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The Intelligent Way

Coping with Light variations and other False Alarms in CCTV based Intelligent Surveillance Systems

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Executive Summary

CCTV based systems suffer from false alarms caused by light variations, waving trees and waves on water among other things.

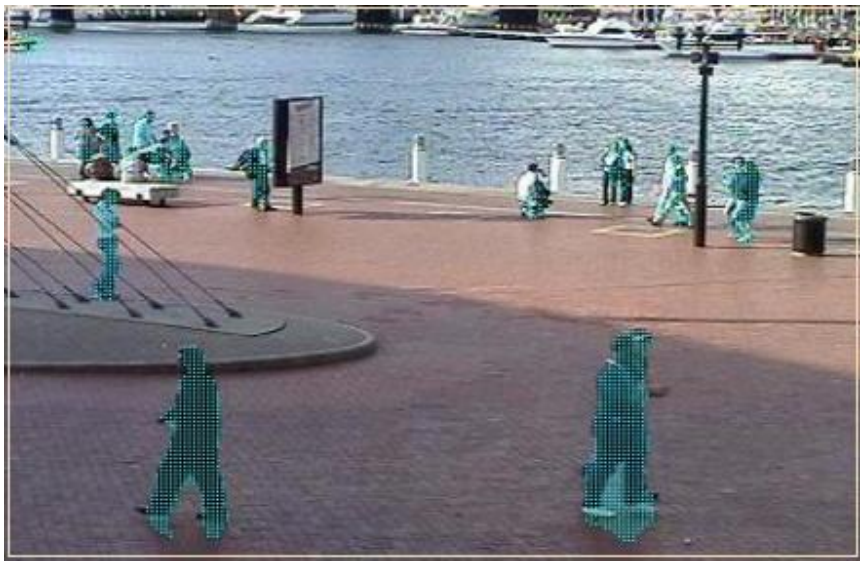
This paper discusses why most existing systems suffer from these limitations and explains how the iOmniscient IQ Series handles these difficult situations to provide consistent accurate detection without being plagued by false alarms like traditional Video Motion Detection systems.

Limitations of most CCTV Systems

Virtually all CCTV systems (iOmniscient's IQ series being one of the only exceptions) use VMD (Video Motion Detection) to do their detection analysis. This essentially involves getting one image and comparing it against the previous image. If there is a difference then there was motion in the scene. Many variations have emerged on this theme including the use of statistical analysis (so one looks for an average change over several frames instead of a comparison between only two frames. Sometimes the comparison is done pixel by pixel but it is still a relatively simple comparison none the less.

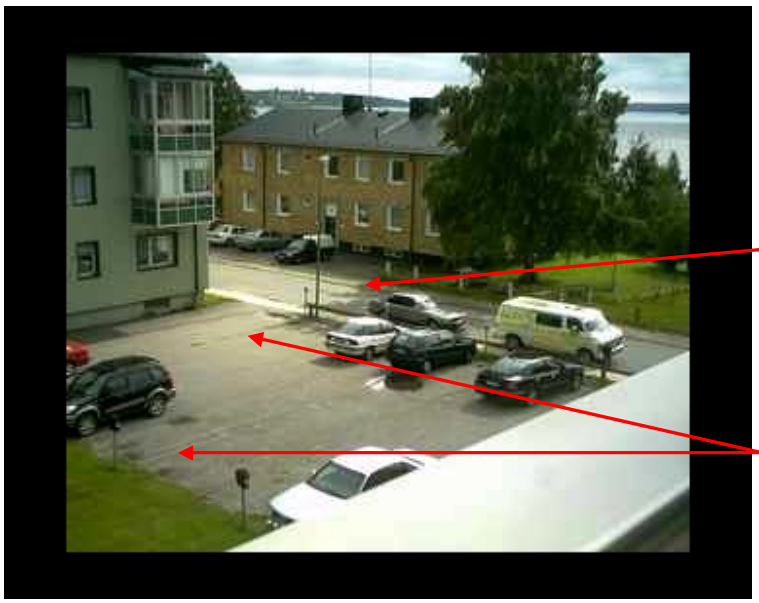
The motion in a VMD system is defined in the form of a **blob**. The challenge is to determine what the **blob** is. It is difficult to understand whether a blob is a shadow following another object or a reflection off a metallic surface. Understanding that some motion is caused by a waving tree or waves on a body of water is very difficult for a system that operates without context.

An example of the "blob"



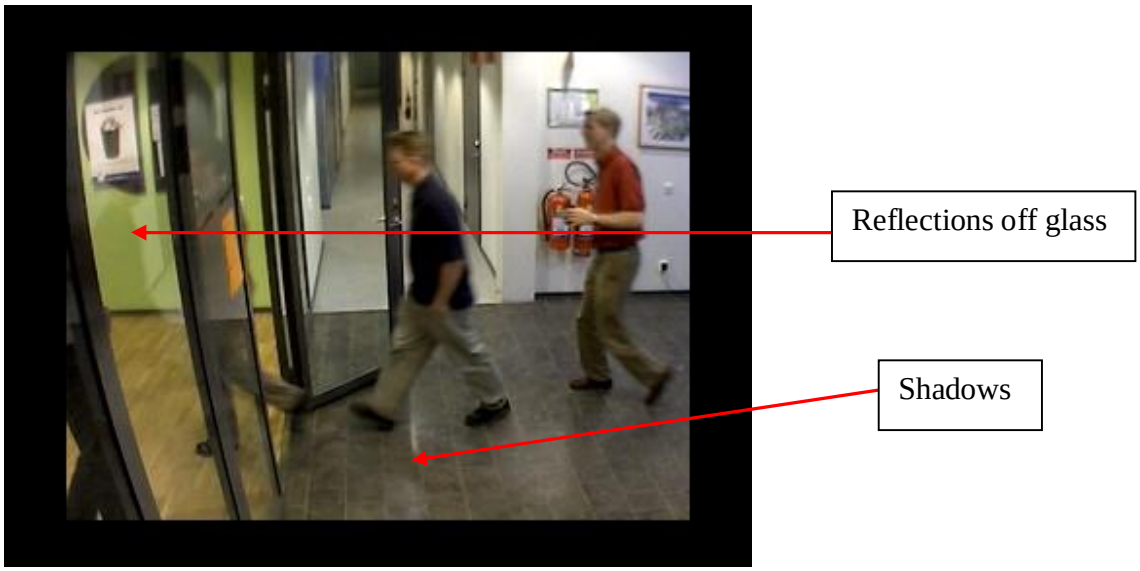
The primary causes of False Alarms are:

- **Global Light Changes (such as when a cloud passes across the sky)**

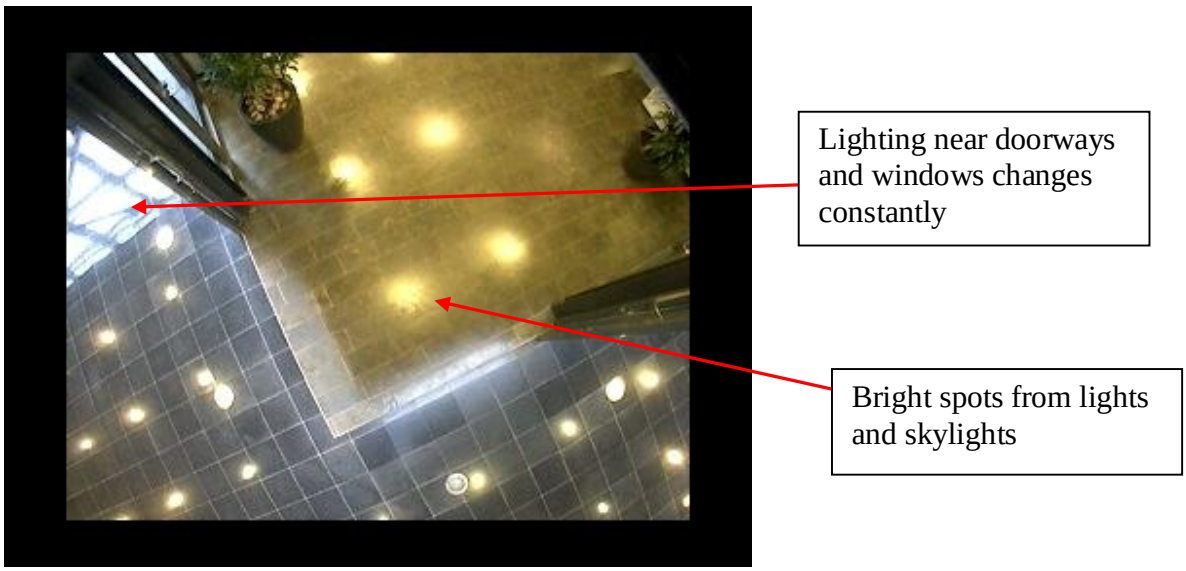


- **Local light variations (such as when light shining off a vehicle is reflected onto the ground in a different part of the scene).**

- **Shadows of all sorts**

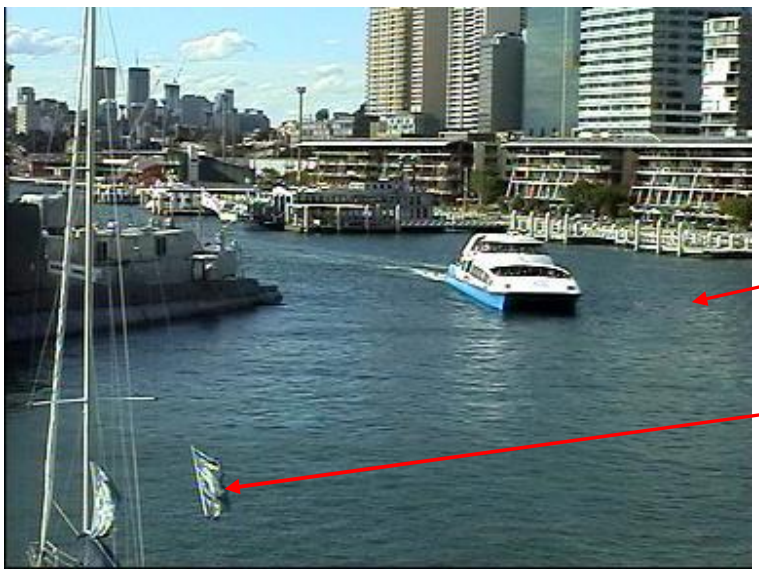


- **Light creeping across the scene (such as light from a skylight that moves slowly across the scene)**



- **Waving trees**

- **Waves rippling on a surface of water such as a lake.**



Approaches taken by Traditional VMD systems:

Some of the smarter VMD systems attempt to classify the motion so a repetitive motion may be viewed as one coming from a flag or from a tree waving in the breeze.

Other systems may desensitize the system so that only motion of a certain significance is detected. In such systems the ability to ignore things like light variations is inversely proportional to the ability to do accurate detections.

Many systems will merely mask out problem areas and consequently lose the ability to detect within those areas.

A more complex but manually intensive method is to get the system to learn certain specific aspects of the scene and define them as false alarms. Hence whenever the system sees that type of pixel change it will know it is a false alarm. However this requires a person to sit with the system and educate it over a long period of time – often several days. If there is a major scene change (such as due to changing seasons or new light fixtures) then this extended learning experience will need to be repeated.

Camera Incompetence and Sabotage Warnings:

Traditional CCTV based VMD systems can suffer from numerous false alarms due to camera sabotage or incompetence. Sabotage can result if someone paints over a camera or covers it with a cloth. It may also be a simple action such as someone moving the camera so that it can no longer observe the scene that it was meant to observe.

Camera incompetence can result from the camera not being able to see clearly due to things like fog or rain. Other causes of incompetence include the camera's focus being changed or the scene being overcrowded so that the algorithms cannot work effectively.

Both camera sabotage and camera incompetence can become major issues in the operation of a system. The more intelligent systems have mechanisms for dealing with these.

Remembering the Basics

Before one even considers adding Intelligence to a system it is important to understand the importance of selecting the right types of cameras and ensuring their appropriate placement.

If the objective is to see in low light or no light at all then it is important to use cameras that can operate with low light or use alternative parts of the spectrum such as Infrared or thermal.

In terms of placement, having a camera facing a doorway such that sunlight can shine directly onto the camera, for instance, is something any amateur photographer will know to avoid. The first rule of camera placement is to ensure the camera is placed such that a human watching the scene can detect whatever action, behavior or object that needs to be detected. If a human cannot see what needs to be seen it is unlikely that a system will have the ability to do the detection. (A system like the iOmniscient IQ 180 constitutes an exception to this rule as it can detect objects that may be invisible to the human eye but in general this is an important principle).

Intelligence to the Rescue

iOmniscient's IQ Series uses Artificial Intelligence techniques (several of which are patented) to understand what is happening in the scene.

For instance if one wanted to recognize a dog one can use the traditional approach of comparing the image one sees with a database of "dog images" – dogs of various types taken from various angles. If there is a match one knows that it is a dog. The alternative is to do what a human would do – recognize that the object has a wagging tale, a tongue hanging out and it barks and know from that that it is a dog.

The same principle can be used to understand if "the blob" is a person or a waving tree or in fact some light falling on the wall.

Using these principles the iOmniscient IQ Series can in most instances understand the presence of light, trees swaying in the breeze, waves of water and so on and differentiate between them and real objects such as people or vehicles.

Nuisance alarms can also be caused by factors outside of the image itself. For instance, if the camera is on a pole it could sway in the breeze and the resulting image could be significantly blurred. All the products in the IQ Series have the ability to compensate for camera shake of this type.

Today the IQ series can operate with virtually zero nuisance alarms caused by extraneous factors such as those described above.

These techniques also allow the system to understand if the camera has been sabotaged or is rendered incompetent due to factors such as poor weather.

However even intelligent systems have limitations. Just as humans can see mirages and optical illusions, so can CCTV systems. However they are as effective as humans in making assessments on the nature of objects. Furthermore they do have the advantage of never losing concentration and being able to analyze thousands of CCTV cameras at the same time.

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Please contact info@iomniscient.com if you are interested in obtaining more information about iOmniscient's ability to operate in complex environments involving light variations and other sources of nuisance alarms. Video clips showing how its Nuisance Alarm Minimization System (NAMS) operates are available.

Other whitepapers on how iOmniscient's technology operates even in crowded scenes using its patented non-motion detection (NMD) technology and on the System Architecture are also available.