 0°)
    - From top to bottom: up to 50% occlusion is detectable
    - From bottom to top: up to 25% occlusion is detectable
    - From side (left to right/ right to left): up to 33% occlusion is detectable
2. Side view (Yaw angle: 45°)
    - From side (from car head): up to 33% occlusion is detectable
3. Side view (Yaw angle: 90°)
    - From top to bottom: up to 33% occlusion is detectable
    - From bottom to top: up to 33% occlusion is detectable
    - From side (from car head): up to 33% occlusion is detectable
4. Back view (Yaw angle: 180°)
    - From top to bottom: up to 33% occlusion is detectable
    - From bottom to top: up to 33% occlusion is detectable
    - From side (left to right/ right to left): up to 33% occlusion is detectable.

Front view (Yaw angle: 0°):

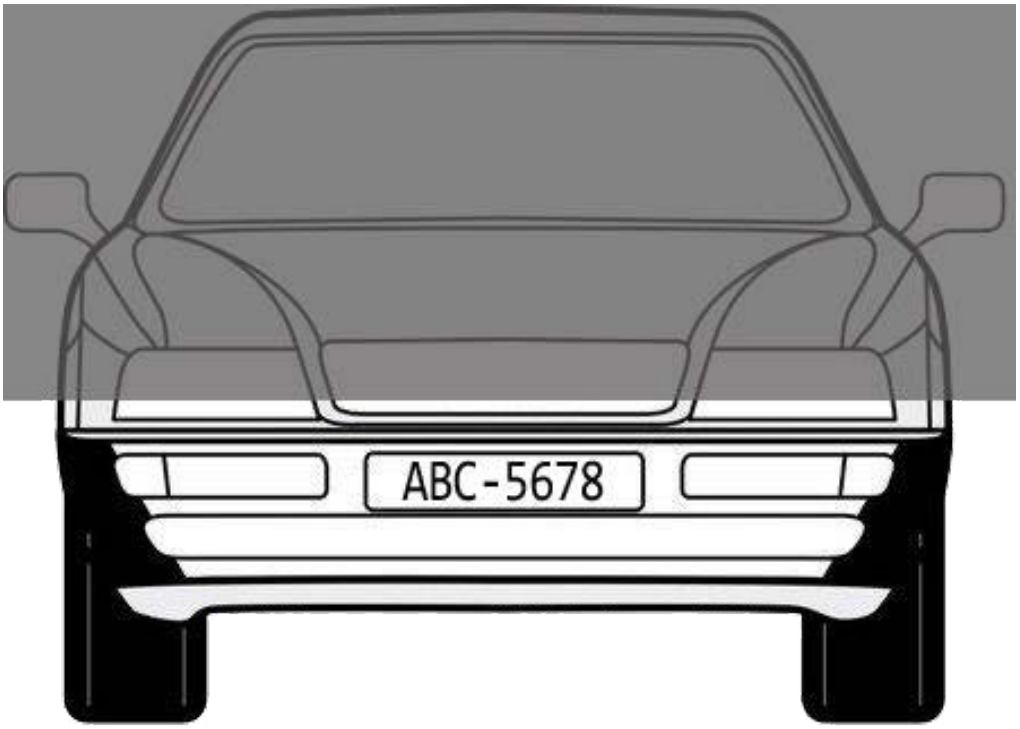


Fig. 7: The detectable degree of occlusion is up to 50% (from top to bottom).

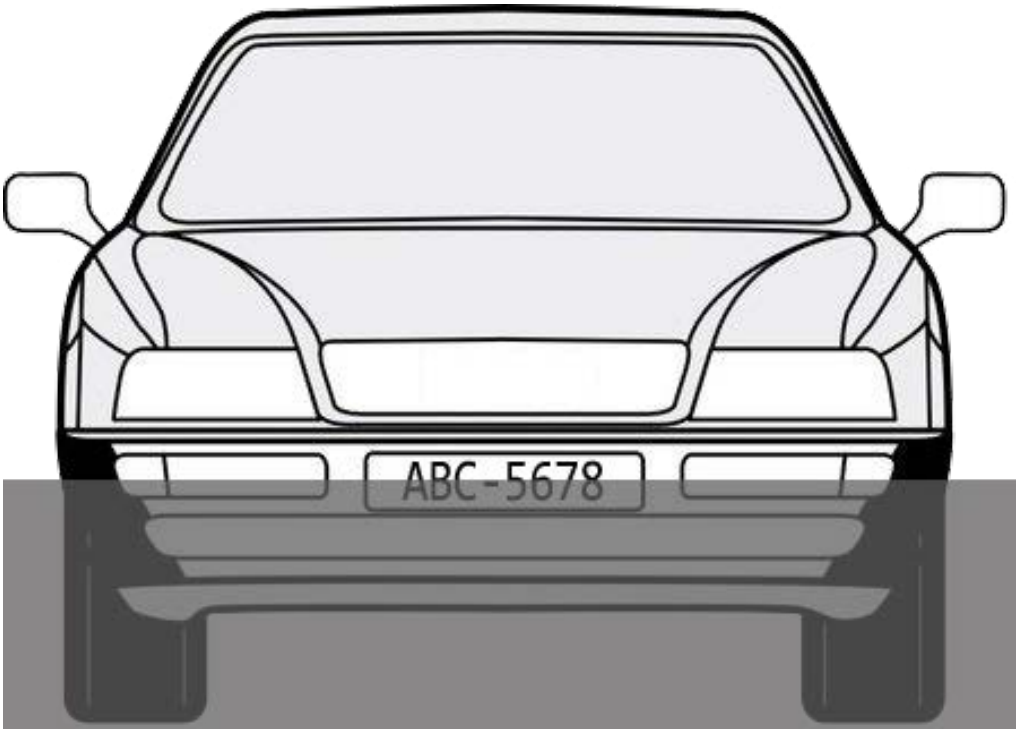


Fig. 8: The detectable degree of occlusion is up to 25% (from bottom to top).

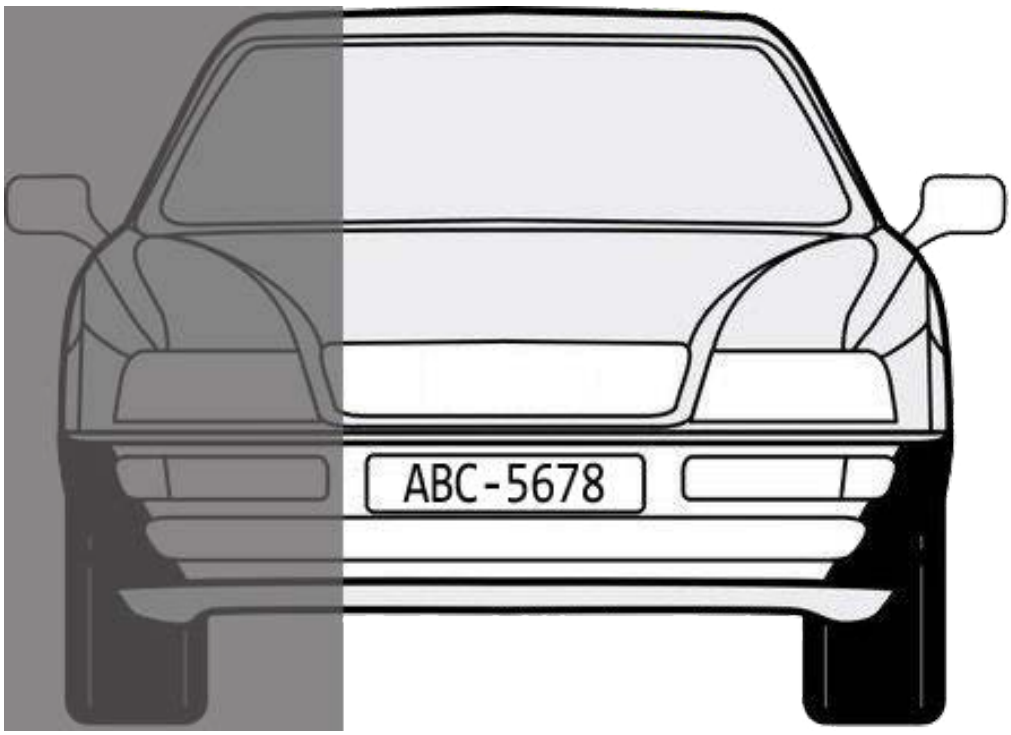


Fig. 9: The detectable degree of occlusion is up to 33% (from left to right/ right to left).

Configuration

1. Select this behavior as “VA1” or “VA2” from “Video Analytics”.
2. Select **Loitering Detection** from “Selected Behaviors”.
3. Click / and draw a zone of interest.
4. Name the zone; setup “Dwell time” and “Delay before alarm.”
5. Click and set the maximum / minimum size of the objects.
6. Setup what behaviors to take when an event occurs under “Triggered Action & File name” section.
7. Click save to apply the setting.

If any suspicious person or vehicle stays in the specified zone longer than the user-defined time, the camera will trigger the alarm and / or send notification to users according to what behaviors users previously set.

Object Counting

“Object Counting” counts the number of objects that enter a user-defined zone. This behavior can be used to count people at a store entrance/exit. On the hand, it is also suitable to monitor vehicle

traffic on highways, local streets/roads, parking lots and garages.

Installation Requirements

Minimum target size (pixel)	Human: 50 x 135 pixels (@1080p) Car: 70 x 70 pixels (@1080p)
Suggested environment illumination (lux)	To have optimal performance, stable and adequate lighting is necessary. We recommend minimum 300 lux as suitable lighting level.

Below are installation parameters for common scenario with 1080p, focal length 3.6 mm camera.

Camera mounting height	The suggested mounting height is 3 to 5 m
Camera tilt angle	30°
Yaw angle	**Human:** Front (0°), Side (90°), Back (180°) are all detectable. However to detect side view, shorter detection distance is required. **Vehicle:** Front (0°), Side (45°/ 90°), Back (180°) are all detectable. However for yaw angle other than front view (0°) requires shorter detection distance.
Detection range	Make sure the object size is within the acceptable target size range. The actual detection range depends on sensor dimension, object size and lens focal length.

Scene Requirements

- There should be sufficient dissimilarity between the object and the background in order to make the object to stand out from the scene.
- Postures other than upright position (e.g., crawling, crouching) would reduce the accuracy of human detection.
- For all the object type, object overlap needs to be prevented. Otherwise the object trajectory might be mixed and reduce accuracy.
- Occlusion would have negative effect on the detection result.
- Below are occlusion tolerance test result based on 2MP pixels cameras, full wide zoom (focal length = 3.6 mm), mounting on 3 meter high wall with tilt angle 30°.

Human (detection distance 3.2 meter)

1. Front view (Yaw angle: 0°)
    - From top to bottom: up to 15% occlusion is detectable (head is occluded)
    - From bottom to top: up to 50% occlusion is detectable
    - From side (left to right/ right to left): up to 25% occlusion is detectable

Car (detection distance 5.9 meter)

1. Front view (Yaw angle: 0°)
    - From top to bottom: up to 50% occlusion is detectable
    - From bottom to top: up to 25% occlusion is detectable
    - From side (left to right/ right to left): up to 33% occlusion is detectable
2. Side view (Yaw angle: 45°)
    - From side (from car head): up to 33% occlusion is detectable
3. Side view (Yaw angle: 90°)
    - From top to bottom: up to 33% occlusion is detectable
    - From bottom to top: up to 33% occlusion is detectable
    - From side (from car head): up to 33% occlusion is detectable
4. Back view (Yaw angle: 180°)
    - From top to bottom: up to 33% occlusion is detectable
    - From bottom to top: up to 33% occlusion is detectable
    - From side (left to right/ right to left): up to 33% occlusion is detectable.

Front view (Yaw angle: 0°):

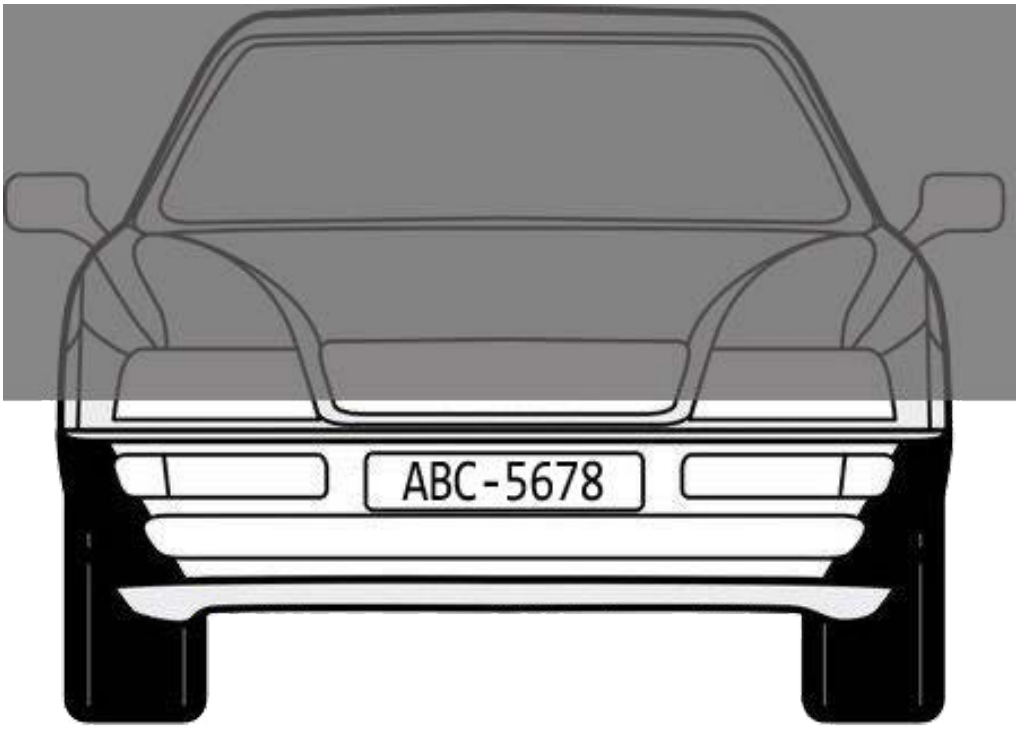


Fig. 10: The detectable degree of occlusion is up to 50% (from top to bottom).

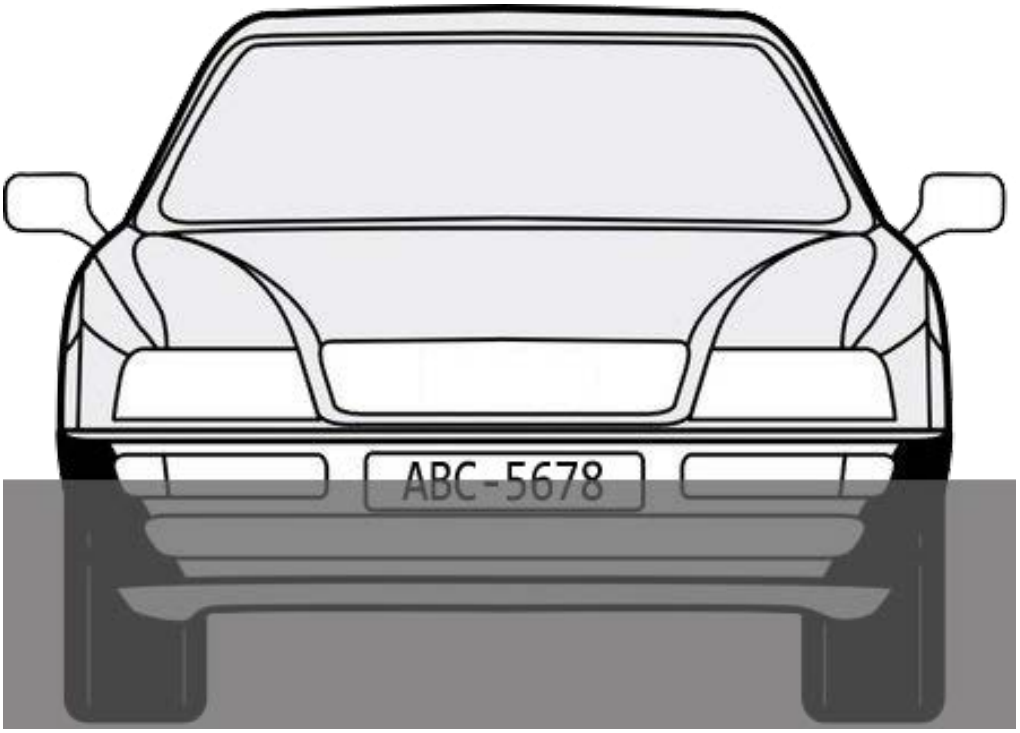


Fig. 11: The detectable degree of occlusion is up to 25% (from bottom to top).

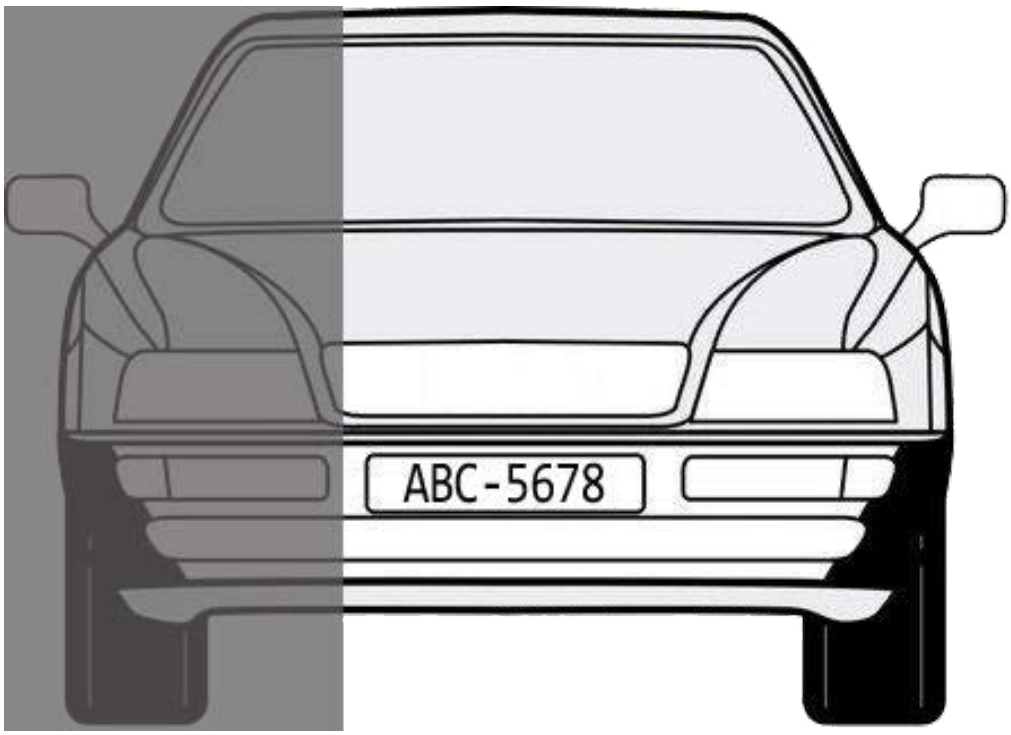
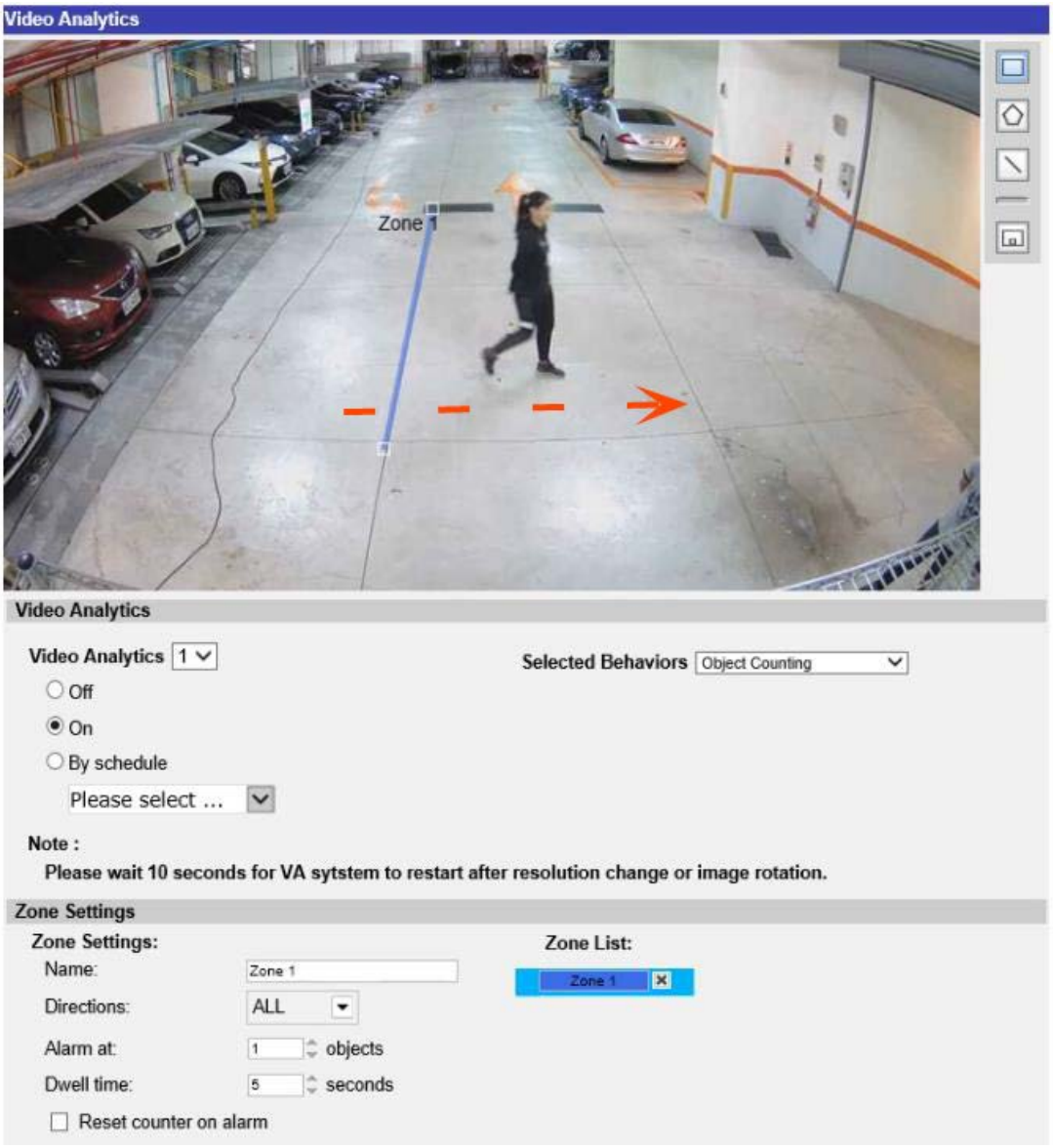


Fig. 12: The detectable degree of occlusion is up to 33% (from left to right/ right to left).

Configuration



1. Select this behavior as “VA1” or “VA2” from “Video Analytics”.
2. Select **Object Counting** from “Selected Behaviors”.
3. Click / / and draw a block or line for the scene.
4. Name the zone setup “Dwell time.”
5. Click and set the maximum / minimum size of the objects (people).
6. Assign “Direction” for the proceeding direction of the objects and “Dwell time” for the event.
7. Set the amount of objects to trigger the alarm in
   “Alarm at __ objects”. When the number of the counted objects reaches the setting number, the alarm will be triggered.

8. Check the “Reset counter on alarm” box to reset the object counting once an alarm is triggered. Or, uncheck to disable this function.
9. Setup what behaviors to take when an event occurs under “Triggered Action & File name” section.
10. Click save to apply the setting.

If the amount of entering objects exceeds the user-defined number, the camera will trigger the alarm and/or send notification to users according to what behaviors users previously set.

Object Removal

“Object Removal” triggers an alarm if the monitored object is removed from a user-defined zone. The ideal size of the object to be monitored is to occupy major proportion of ROI, such as a painting from a wall or a statue from a pedestal.

Installation Requirements

Suggested target size (pixel)	50 x 50 ~ 500 x 500 (@ 1080p)
Camera mounting height	The suggested installation height is 3 to 5 m. The actual installation height may vary depending on the size of the object.
Detection range	Make sure the object size is within the acceptable target size range. Real detection range depends on sensor dimension, object size, lens focal length.
Suggested environment illumination (lux)	To have optimal performance, stable and adequate lighting is necessary. We recommend minimum 300 lux as suitable lighting level.

Scene Requirements

- The monitored object should occupy at least 500x500 pixels of the camera scene.
- The size of the detection zone should be the same as the size of the target object.
- Three-dimensional objects or objects with stereoscopic vision (e.g., paintings, sculptures) are considered better targets compared to flat objects like plain papers.
- Other objects unrelated to the scene passing in front of the target would trigger false alarm.
- Camera tampering or severe illumination changes (e.g., from a well-lighted room becomes a completely dark room) might trigger false alarm.

Configuration

1. Select this behavior as “VA1” or “VA2” from “Video Analytics”.
2. Select **Object Removal** from “Selected Behaviors”.
3. Click ▭ / ⬠ and draw a zone of interest.
4. Name the zone; setup “Dwell time” and “Delay before alarm.”
5. Setup what behaviors to take when an event occurs under “Triggered Action & File name” section.
6. Click save to apply the setting.

When the monitored object is removed from the defined zone, an alarm will be triggered and/or a notification will be sent, or other actions will be taken according to what behaviors users previously set.

Stopped Vehicle

“Stopped Vehicle” detects vehicles stopped near a specific area (e.g. no parking zone), and sets an alarm if the vehicle stays inside the area for longer than user-defined period of time. This behavior is ideal for parking enforcement, identifying suspicious parking, finding traffic lane break-downs, and spotting vehicles waiting at gates.

Installation Requirements

Minimum target size (pixel)	Human: 50 x 135 pixels (@1080p) Car: 70 x 70 pixels (@1080p)
Suggested environment illumination (lux)	To have optimal performance, stable and adequate lighting is necessary. We recommend minimum 300 lux as suitable lighting level.

Below are installation parameters for common scenario with 1080p, focal length 3.6 mm camera.

Camera mounting height	The suggested mounting height is 3 to 5 m
Camera tilt angle	30°
Yaw angle	**Human:** Front (0°), Side (90°), Back (180°) are all detectable. However to detect side view, shorter detection distance is required. **Vehicle:** Front (0°), Side (45°/ 90°), Back (180°) are all detectable. However for yaw angle other than front view (0°) requires shorter detection distance.
Detection range	Make sure the object size is within the acceptable target size range. The actual detection range depends on sensor dimension, object size and lens focal length.

Scene Requirements

- There should be sufficient dissimilarity between the object and the background in order to make the object to stand out from the scene.
- Postures other than upright position (e.g., crawling, crouching) would reduce the accuracy of human detection.
- For all the object type, object overlap needs to be prevented. Otherwise the object trajectory might be mixed and reduce accuracy.
- Occlusion would have negative effect on the detection result.
- Below are occlusion tolerance test result based on 2MP pixels cameras, full wide zoom (focal length = 3.6 mm), mounting on 3 meter high wall with tilt angle 30°.

Human (detection distance 3.2 meter)

1. Front view (Yaw angle: 0°)
    - From top to bottom: up to 15% occlusion is detectable (head is occluded)
    - From bottom to top: up to 50% occlusion is detectable
    - From side (left to right/ right to left): up to 25% occlusion is detectable

Car (detection distance 5.9 meter)

1. Front view (Yaw angle: 0°)
    - From top to bottom: up to 50% occlusion is detectable
    - From bottom to top: up to 25% occlusion is detectable
    - From side (left to right/ right to left): up to 33% occlusion is detectable
2. Side view (Yaw angle: 45°)
    - From side (from car head): up to 33% occlusion is detectable
3. Side view (Yaw angle: 90°)
    - From top to bottom: up to 33% occlusion is detectable
    - From bottom to top: up to 33% occlusion is detectable
    - From side (from car head): up to 33% occlusion is detectable
4. Back view (Yaw angle: 180°)
    - From top to bottom: up to 33% occlusion is detectable
    - From bottom to top: up to 33% occlusion is detectable
    - From side (left to right/ right to left): up to 33% occlusion is detectable.

Front view (Yaw angle: 0°):

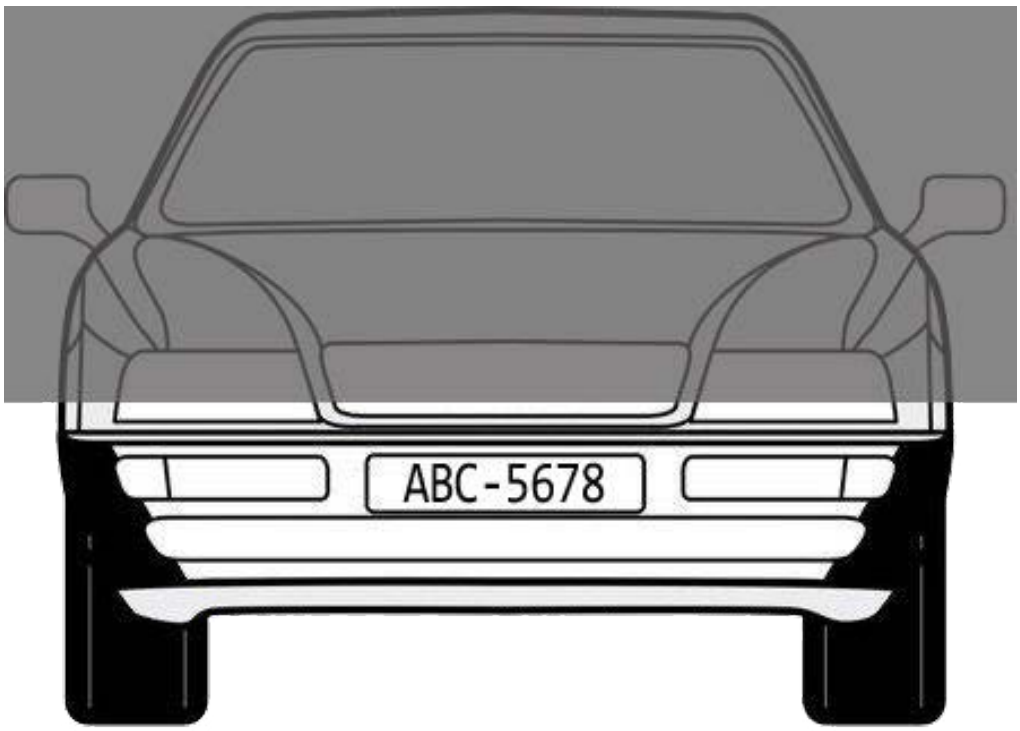


Fig. 13: The detectable degree of occlusion is up to 50% (from top to bottom).

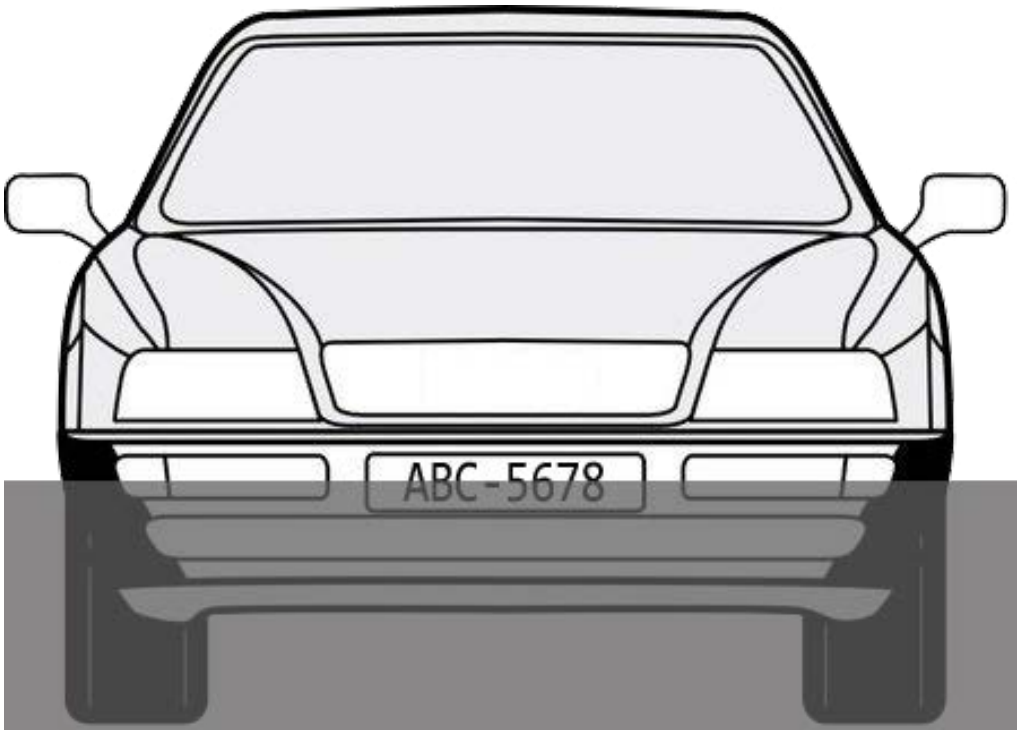


Fig. 14: The detectable degree of occlusion is up to 25% (from bottom to top).

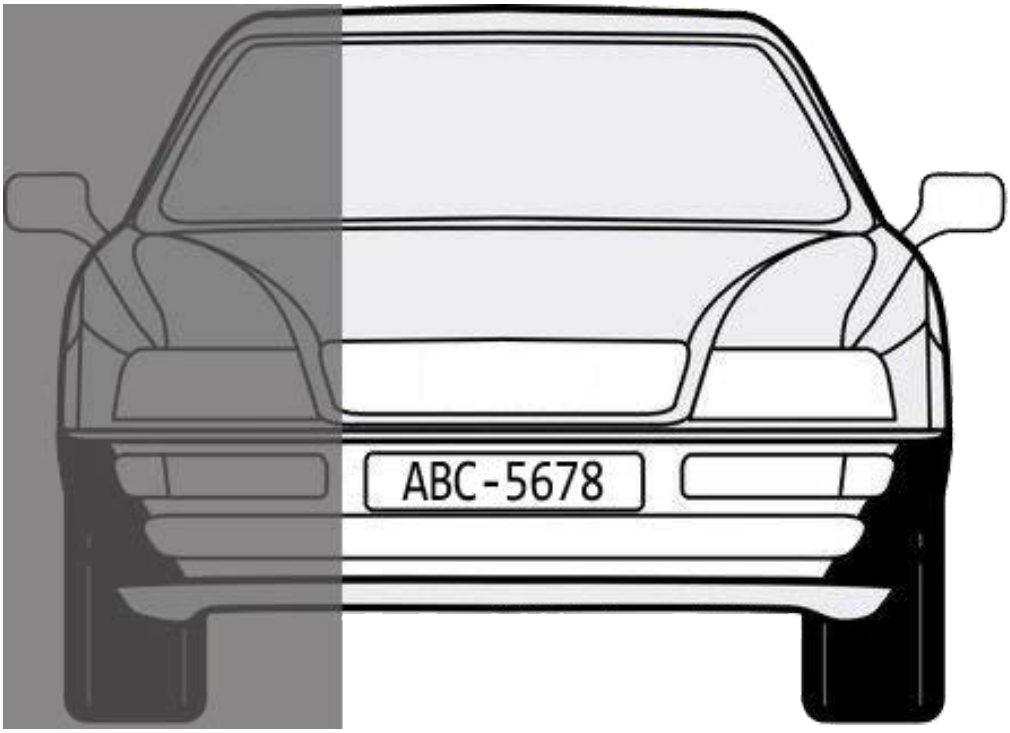
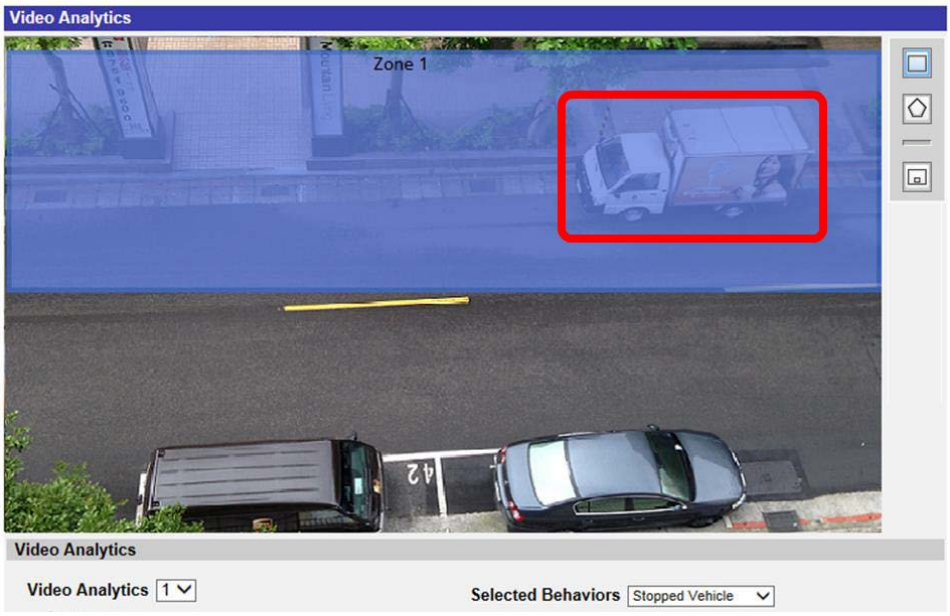


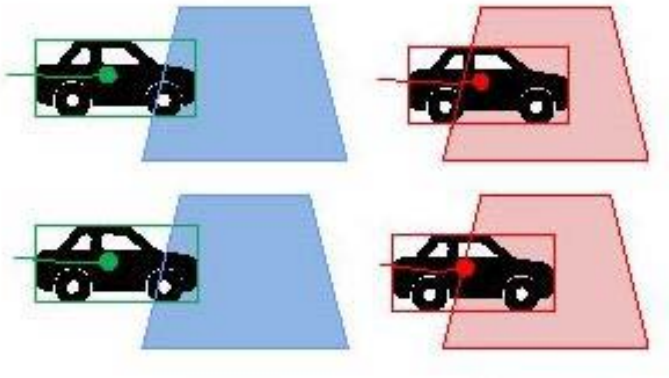
Fig. 15: The detectable degree of occlusion is up to 33% (from left to right/ right to left).

Configuration

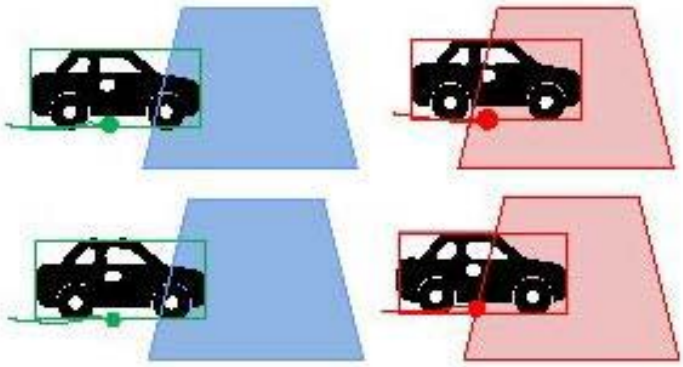


1. Select this behavior as “VA1” or “VA2” from “Video Analytics”.
2. Select **Stopped Vehicle** from “Selected Behaviors”.
3. Click ▭ / ⬠ and draw a zone of interest. Name the defined zone; setup “Dwell time” and “Delay before alarm.”

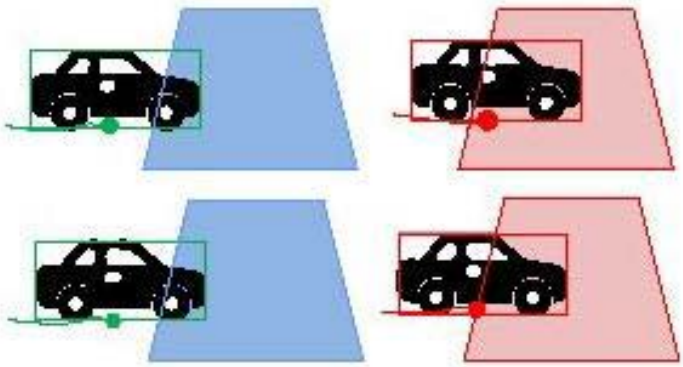
4. Select a trigger type:
   - **Object center:** The camera will trigger the alarm when the center point of the bounding box touches or is within the detection zone.



   - **Bottom center:** The camera will trigger the alarm when the bottom center point of the bounding box touches or is within the detection zone.

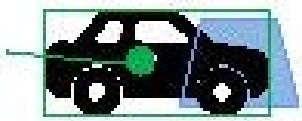
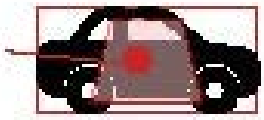


   - **Edge:** The camera will trigger the alarm when the edge of the bounding box touches or is within the detection zone.



- **Fully inside:** The camera will trigger the alarm when the bounding box is fully within the detection zone.


- **Fully cover:** The camera will trigger the alarm when the bounding box fully covers the detection zone.

5. Click and define the minimum and maximum size of objects.
6. Setup what behaviors to take when an event occurs under “Triggered Action & File name” section.
7. Click save to apply the setting.

When any vehicle stops near the specified zone and stays in the zone longer than the defined time period, an alarm will be triggered and / or a notification will be sent, or other actions will be taken according to what behaviors users previously set.

Face Detection

NOTE! This feature is only available on specific camera models; please check the corresponding **Technical Specifications** document of your camera if it supports the **DNN Features**.

“Face Detection” applies to target marketing efforts on demographic segmentation. This function identifies the gender of the visitors and their approximate age range by detecting and analyzing their faces. The information shown by this function can be used for targeted merchandising and campaign evaluation.

Installation Requirements

Minimum target size	Human: 60 x 60 px ~ 1080 x1080 px (@1080p)

(pixel)		
Suggested environment illumination (lux)	To have optimal performance, stable and adequate lighting is necessary. We recommend minimum 300 lux as suitable lighting level.	

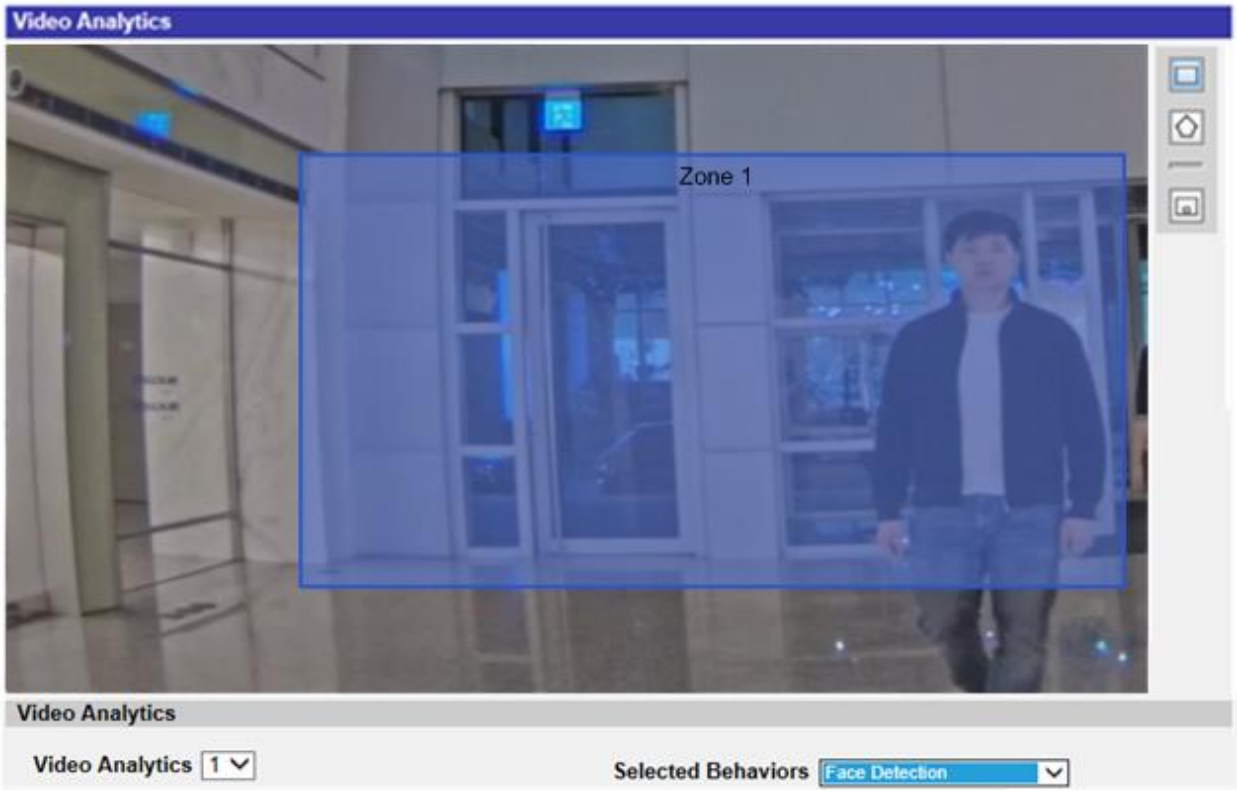
Below are installation parameters for common scenario with 1080p, focal length 3.6 mm camera.

Camera mounting height	1,5 m	3 m
Camera tilt angle	0°	30°
Yaw angle	Under installation condition mentioned above, 0°, 45°and 90° are all detectable. However, larger yaw angle would reduce the detection range.	
Detection range	Up to 6 m	Up to 5 m

Scene Requirements

- The camera must be installed in a way that it provides a frontal/side view of the persons. Front view provides best recognition result. The detection distance will reduce if side view is presented.
- If age and gender is required, facial features (including 2 eyes, mouth and nose) couldn’t be occluded.
- Face with partial occlusion might reduce the accuracy. Though in our internal test, people with hat, face-mask and helmet (with front glass cover) / people with helmet and face-mask are still detectable. In these cases, larger target size will be required to get good result (the detection range would be reduced accordingly).
- Challenging lighting conditions (e.g., backlight, low light) might make facial details blur. Light compensation or WDR function will be required in this condition.

Configuration



1. Select this behavior as “VA1” or “VA2” from “Video Analytics”.
2. Select **Face Detection** from “Selected Behaviors”.
3. Click ▭ / ⬠ and draw a zone of interest. Name the defined zone; setup “Dwell time”.
4. Click ▣ and define the minimum and maximum size of objects.
5. Setup what behaviors to take when an event occurs under “Triggered Action & File name” section.
6. Click save to apply the setting.

When the visitor enters the specified zone, an alarm will be triggered and / or a notification will be sent, or other actions will be taken according to what behaviors users previously set.

Face Recognition

NOTE! This feature is only available on specific camera models; please check the corresponding **Technical Specifications** document of your camera if it supports the **DNN Features**.

“Face Recognition” is designed for access control and personnel identification. To enable this function, it is necessary to create a database. Once the person’s facial images and the related information have been entered into the database, he/she can be detected. The name of the person detected and the confidence rate will be shown under this function.

Installation Requirements

Minimum target size (pixel)	Human: 6100 x 100 px ~ 1080 x1080 px (@1080p)
Suggested environment illumination (lux)	To have optimal performance, stable and adequate lighting is necessary. We recommend minimum 300 lux as suitable lighting level.

Below are installation parameters for common scenario with 1080p.

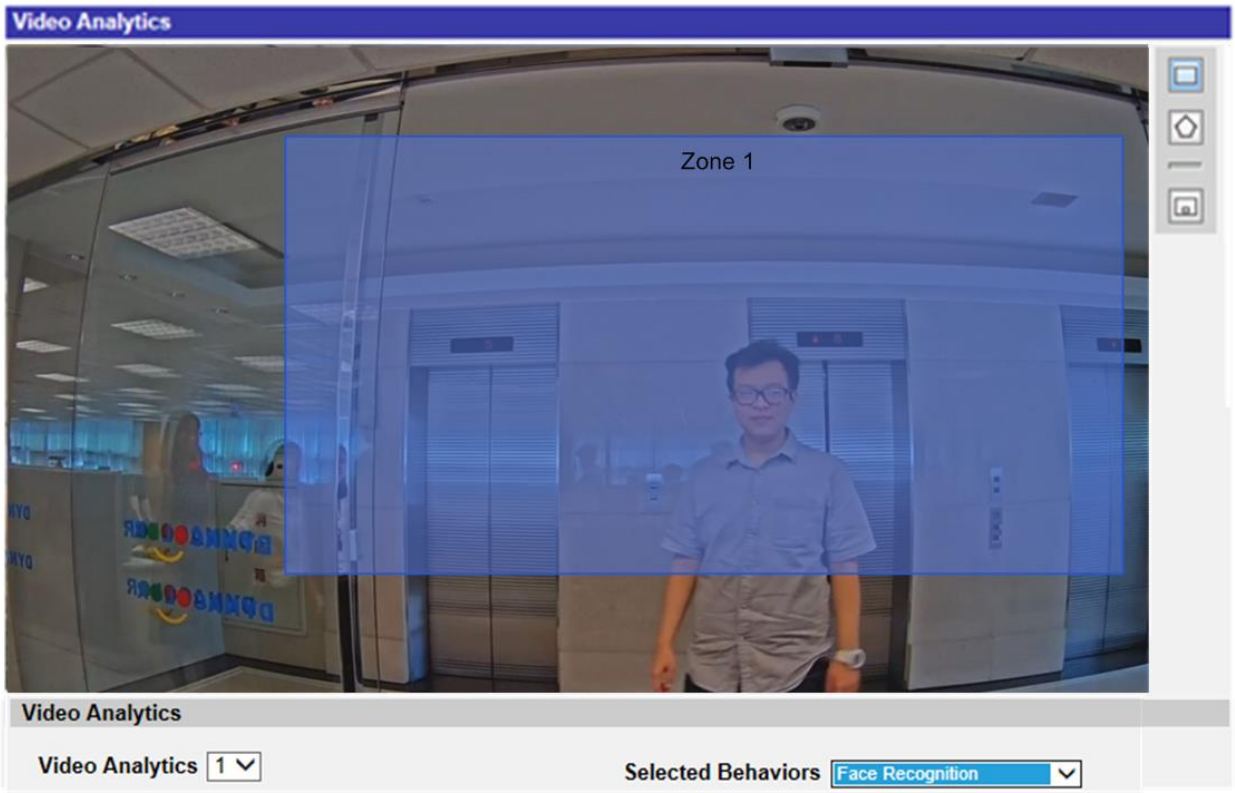
Camera mounting height	1,5 m	3 m
Camera tilt angle	0°	30°
Yaw angle	Depending on the training data. If training data with different angle is provided,	

	the performance could be better.	
Detection range	Up to 6 m	Up to 5 m

Scene Requirements

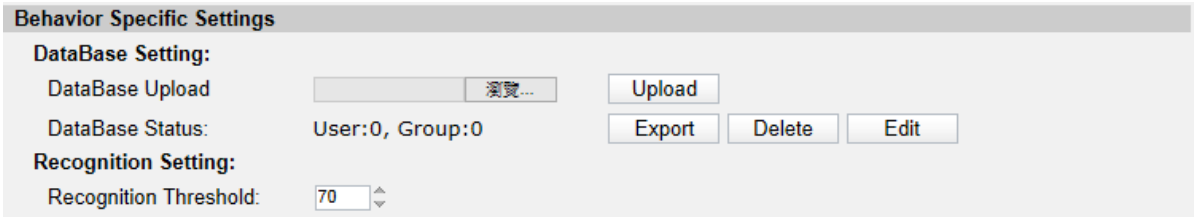
- The camera must be installed in a way that it provides a clear frontal view of the persons.
- Facial features are clearly revealed (2 eyes, nose and mouth).
- Occlusion of facial features such as wearing glasses, full-face helmet, or face mask would reduce recognition accuracy.
- Challenging lighting conditions (e.g., backlight, low light) might make facial details blur. Light compensation or WDR function will be required in this condition.

Configuration

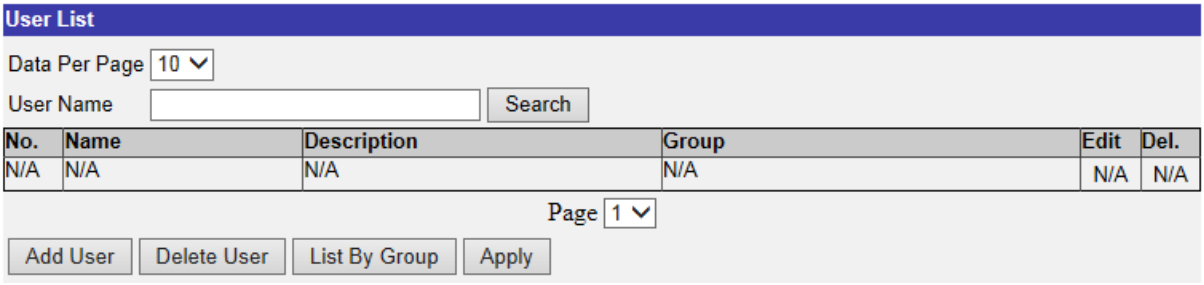


1. Select this behavior as “VA1” or “VA2” from “Video Analytics”.
2. Select **Face Recognition** from “Selected Behaviors”.

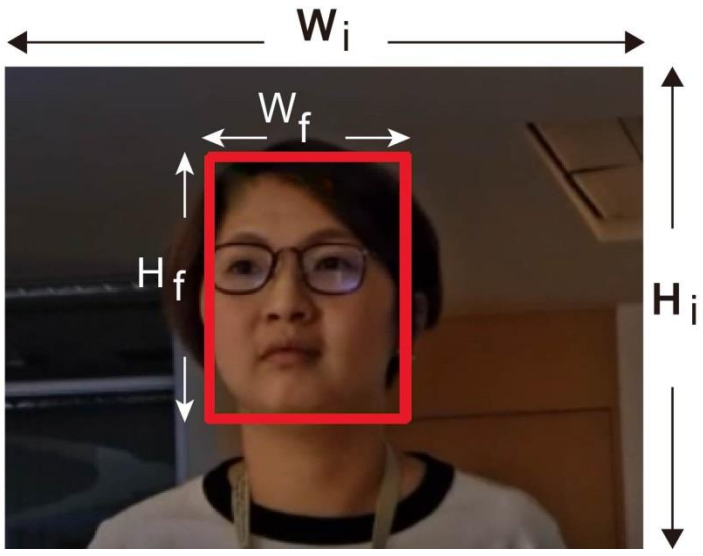
3. Click Edit from “Behavior Specific Settings”.



4. Click Add User from “User List”.



5. Enter the user’s name into **Name**. Fill in **Description** if needed.
6. Click from **Face Image List**. Choose the image files of the user. Upload at least three images of the user’s face. The face must take up 20 % of the image. More images with multiple angles (both eyes should be revealed) or various looks of the user, e.g., with/without glasses, with different hairstyles, are preferred. Supported image formats are JPEG/PNG/BMP. Recommended image size is between 200x200 to 1920x1080 pixels.

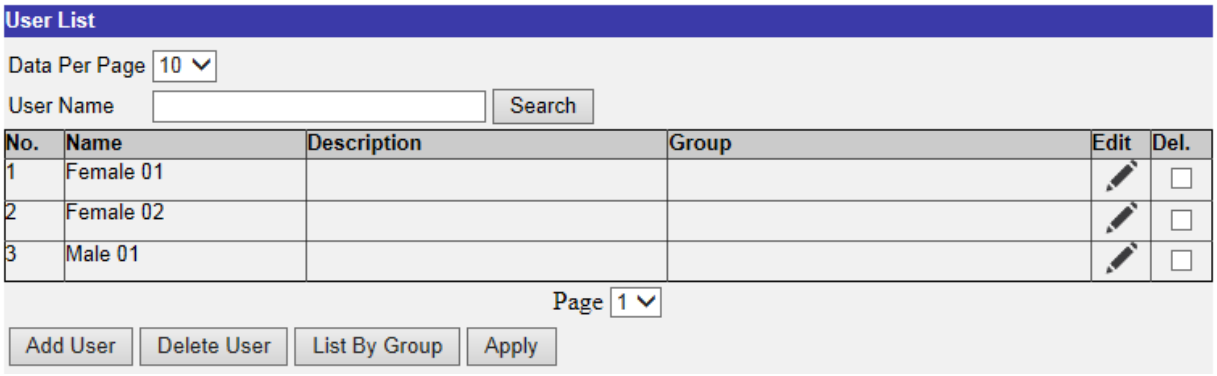


Formula:

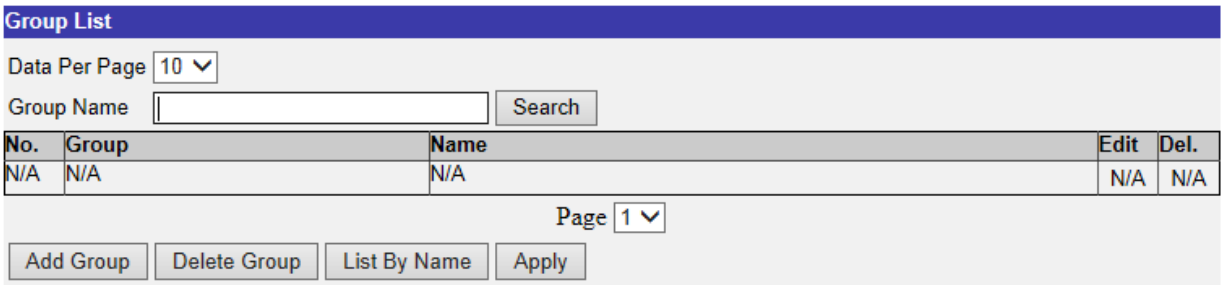
(Width **f** x Height **f**) / (Width **i** x Height **i**) =

The percentage of the face (**f**) taking up space in an image (**i**)

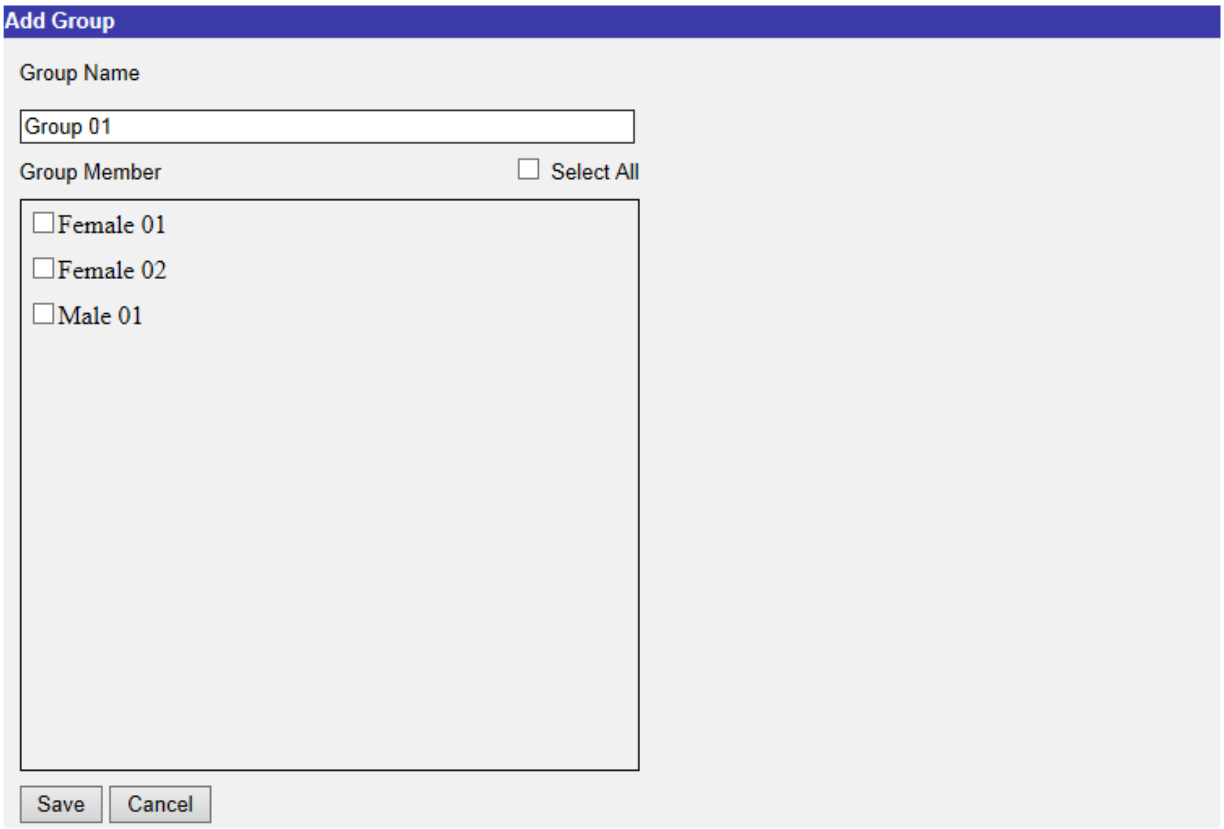
7. Click save to apply the setting.
8. Click List By Group from “User List” after finishing adding the users.



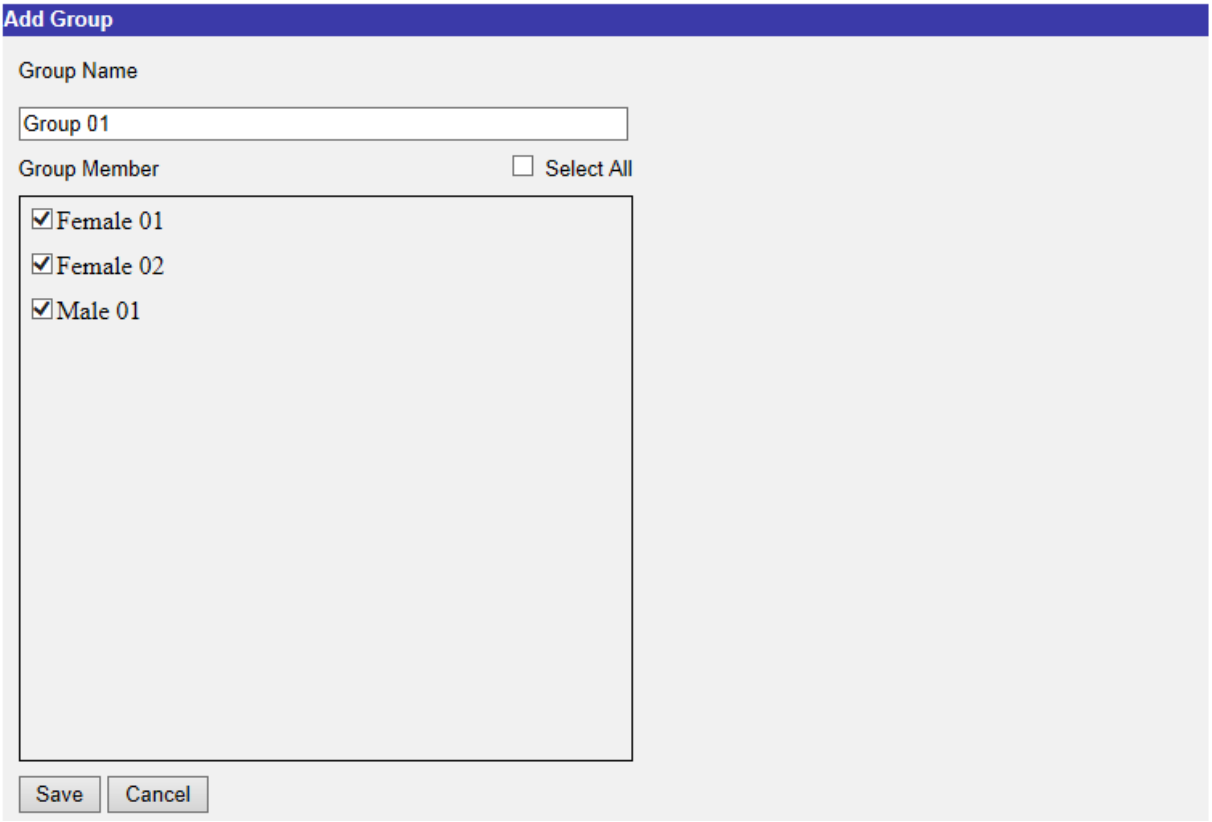
9. Click Add Group from “Group List”.



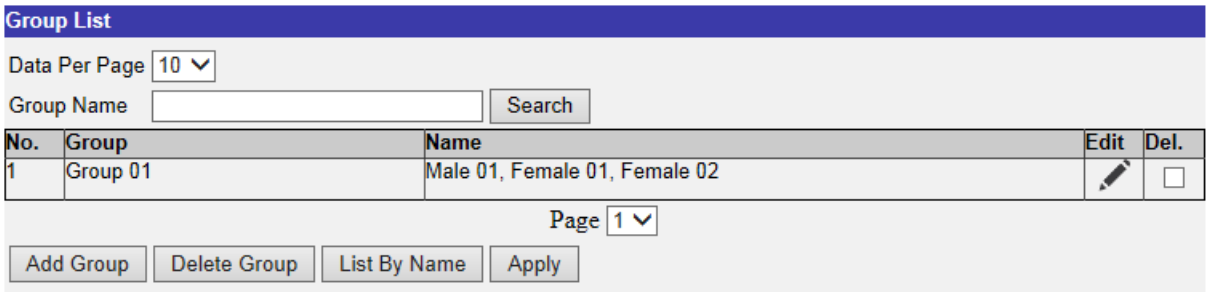
10. Enter the name of the group into “Group Name”.



11. Select the group member(s) into the group.
12. Click save to apply the setting.



13. Step 13: Click Apply from “Group List” to save the setting.



NOTE!
The user and group data can be imported into other cameras. For those who need to export the data into a database file or to upload a database file (see Database Management, p. 62). If not, proceed to Step 14.

14. Select **Recognition Threshold** from Behavior Specific Settings. The default setting is 70. The value range is 1 to 100.

NOTE!

Recognition Threshold is a set value to be compared with the face data value. If the value of the scanned face is higher than the threshold, the verification passes, and the scanned person's name will 28 be shown. If not, the status will be **UNKNOWN**. For further information about the face image requirements, please refer to Click from Face Image List. Choose the image files of the user. Upload at least three images of the user's face. The face must take up 20 % of the image. More images with multiple angles (both eyes should be revealed) or various looks of the user, e.g., with/without glasses, with different hairstyles, are preferred. Supported image formats are JPEG/PNG/BMP. Recommended image size is between 200x200 to 1920x1080 pixels., p. 51.

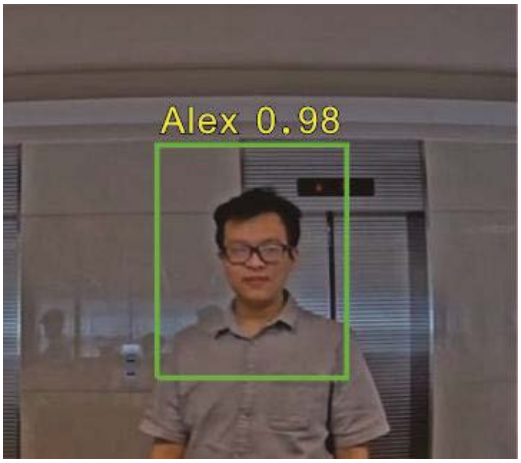
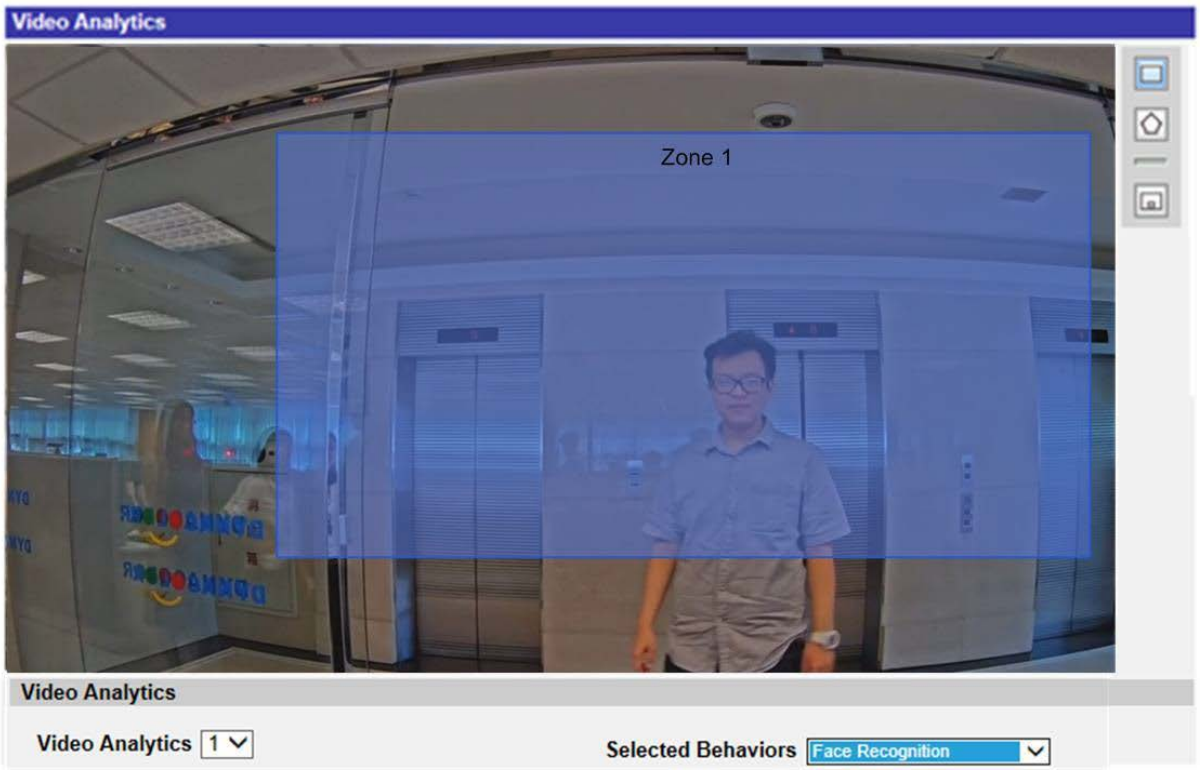
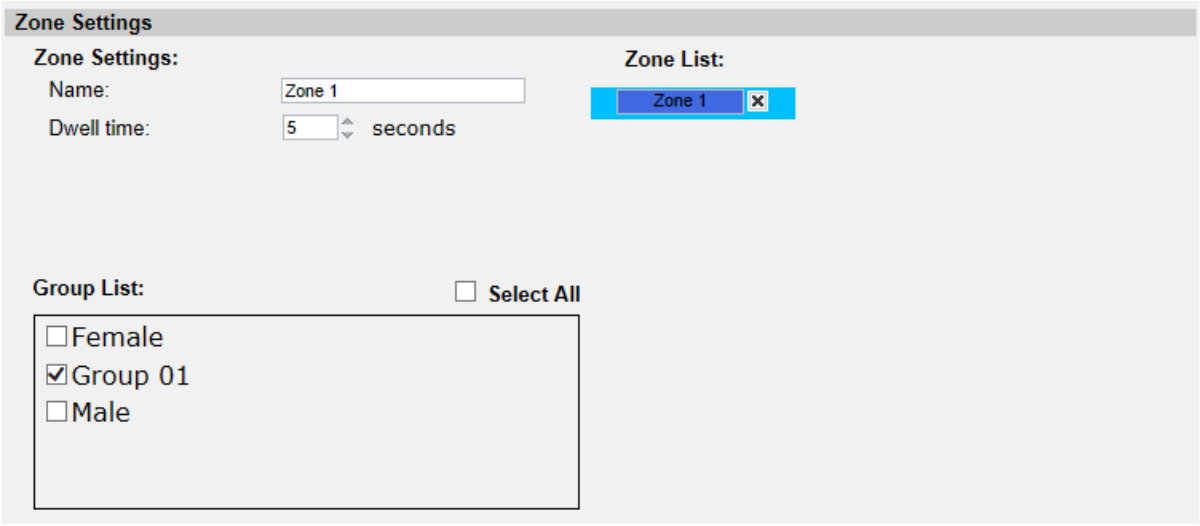


Fig. 16: The verification passes when the face data value (0.98) is higher than "Recognition Threshold" value (70).

15. Click ▭ / ⬠ and draw a zone of interest.

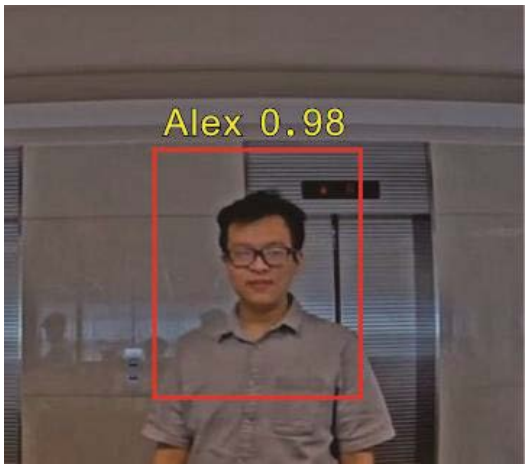


16. Setup **Dwell Time** from Zone Settings.
17. Click  and define the minimum and maximum size of objects.
18. Select the group(s) from “Group List”.



19. Setup what behaviors to take when an event occurs under “Triggered Action & File name” section.
20. Click save to apply the setting.

After the zone of interest & group list are set up, and the group member entered the zone, an alarm will be triggered and / or a notification will be sent, or other actions will be taken according to what behaviors users previously set. When the alarm is triggered successfully, the detection frame will be red.



License Plate Recognition

NOTE! This feature is only available on specific camera models; please check the corresponding **Technical Specifications** document of your camera if it supports the **DNN Features**.

“License Plate Recognition” captures the license plate in real time. To enable this function, it is necessary to create a database. Once the license plate number has been entered into the database, it can be detected and the confidence rate will be shown under this function. The information can be further used for purposes like generating alerts, opening the gate, or adding costs.

Installation Requirements

Suggested target size (pixel)	100 x 60 px ~ 9600 x 540 px (@1080p)
Suggested environment illumination (lux)	To have optimal performance, stable and adequate lighting is necessary. We recommend minimum 300 lux as suitable lighting level.
Shutter Speed	Faster than 1/300 second.

Below are installation parameters for common scenario with 1080p.

Camera installation position	In front of the target	Look down upon the target
Camera mounting height	1 m	2 m
Camera tilt angle	30°	20°
Yaw angle	< 30°	
License plate roll angele	< ±5°	
Detection range	2 to 8 m	4 to 10 m

Scene Requirements

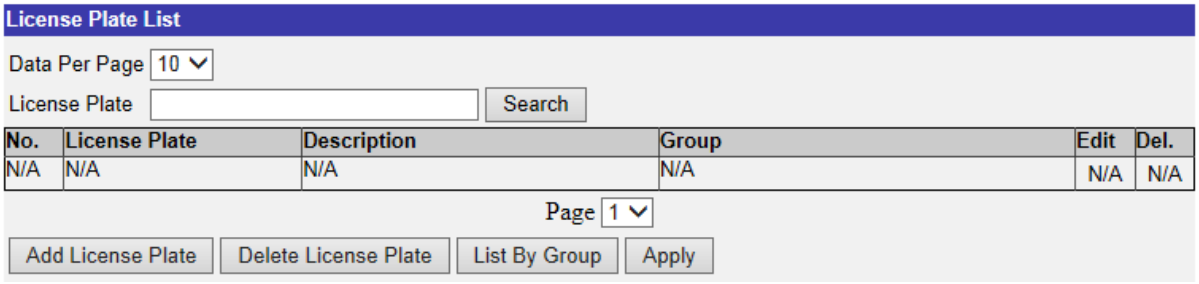
- All the characters need to be clear and recognizable.
- Lighting compensation is highly recommended to provide stable result in different lighting condition and vehicle speed.
- Suitable light source might vary in different regions. For example, for regions that have license plate with red character and white background, using IR illuminator would make both background and character red and indistinguishable.
- WDR might be needed to deal with the high dynamic range caused by headlight.

- Challenging characters might cause recognition error due to poor image quality or license plate rule changes (for example, filed used to limited to alphabetic character only are now open for numerical character). Special characters in diacritics might be ignored due to shadow.
  - 0 and o
  - 1 and I
  - V and U
  - Diacritics like ï and I, Ü and U.

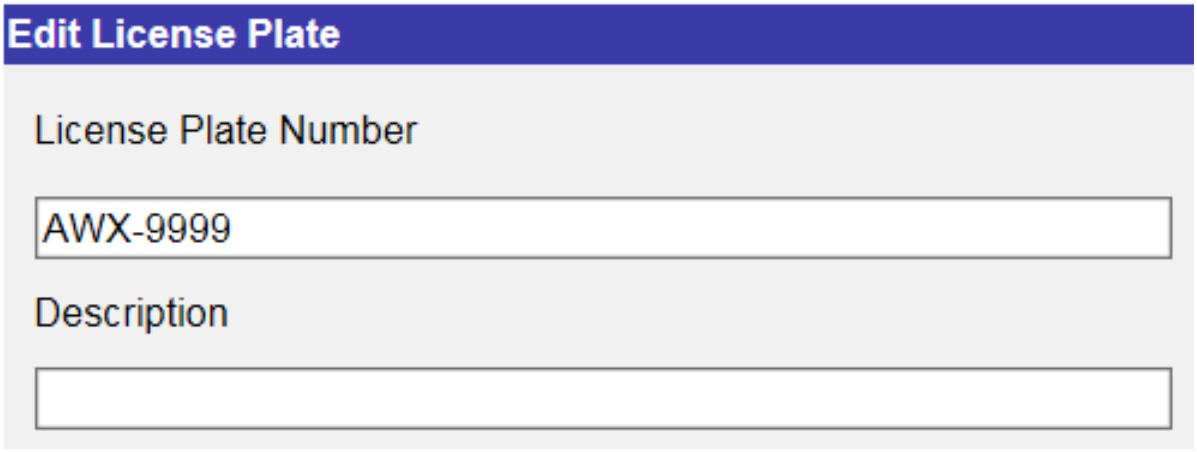
Configuration

1. Select this behavior as “VA1” or “VA2” from “Video Analytics”.
2. Select **License Plate Recognition** from “Selected Behaviors”.
3. Click Edit from “Behavior Specific Settings”.

4. Click Add License Plate from “License Plate List”.



5. Enter the license plate number into **License Plate Number**. Fill in **Description** if needed.

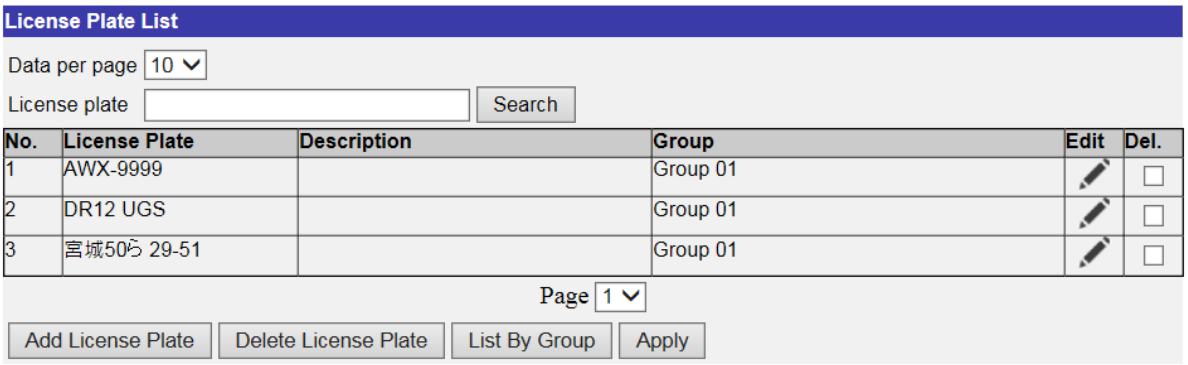


NOTE!
Three recognition regions are **General**, **Japan** and **Taiwan**. When entering Taiwanese license plate number, note that hyphens (“–”) in the plate number is required. License plate number of other countries can be recognized with and without hyphens and spaces. See examples below.

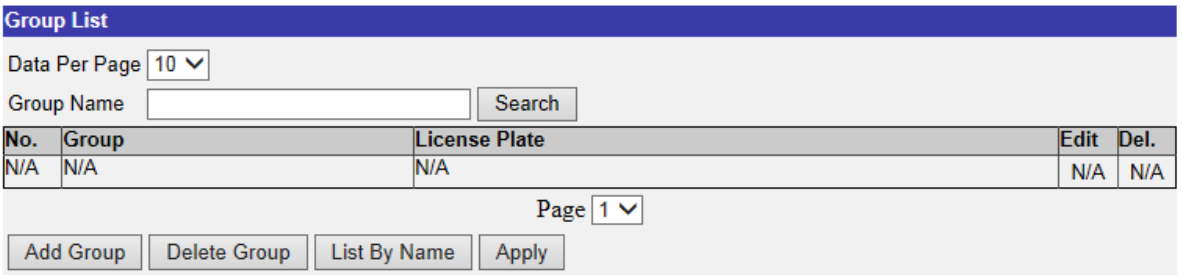
Recognition region	License plate	Correct input
General		DR12 UGS
		AB-412-AA or AB 412 AA

Recognition region	License plate	Correct input
Japan		宮城 50ら 29-51 or 宮城 50ら 2951
Taiwan		AWX-9999

6. Click save to apply the setting.
7. Click List By Group from “License Plate List” after finishing adding the license plate numbers.



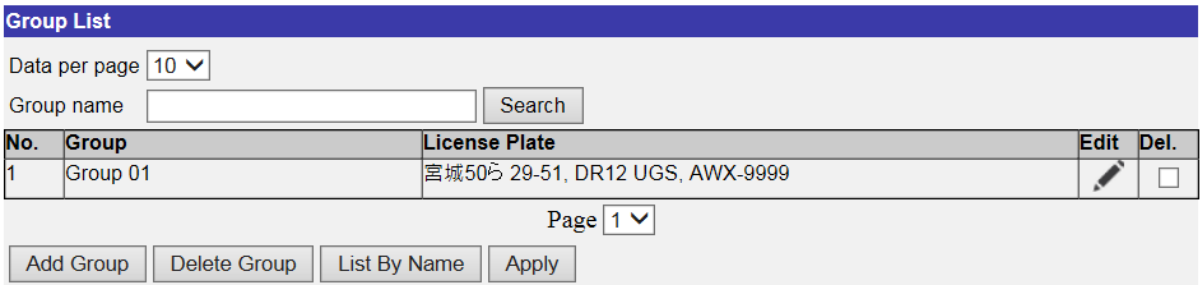
8. Click Add Group from “Group List”.



9. Enter the name of the group into "Group Name".
10. Select the group member(s) into the group.

11. Click save to apply the setting.

12. Click Apply from “Group List”.



NOTE!
The group data can be imported into other cameras. For those who need to export the data into a database file or to upload a database file (see Database Management, p. 62).

13. Select **Recognition Threshold** from "Behavior Specific Settings". The default setting is 70. The value range is 1 to 100.

NOTE!
Recognition Threshold is a set value to be compared with the license plate data value. If the value of the scanned license plate is higher than the threshold, the verification passes, and the license plate will be shown.

Example: The verification passes when the license plate data value (0.95) is higher than the "Recognition Threshold" value (70).

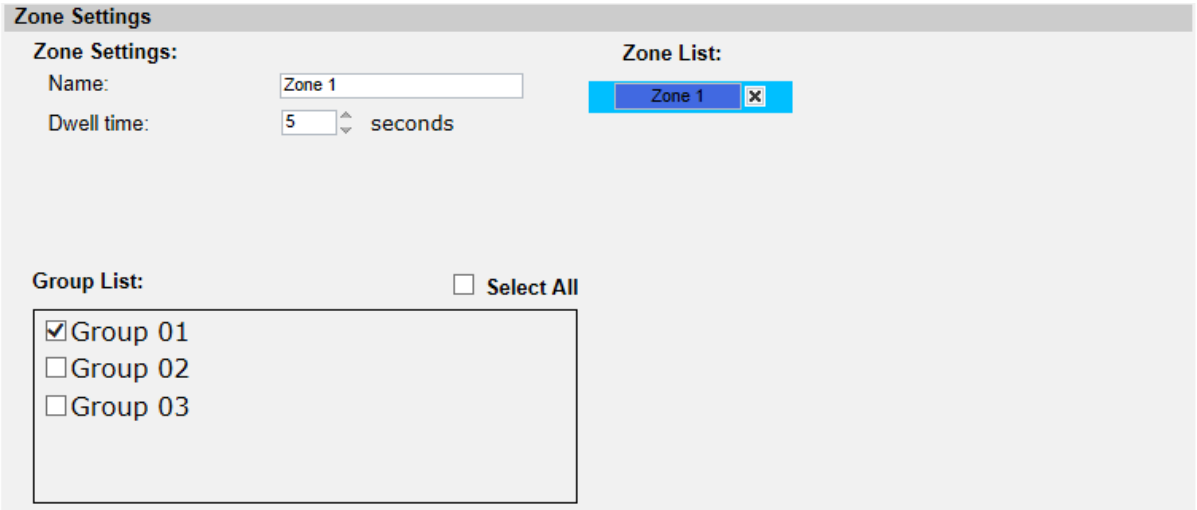
14. Select **Recognition Region** from "Behavior Specific Settings". Available region options are **General**, **Japan** and **Taiwan**.

> **NOTE!**
> Note that **General** contains several European countries and some Asian countries. For further information, contact the manufacturer.

15. Click ▭ or ⬠ and draw a zone of interest.

16. Set **Dwell Time** from Zone Settings.

17. Click and define the minimum and maximum size of objects.
18. Select the group(s) from "Group List".



19. Define the behaviors to take when an event occurs in the Triggered Action & File name section.
20. Step 20: Click save to apply the setting.

After the zone of interest & group list are set up, and the group member entered the zone, an alarm will be triggered and / or a notification will be sent, or other actions will be taken according to what behaviors users previously set. When the alarm is triggered successfully, the detection frame will be red.

Database Management

To export the database, follow the steps below after the user and group setup.

1. Click Export from “Behavior Specific Settings Settings” to export the database into a CSV file.

2. When prompted, click **Save** to save the database file.

Export the Database

To export the database, follow the steps below after the user and group setup.

1. Click Export from “Behavior Specific Settings Settings” to export the database into a CSV file.

2. When prompted, click **Save** to save the database file.

Upload the Database

To import and upload a database file, please follow the steps below after the user and group setup.

1. Click **Browse** and select the database file.
2. Click Upload to finish the setting.

3. Click **Yes** in the pop pop-up window after the database file is uploaded successfully.

A

Appendix

This section contains the following information:

MOBOTIX MOVE Camera Video Analytics Overview

VA Type	2&5MP -VA	12MP -VA Hemispheric			4K -VA
	S6Lm SX-Firmware	CV22 UX-Firmware **(Set to Wall Mount)**	CV22 UX-Firmware **(Set to Ceiling Mount+feoverview)**	CV22 UX-Firmware **(Set to Ceiling Mount+feptz)**	CV22 UX-Firmware
For first 8 VA (Not include Face Recog./Detec.)	2 VA at a time	2 VA at a time	2 VA at a time	2 VA at a time	2 VA at a time
Abandoned DNN / Objec	Y	Y	Y	Y	Y
Intrusion Detection	Y	Y (DNN / Object based)	Y	Y (DNN / Object based)	Y (DNN / Object based)
Camera Sabotage	Y	Y	Y	Y	Y
Wrong Direction	Y	Y	Y	Y	Y
Loitering Detection	Y	Y (DNN / Object based)	Y	Y (DNN / Object based)	Y (DNN / Object based)
DNN / Object based Cou	Y	Y (DNN / Object based)	Y	Y (DNN / Object based)	Y (DNN / Object based)
DNN / Object based Rem	Y	Y	Y	Y	Y
Stopped Vehicle	Y	Y (DNN / Object based)	Y	Y (DNN / Object based)	Y (DNN / Object based)
Recognition/Detection					
Face Detection/Recog	N/A	N/A	N/A	N/A	Y
License Plate Recog	N/A	N/A	N/A	N/A	Y

*DNN / Object based Recognition can determine: bicycle,bus, car, motorbike, person

*Face Detection/Recognition can determine: Gender, Age

*Notes while running 2 VA simultaneously: Cannot support 2 VA when one stream set to 5MP

*LPR Contries: General -

Austria, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Finland, France, Germany, United Kingdom, Greece, Hungary, Italy, Luxembourg, Monaco , Montenegro, Netherlands, North Macedonia, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Russia, Armenia, Azerbaijan, Belarus, Estonia, Georgia, Kazakhstan , Kyrgyzstan, Latvia, Lithuania, Moldova, Ukraine, Uzbekistan, Turkey, Israel, Vietnam, Ireland

Performance levels reported in this document represent max. Performance spec that can be achieved under "ideal" conditions !

MOBOTIX MOVE Camera Video Analytics Overview

Operational results may vary from those values due to Application Specific Camera Setup and Environmental Conditions !

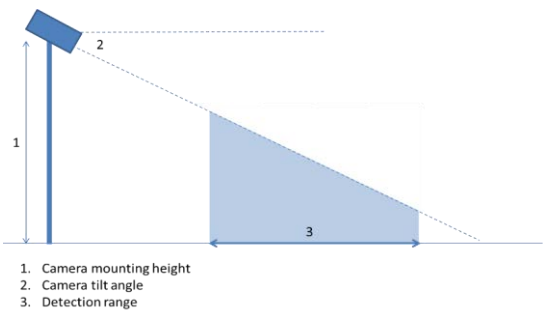
MOBOTIX MOVE Camera UX-Firmware Video Analytics Accuracy

Rule name		Abandoned Object	Object Removal	Wrong Direction	Camera Sabotage
Installation	**Definition**				
Suggested target size (pixel)	The suggested object size to trigger video analytics function	50 x 50 ~ 500 x 500 (@ 1080p)	500 x 500 ~ 1440 x 810 (@ 1080p)	500 x 500 ~ 1440 x 810 (@ 1080p)	Not relevant
Effective FoV - 5MP + 2.7-12mm	Camera FoV due to lens distortion / blurring	H-FOV: 102.1°(Wide); 31.5°(Tele) V-FOV: 70.3°(Wide); 22.7°(Tele)			
Effective FoV - 8MP + 3.6-11mm	Camera FoV due to lens distortion / blurring	H-FOV: 115°(Wide); 47.5°(Tele) V-FOV: 61.2°(Wide); 27.0°(Tele)			
Camera mounting height	The height that the camera is installed	1. No limitation for installation height 2. Normal installation height is 3~5 m.			
Detection range	The detectable distance range between camera and target object	Need to make sure the object size is within our acceptable target size range. Real detection range depends on sensor dimension, object size, lens focal length.			
Object speed	The object speed range that the camera could detect	Not relevant	Not relevant	270 pixel/ sec ~1080 pixel/ sec	Not relevant
Suggested environment illumination (lux)	Suggested illumination to offer optimal performance	To have optimal performance, stable and adequate lighting is necessary. We recommand minimum 300 lux as suitable lighting level. For camera sabotage, the minimum environment illumination is 10 lux.			
Performance					
Recall rate (good light condition)	True positive/ (True positive + False negative)	95%	95%	80%	90%
Precision rate (good light condition)	True positive/ (True positive + False positive)	90%	90%	90%	90%
Accuracy (good light condition)	(True positive + True negative) / (True positive + True negative + False positive + False negative)	90%	90%	80%	90%

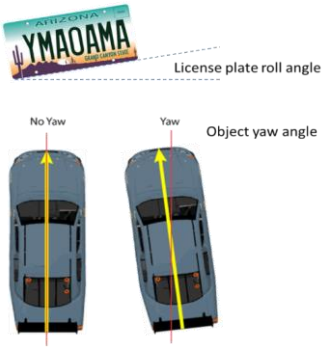
Rule name		Intrusion	Object Counting	Loitering	Stopped Vehicle
Installation	**Definition**				
Suggested target size (pixel)	The suggested object size to trigger video analytics function	- Human (upright position, front view): 50 x 135 pixels (@ 1080p) - Car (fron view): 70 x 70 pixels (@ 1080p)			
Effective FoV - 5MP + 2.7-12mm	Camera FoV due to lens distortion / blurring	H-FOV: 102.1°(Wide); 31.5°(Tele) V-FOV: 70.3°(Wide); 22.7°(Tele)			
Effective FoV - 8MP + 3.6-11mm	Camera FoV due to lens distortion / blurring	H-FOV: 115°(Wide); 47.5°(Tele) V-FOV: 61.2°(Wide); 27.0°(Tele)			
Camera mounting height	The height that the camera is installed	Under condition that camera is installed at 3 m height, tilt 30°, full wide zoom (@1080p):			
Detection range	The detectable distance between camera and target object				
Camera tilt angle	The angle between camera direction and the horizontal plane	**Human (detection distance = 3.2 m)** 1. Front view (0deg) - From top to bottom: up to 15% occlusion is detectable (head is occluded) - From bottom to top: up to 50% occlusion is detectable - From side (left to right/ right to left): up to 25% occlusion is detectable (arm is occluded) **Vehicle (detection distance = 5.9 m)** 1. Front view (0deg) - From top to bottom: up to 50% occlusion is detectable - From bottom to top: up to 25% occlusion is detectable - From side (left to right/ right to left): up to 33% occlusion is detectable 2. Side view (45 deg) - From side (from car head): up to 33% occlusion is detectable 3. Side view (90 deg) - From top to bottom: up to 33% occlusion is detectable - From bottom to top: up to 33% occlusion is detectable - From side (from car head): up to 33% occlusion is detectable 4. Back view (180 deg) - From top to bottom: up to 33% occlusion is detectable - From bottom to top: up to 33% occlusion is detectable - From side (left to right/ right to left): up to 33% occlusion is detectable			
Object yaw angle	The angle between camera direction and the object facing direction	**Human** Front (0°)/ Side (90°)/ Back (180°) are all detectable. But for side view, the detection range would be shorter **Vehicle** Front (0°)/ Side (45° and 90°)/ Back (180°) are all detectable. But for side/ back view, the detection range would be shorter			
Resilience to object occlusion	To indicate if a specific function will be affected when part of the object is hidden/ occluded	**Human** 1. Front view (0deg) - From top to bottom: up to 15% occlusion is detectable (head is occluded) - From bottom to top: up to 50% occlusion is detectable - From side (left to right/ right to left): up to 25% occlusion is detectable (arm is occluded) **Vehicle** 1. Front view (0deg) - From top to bottom: up to 50% occlusion is detectable - From bottom to top: up to 25% occlusion is detectable - From side (left to right/ right to left): up to 33% occlusion is detectable 2. Side view (45 deg) - From side (from car head): up to 33% occlusion is detectable 3. Side view (90 deg) - From top to bottom: up to 33% occlusion is detectable - From bottom to top: up to 33% occlusion is detectable - From side (from car head): up to 33% occlusion is detectable 4. Back view (180 deg) - From top to bottom: up to 33% occlusion is detectable - From bottom to top: up to 33% occlusion is detectable - From side (left to right/ right to left): up to 33% occlusion is detectable			
Suggested environment illumination (lux)	Suggested illumination to offer optimal performance	To have optimal performance, stable and adequate lighting is necessary. We recommand minimum 300 lux as suitable lighting level.			
Performance					
Recall rate (good light condition)	True positive/ (True positive + False negative)	90%			
Precision rate (good light condition)	True positive/ (True positive + False positive)	90%	85% (Target)	90% (Target)	90% (Target)
Accuracy (good light condition)	(True positive + True negative) / (True positive + True negative + False positive + False negative)	85%			

MOBOTIX MOVE Camera UX-Firmware Video Analytics Accuracy

Rule name		Face Detection	Face Recognition	License Plate Recognition
Installation	**Definition**			
Suggested target size (pixel)	The suggested object size to trigger video analytics function	60 x 60 ~ 1080 x 1080 (@1080p)	100 x 100 ~1080 x 1080 (@1080p	100 x 60 ~ 960x540 (@1080p)
Effective FoV - 5MP + 2.7-12mm	Camera FoV due to lens distortion /	H-FOV: 102.1°(Wide); 31.5°(Tele) V-FOV: 70.3°(Wide); 22.7°(Tele)		
Effective FoV - 8MP + 3.6-11mm	Camera FoV due to lens distortion /	H-FOV: 115°(Wide); 47.5°(Tele) V-FOV: 61.2°(Wide); 27.0°(Tele)		
Installation suggestion	Camera mounting height: The height that the camera is Detection range: The detectable distance between Camera tilt angle: The angle between camera direction and the horizontal plane	To fulfill minumum target size 60 x 60 (@1080p), below are installation suggestion in common scenarios: **- Camera is in front of the subject:** Camera height = 1.5 m, tilt angle = 0°, full wide zoom (focal length 3.6 mm) => Detection range is up to 6 m **- Camera looks down upon the subject:** Camera height = 3 m, tilt angle = 30°, full wide zoom (focal length 3.6 mm) => Detection range is up to 5 m	To fulfill minumum target size 100 x 100 (@1080p), below are installation suggestion in common scenarios: **- Camera is in front of the subject:** Camera height = 1.5 m, tilt angle = 0°, full wide zoom (focal length 3.6 mm) => Detection range is up to 6 m **- Camera looks down upon the subject:** Camera height = 3 m, tilt angle = 30°, full wide zoom (focal length 3.6 mm) => Detection range is up to 5 m	To fulfill minumum target size 100 x 60 (@1080p), below are installation suggestion in common scenarios: **- Camera is in front of the subject:** Camera height = 1 m, tilt angle < 30°, full wide zoom (focal length 3.6 mm) => Detection range is 2 m to 8 m **- Camera looks down upon the subject:** Camera height = 2 m, tilt angle < 30°, full wide zoom (focal length 3.6 mm) => Detection range is 4 m to 10 m
Object yaw angle	The angle between camera direction and the object	Under installation condition mentioned above, 0°, 45°and 90° are all detectable. However larger yaw angle would reduce the detection range.	Dependning on the training data. If traning data with different angle is provided, the performance could be better.	<30°
License plate roll angle	The rotation angle of the license plate	Not relevant	Not relevant	<±5°
Resilience to object occlusion	To indicate if a specific function will be affected when	Detectable under below conditions: with hat, face-mask, helmet (with front glass cover), helmet+face-mask	Need to reveal face features (2 eyes, nose, mouth)	Need to reveal the whole license plate
Suggested environment illumination (lux)	Suggested illumination to	To have optimal performance, stable and adequate lighting is necessary. We recommand minimum 300 lux as suitable lighting level.		
Others	Any other information	N/A	N/A	To have optimal result, shutter speed has to be faster than 1/300 second
Performance				
Accuracy (good light condition)	(True positive + True negative) / (True positive + True negative + False positive + False negative)	88%	99.5% on public standard dataset	tw - 99% jp - 98% eu - 98%



1. Camera mounting height
2. Camera tilt angle
3. Detection range



MOBOTIX MOVE Camera SX-Firmware Video Analytics Accuracy

Rule name		Abandoned Object	Object Removal	Wrong Direction	Camera Sabotage	Intrusion	Object Counting	Stopped Vehicle	Loitering
Installation	**Definition**								
Suggested target size (pixel)	The suggested object size to trigger video analytics function	50 x 50 ~ 500 x 500 (@ 1080p)	500 x 500 ~ 1440 x 810 (@ 1080p)	500 x 500 ~ 1440 x 810 (@ 1080p)	Not relevant	50 x 50 ~ 500 x 500 (@ 1080p)	50 x 50 ~ 500 x 500 (@ 1080p)	50 x 50 ~ 500 x 500 (@ 1080p)	50 x 50 ~ 500 x 500 (@ 1080p)
Effective FoV	Camera FoV due to lens distortion / blurring	100%							
Camera mounting height	The height that the camera is installed	1. No limitation for installation height 2. Normal installation height is 3~5 m.							
Detection range	The detectable distance range between camera and target object	Need to make sure the object size is within our acceptable target size range. Real detection range depends on sensor dimension, object size, lens focal length.							
Object speed	The object speed range that the camera could detect	Not relevant	Not relevant	270 pixel/ sec ~1080 pixel/ sec	Not relevant	TBD	TBD	Not relevant	TBD
Suggested environment illumination (lux)	Suggested illumination to offer optimal performance	To have optimal performance, stable and adequate lighting is necessary. We recommend minimum 300 lux as suitable lighting level.							
Performance									
Recall rate (good light condition)	True positive/ (True positive + False negative)	95%	95%	80%	90%	90%	85%	90%	90%
Precision rate (good light condition)	True positive/ (True positive + False positive)	90%	90%	90%	90%	90%	90%	90%	80%
Accuracy (good light condition)	(True positive + True negative) / (True positive + True negative + False positive + False negative)	90%	90%	80%	90%	85%	85%	90%	80%

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BeyondHumanVision

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