Applied Intelligence

VCA: Motion Object Tracker Technical Note

v04.22

Motion Object Tracker

Technical Note

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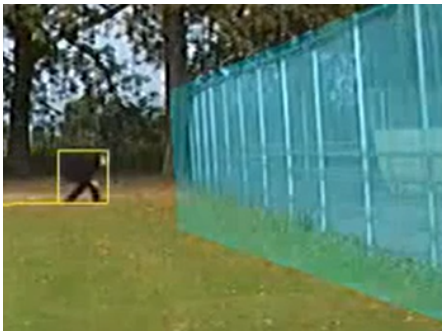
Introduction

This technical note details the best practices for using the motion object tracker along with some answers to common questions about when to use it and some considerations.

Applications

The motion object tracker is designed to detect and track movement in a scene based on grouped pixel activity and in line with the defined settings. These objects pass through our zones and rules to be discarded or become events. Applications include.

- Security
  - Perimeter protection
  - Areas where access is restricted
  - Remote site security
  - Sterile zone
- Retail
  - Top down people counting
- Traffic
  - Top down vehicle counting



Limitations

The motion object tracker groups pixel objects together and is not designed for high activity areas, it is therefore not suited for the following.

- Areas of high activity
- Areas with multiple ground plane levels
- PTZ or other cameras that move.
- Areas with lots of environmental factors, such as water and large foliage movement.
- Tracking objects from a moving vehicle.

General Guidelines

The following guidelines should be used to provide optimal tracking and classification.

Camera Position and Angle

- Minimumal camera height of 2.8 meters from the ground plane.
- Cameras should be mounted on a stable surface to reduce the effects of vibration or other environmental factors.
- The camera view angle (tilt) should be within 30° from the horizontal.
- For high tracking accuracy, position the camera so objects are present for at least 2 seconds.

Obstructions

Camera scenes should be clear of foliage and other environmental factors that can reduce object detection and tracking.

- Avoid location that include foliage and large objects that can interfere with tracking.
- Be aware of surfaces that can reflect light (both white and infrared) to the camera lens

Light conditions

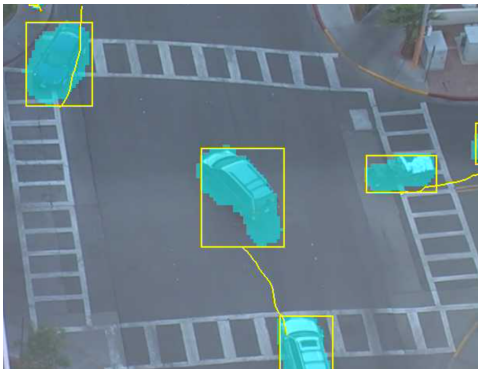
- Camera positions should avoid direct sunlight and other bright light sources direct to the lens.
- Avoid locating cameras that experience drastic light changes.
- Avoid locations where the camera lens exposed to indirect light sources

Example situations are: Direct sunlight, Headlights, reflective surfaces and white light illumatinators. These can result in poor object detection and tracking and reduce the effectiveness of video analytics.

- Minimum recommended Lux on target is 10. Some cameras provide a reading of the value, third-party tools are available to provide a lux reading.
- Bad weather environments will impact video analytics and can reduce accruacy.

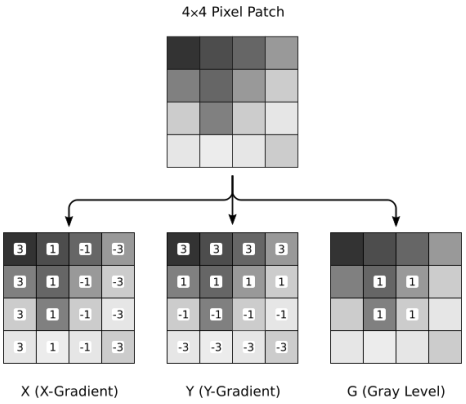
Frequently Asked Questions

How does the motion object tracker detect objects?

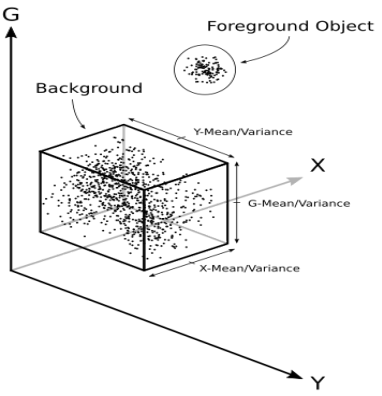


The motion object tracker uses a method of background segmentation, it performs an initial “learning scene” process where the current view is used to create a reference point for a typical scene from the camera. The motion object tracker detects the change of pixels from one frame to the next and, where pixels group together, creates a bounding box to identify an object being tracked, the tracker only identifies and tracks objects in a scene, it does not perform any classification or filtering. In order to classify objects, the calibration feature will need to be configured.

Background Segmentation is performed using an *Enhanced Mixture of Gaussians* (EMOG) background model. The background of the image is modelled using gaussian modelling of X and Y-gradients and luminance (G).



As frames are processed, the X, Y and G-values are statistically modelled using gaussian models. Each gaussian model keeps a running average of the mean and variance of the X, Y and G-values sampled from each patch i.e. 3× mean values, and 3× variance values. A sample is within the gaussian if the value is contained within the range specified by the mean and variance.



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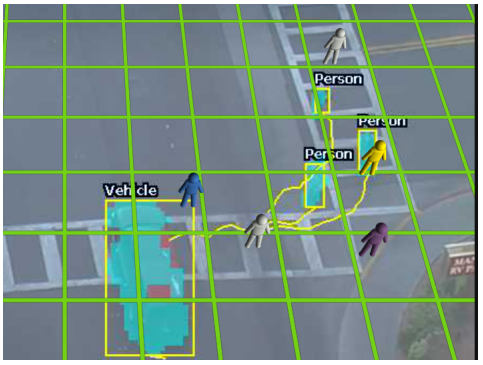
What is calibration and why do I need it?

Calibration is a process of informing the camera channel about the height, tilt and vertical field of view; these allow the classification algorithm to understand the scene perspective, estimate the object size, speed and group them into the defined classifiers.



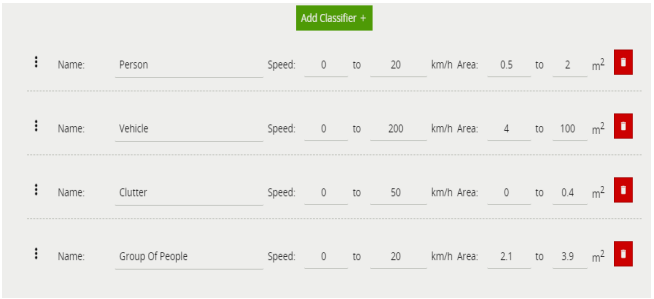
Calibration operates on a single ground plane and can be configured to account for angled ground planes. It will not work in scenes that incompaises stairs or other multi-angled ground planes. Where these environments exist, it is advised to use our other trackers or attempt a 'best efforts' calibration and focus on a particular area of the scene.

More details on how to use the calibration tool can be found in the VCAserver documentation, available through the support portal (https://vcatechnology.com/downloads/).

Classification is only required if you require object filtering, it does not affect the detection or tracking of objects in the scene.

How can I classify objects differently?

Objects are classified based on their estimated speed and size, provided by the calibration. An object is classified when its speed and size fit into the boundaries of a class. For example: if an object is estimated to be walking between 0-20 kmph and has an estimated area of 0.5m2 to 2.0m2 then the object would be defined as a Person. However, if that object was a person and was walking through the scene but the estimated speed and area match the classifier for a vehicle, then they will be classified as a vehicle. Objects are grouped into user defined classes.



How do I define the camera view?

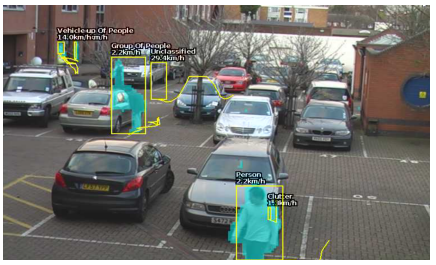
The viewing angle of the camera is essential in order to achieve a good result through video analytics. The best practice is to position the camera so objects move across the scene rather than vertically up and down the scene. This is because the tracker detects motion, the movement of pixels across the horizontal is more than the vertical in a scene.

Avoid having large objects in a scene, these can result in inaccurate object tracking and the object tracker can incorrectly bound all objects into a single bounding box object.

Because the motion object tracker detects objects through the motion in the scene, busy scenes where large objects can pass through causes movement from multiple objects to be grouped into a single bounding box and seen as a single object.

Camera positioning should avoid scenarios where objects can cross paths and merge together, for example. Cameras positioned to monitor traffic should be overhead, this minimizes object blocking.

The motion object tracker will function in the scene shown in the image but vehicle movement will cause a lot of false object detection and can result in high false events. Position cameras to provide a more overhead view or look at one of the other DL trackers as an alternative solution.



The motion object tracker is ideal for sterile environments, where only valid objects should cause events to be produced. The motion object tracker reduces the false events caused by foliage and other environmental factors and can create events for valid objects that are detected.

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Scenes that include high levels of activity are not suited for the object motion tracker, these include areas such as pedestrian zones and streets. Scenes where a high number of objects move through the scene will cause the motion tracker to group motion together into a single bounding box and be misclassified.

The height of the camera is also important. The lower the camera height, the larger objects will appear to the motion tracker and the more chance that objects will be bound together into a single unidentified object. It is also important to consider that the lower the camera height, the more chance of objects being obstructed by other objects in the scene.

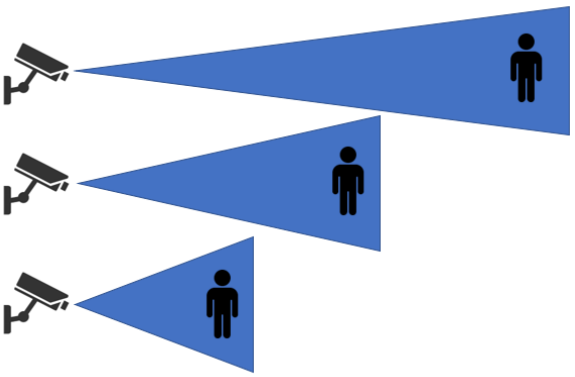
What distance will video analytics detect objects?

Detection range will vary based on a camera's field of view, which is defined by the camera lens and focal point. Instead, the object tracker has sensitivity settings that can be adjusted to make the tracker more or less sensitive to motion in the scene.

It is important to note that making the tracker more sensitive increases the detection of motion in the scene and can lead to an increase in false object tracking.

Video analytics is not performed on the original camera resolution but instead uses a resized version of the original frame, this reduces the computational power requirements.

The motion object tracker will detect more accurately around the centre of the scene and will have reduced detection and tracking around the edges



What image settings should I use on the camera?

The image quality is an essential component to achieving accurate detection and tracking. The optimal resolution is 640x480 or D1 (720x480). Defining a lower resolution will reduce detection and tracking accuracy while defining a larger resolution, such as 1920x1080 may provide a small increase in detection and tracking but will significantly increase the resource usage and reduce the system's channel capacity.

The optimal framerate is 15 fps, providing a lower framerate reduces the detection and tracking accuracy while increasing the framerate will only result in an increase in resource usage without providing an increase in detection and tracking.

The image quality and bitrate are important to ensure a good quality image is provided for video analytics. Where possible, the image quality and bitrate should be set to a high or max setting with bitrate defined near or at the maximum available limit. This ensures that a good image can be presented for the tracker to detect and track accurately..

Setup

The motion tracker is active on the channel as soon as it is activated, it requires a few seconds to 'learn the scene', during this time it will not track any objects in the scene. If the scene changes suddenly then the learning scene function will initiate and repeat the process.

General

- Check that the prerequisites are installed and working correctly..

Note: More information on the exact requirements can be found in our support portal, in the manual and through the hardware requirements document. (https://vcatechnology.com/downloads/)

- Object tracking is controlled through licensing. Ensure the correct license has been activated on the system.
- Licenses are assigned to channels. Ensure the correct license is assigned to the channel.
- Ensure you have selected the correct tracker for your application.
- Camera shaking will affect object tracking and can cause the relearning of the scene to occur. When an image shakes, the resulting movement can cause false objects to appear and be tracked across the scene, this may cause false events to be reduced.
- When changing sensitivity settings, focus on detecting the event you need for the alert. Once the sensitivity is correct, check for any false events. Zones and rules are available to reduce false events.