Video Analytic Perimeter Protection

Optimal Camera Placement for Object Detection Accuracy

Video Analytics works on the principle of image processing to detect objects and provide situational alerts on rule violations. For effective video analytics and object detection accuracy, the object should be of right resolution. This write-up explains the relationship between the distance of object from camera and the resolution for effective video analytics and their implication on server requirement.

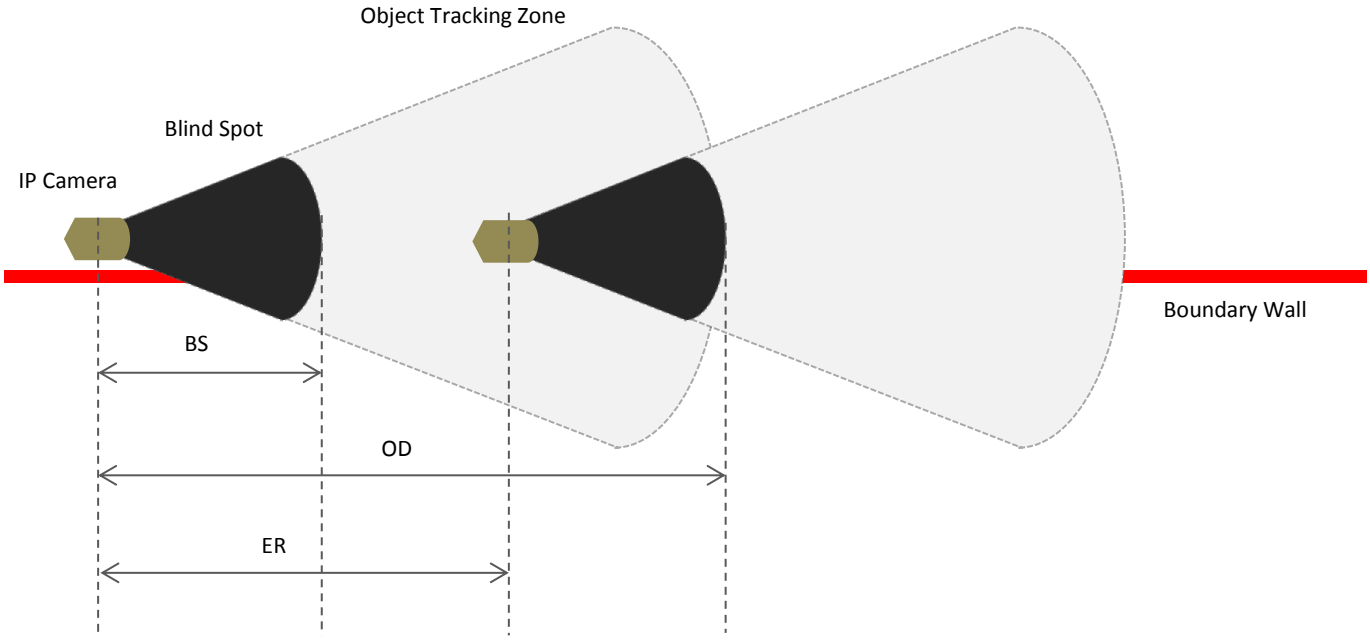
Video Analytics takes video feed from network surveillance cameras and analyses the video screens. It detects and tracks objects like people or vehicle for providing situational alerts on violation of pre-set rules defined by the user. Since image processing is the underlying principle, the performance and accuracy of video intelligence depends on the correct capture and camera / image quality (lighting, resolution, focal length etc.) of the monitoring zone by the IP cameras. The range of detection i.e. the maximum distance of the objects being effectively tracked from the cameras should be such that the object consists of minimum recommended pixels. Therefore, while installing cameras for perimeter protection, the optimum distance should be maintained between consecutive cameras along the perimeter.

Another angle to the use of video analytics is the server requirement. Channel density (the number of channels on which video analytics can run with one server) reduces with increased resolution which increases the server cost. However a lower resolution results in a lower range of effective object detection which means cameras need to be placed more frequently along the boundary wall. Below is a comparative analysis of different resolution of cameras and the effective range for video analytics along with the implication on server requirement.

For better detection of an object (say, person) the height should be approx. 100 pixels and width should be 5 pixels resulting in an object size of minimum 500 pixels. This not only takes care of the detection of object but also tracks the movement of the same. If the size is smaller the accuracy will affect as it is difficult to separate out noise. Based on this, if we calculate the range for cameras we get below set of geometries.

Parameters	Scenario 1	Scenario 2
Standard Installation Parameters	Cameras installed along perimeter, at a height of 15 feet and with a tilt of 5 degrees. Required object height for 6 ft. tall human detection = 100 pixels	
Camera Focal Length (mm)	23	29
Camera Resolution (pixels)	1920x1080	640x480
Object distance from camera (meters)	127	71
Blind Spot distance (meters)	27	31
Effective Range for Video Analytics (meters)	100	40
Server Requirement	1 channel / core @3GHz	3 channels / core
Channels supported in a Server E5 2690, 2 CPU (each CPU with 10 core)	20 (=2x10x1)	60 (=2x10x3)

From the above calculations, it is recommended for a fixed camera with 1080p resolution, approx. 127 meters is optimal distance with detection accuracy greater than 90%. If the distance increases the detection accuracy reduces. Also the blind spot distance need to be considered. So the distance between the camera poles would be less than detection distance due to blind spot. The blind spot distance need to be subtracted from the detection distance for camera poles placement.



BS = Blind Spot Length, OD = Object Distance for Tracking, Effective Range, ER = OD – BS, for uniform BS.

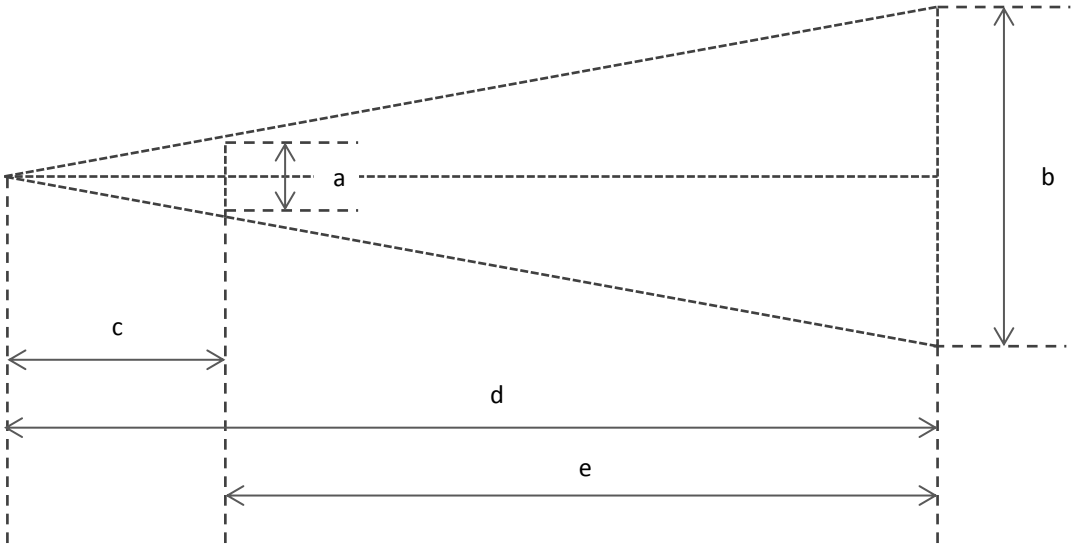
In this case, since the blind spot is approx. 27 meters, the effective range which can be monitored by video analytics is 100 meters (=127-27). So there should be a camera after every 100 meters along the boundary wall. Further it is possible to detect objects up to a greater distance but with less accuracy and for that the camera poles can be further apart with a trade off on accuracy. In this case, it is assumed that analytics is run at 1080p resolution. This means the server load will be high for analytics and fewer number of channels can be run per server.

In case you need to run analytics for more number of channels per server, the resolution has to be lesser (say, 640x480). In that scenario, the effective range reduces to only approx. 40 meters as per the calculation in the given table above. Therefore the cameras have to be placed more frequently – after every 40 meters.

> Note: When analytics is run at 640x480, the camera resolution should be maintained at 1080p for monitoring purpose. This is recommended for the use of surveillance for finding evidence in post event analysis. This helps to find the object by digitally zooming once the alarm is obtained. The alarm co-ordinates will be sent at monitoring resolution which in this case is 1080p.

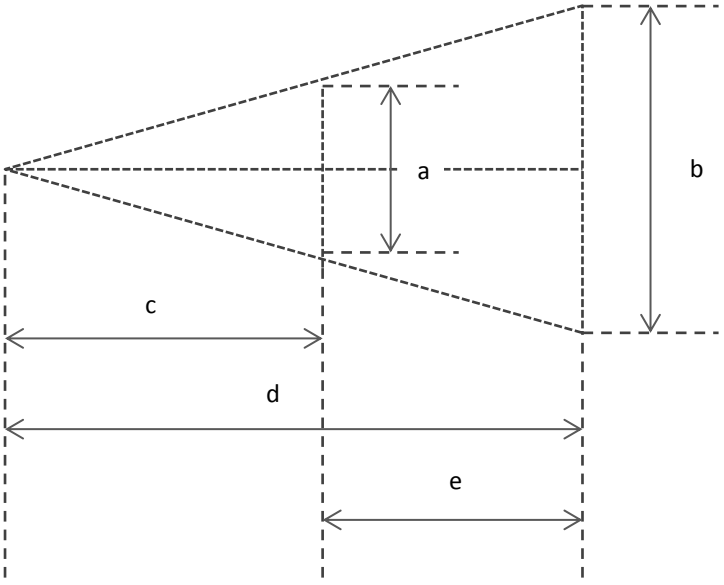
Therefore, in a nutshell, if the detection range has to be increased, there would be requirement of higher resolution which can be processed for analytics with more number of servers.

Geometry of Scenario 1



a = 5.5 m, b = 26.2 m, c = 27.4 m, d = 127.4 m, e = 100 m

Geometry of Scenario 2



a = 4.9 m, b = 11.6 m, c = 30.5 m, d = 70.7 m, e = 40.2 m

About AllGoVision

AllGoVision is a unit of AllGo Embedded Systems, founded in 2005 and headquartered in Bangalore with branches in the US and Dubai, AllGoVision is a leading video analytic software and has a global spread of sales partners, with proven installations worldwide. We have dedicated ourselves into in-depth research and product innovation and house more than 120 top-notch engineers. AllGoVision video analytics software is equipped with 30 plus basic and advanced Video Analytics features. It is an Open Platform Analytics integrated with many VMS manufacturers. AllGoVision focuses on providing following benefits to its customers – robust performance, cost efficiency, ease of use and customization.