WHITE PAPER

# Intelligent Video Technology

## Panasonic Video surveillance systems

Panasonic

## Table of contents

# 1. Introduction

Intelligent Video (IV) is also referred to as Video Content Analysis (VCA) and Video Analytics (VA). IV automatically analyzes the video stream and extracts useful information from images such as detected intruders. The typical applications are video motion detection, video pattern matching and auto tracking.

Today, security departments deploy more and more surveillance cameras to watch broader areas closely 24 hours a day and 7 days a week. IP technology enables building open, reliable and scalable surveillance systems. While video data is increasing, one person can only watch a limited amount of video data. People quickly lose their ability to concentrate and suspicious movements on the screen are frequently overlooked. Intelligent Video works 24 hours a day without stopping, improving surveillance accuracy and effectiveness.

Another way to use Intelligent Video is to change the video data to a gold mine for business. Customer behavior is recorded on the video and contains valuable information for improving marketing effectiveness, store operations, building layout designs, traffic patterns and more. Reviewing hours of video from dozen of cameras was hard, labor-intensive and time-consuming work. Now, Intelligent Video quickly analyzes a large amount of video data.

Intelligent Video is clearly useful for surveillance and business but was expensive and complicated due to requiring high-performance servers and dedicated software. Panasonic now provides the cost-effective and easy-to-deploy Intelligent Video solution based on its field-proven image processing technology and network cameras equipped with high-performance processors. This paper provides an overview of Panasonic's Intelligent Video Technology.

# 2. How Intelligent Video works

Video Motion Detection (VMD) is the basic and prevalent technology in the security industry. VMD compares series of images in the video stream, identifying the static background and moving foreground objects. VMD catches all motion, which is the difference between images, but this simultaneously presents a weakness. VMD detects wind-whipped flags and reflected light as moving objects, which creates costly false alerts because operators must confirm if they are truly threats. Panasonic Intelligent Video technology has made great progress in extracting information such as position, size, moving direction and staying time from the detected objects and analyzing their behavior. Panasonic Intelligent Video Motion Detection (i-VMD) can now distinguish loitering from normal activities.

Another technology is image recognition. While Video Motion Detection focuses on motion and does not care what the object is, image recognition identifies the target by using its shape char-

acteristics. A Facial recognition system, which is one image recognition application, focuses on characteristics of the human face such as the eyes, nose and mouth. Intelligent Video searches for face-shaped parts on a captured image and identifies the person by estimating similarity between the captured face and pictures in data-bases.

# 3. System configuration

There are three system configurations: camera-based systems that Intelligent Video runs on a camera, server-based systems which process on a centralized processing server, and hybrid systems combining camera-based and server-based systems.

## 3.1 Camera-based systems

Network cameras analyze images and send alarms to operators based on pre-configured alert rules. Camera-based systems do not require high-performance central servers, making the systems more scalable, reliable and cost-effective. Panasonic Intelligent Video Motion Detection (i-VMD), auto tracking and face detection use camera-based system configurations.

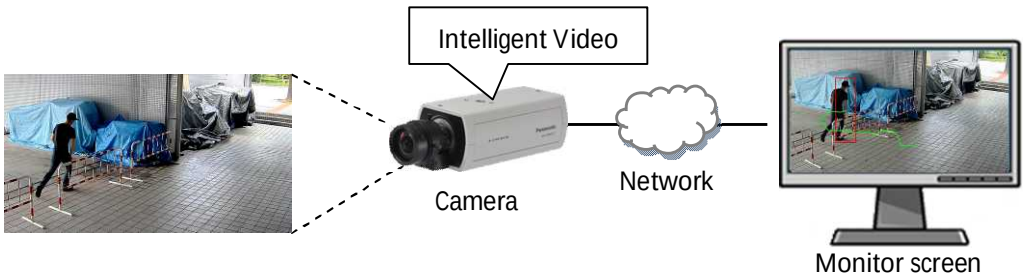


*Figure 1: Camera-based system: Intelligent Video feature runs on the camera.*

## 3.2 Server-based systems

Server-based systems enable more complex analysis. All images captured by cameras are sent to a central server that analyzes them with stronger processing power, more memory, higher-speed data base access and more sophisticated software.

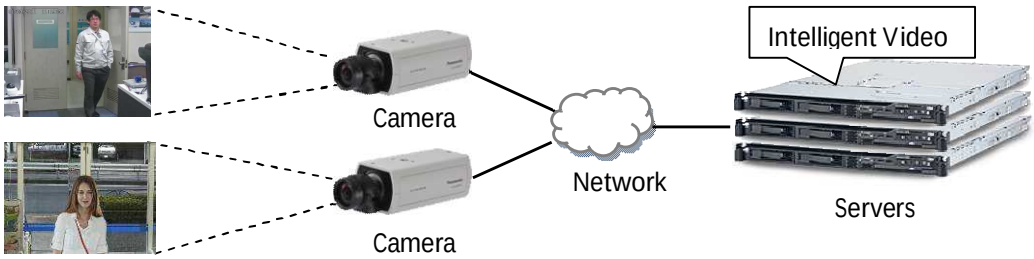


*Figure 2: Server-based system: Intelligent Video application runs on the central servers.*

A large number of industry-leading video management system companies belong to the Panasonic System Developer Network (PSDN) partner program. These seasoned partners provide excellent Intelligent Video applications based on this server-based systems.

## 3.3 Hybrid systems

Hybrid systems combine camera-based systems with server-based systems, substantially reducing server and network overloads. A hybrid system enables a smaller system to run Intelligent Video applications. When a system detects a person from among the people who go by the cameras, the system compares every captured image with photos in a data-base. What the server really needs is the facial part of the captured image. Everything else wastes server and network resources; a hybrid system optimizes this. Cameras clip the facial part and the server only compares; the Panasonic face recognition system use this hybrid system configuration.

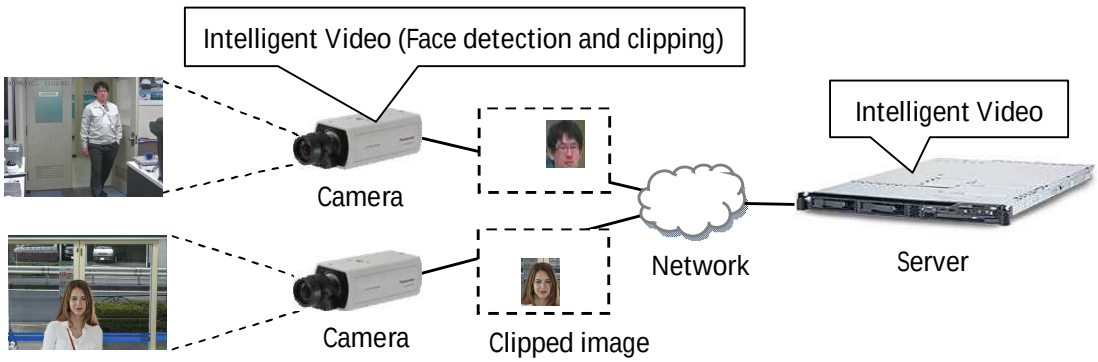


*Figure 3: Hybrid system: Intelligent Video features run on both cameras and server.*

## 4. Panasonic's Camera-based Intelligent Video

Panasonic developed UniPhier, a high-performance chipset, in which Panasonic integrates its audio and video processing technology. UniPhier packs a high-performance AV processor (DSP) and a high-speed CPU onto a single chip and provides high-quality audio and video, low power consumption, real-time processing and secure features. Panasonic network cameras are equipped with the UniPhier platform.

## 4.1 Intelligent Video Motion Detection (i-VMD)

Panasonic i-VMD has six Intelligent Video features: Intruder Detection, Loitering Detection, Direction Detection, Scene Change Detection, Object Detection and Cross Line Detection. The i-VMD extracts information such as position, size, moving direction and staying time from the

moving object detected and analyzes its behavior. As an example, the i-VMD determines if the moving object is loitering or walking normally and sends an alarm to the operators. High-performance UniPhier allows network cameras to simultaneously detect and track up to eight moving objects.

Configuration is also smart. Accurate definition with polygonal detection and the non-detection areas, perspective target size and the schedule for operating and non-operating times enables easily setting them through intuitive GUI.

## 4.2 Intruder Detection (i-VMD)

Intruder Detection detects people or cars trespassing in restricted areas. When a network camera detects moving objects in its view, it starts tracking each one of them. Once they step into a pre-defined detection area, the camera sends an alarm to the operators and highlights them with frames on the screen. This helps operators quickly identify what camera is tracking.

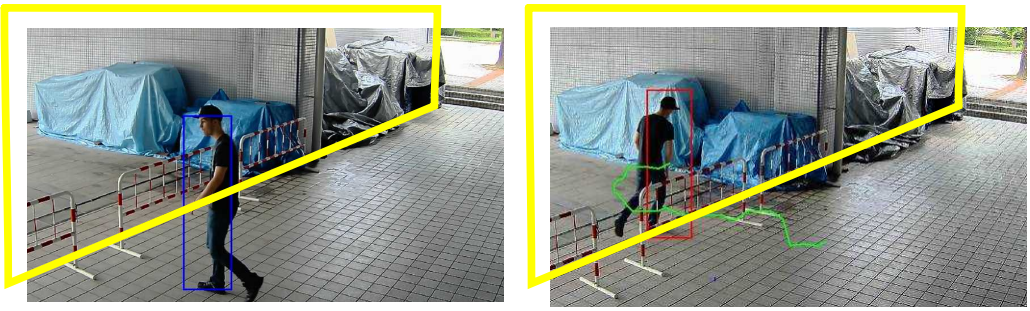

*Figure 4 and 5: Intruder Detection. To the left, the camera was tracking a person in its view. To the right, the person trespassed in the pre- defined detection area and an alarm was issued. Detection areas are shown in yellow for explanation.*

## 4.3 Loitering Detection (i-VMD)

Loitering Detection detects people who are loitering in front of a camera. When a network camera detects human-sized moving objects in its view, the camera starts tracking each one of them. When they loiter there for a specified period of time, the camera sends an alarm to the operators and highlights them with frames. This helps the operators quickly identify whom the camera is tracking.

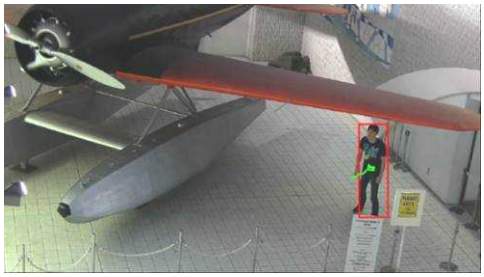

*Figure 6: Loitering Detection. A person stays too long around the exhibit in the museum.*

## 4.4 Direction Detection (i-VMD)

Direction Detection detects people, cars or moving objects that go the wrong direction such as the wrong way on a one-way street. When a network camera detects moving objects in its view, the camera starts tracking the movement and estimates the direction objects are going. When an object is moving in an unauthorized direction, the camera sends an alarm to the operators and highlights the object with frame.

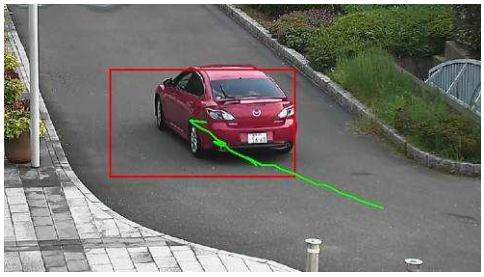

*Figure 7: Direction Detection. A car runs wrong direction on the one-way street.*

## 4.5 Scene Change Detection (i-VMD)

Scene Change Detection detects tampering with the camera view. When a network camera detects interference or tampering such as spraying on a camera dome, changing a camera direction or covering a camera with a cloth, the camera sends an alarm to the operators. People pay little attention to motionless pictures. If a picture is missed, a long time will be necessary before an operator becomes aware of it. The i-VMD finds tampering immediately.

*Figure 8: Scene Change Detection. A person sprays on the camera.*

## 4.6 Object Detection (i-VMD)

Object detection detects objects disappearing that should be present or something left behind that shouldn't be there. A network camera constantly keeps watching on pre-defined areas, comparing current footage with the past footage. When a left or removed object is detected, the camera sends an alarm to the operators and highlights the object or place with frame. This helps the operators easily identify what is left or removed.

*Figure 9 and 10: Object detection. The image to the left, a person left a suspicious backpack in the corner. The image to the right, a person took a picture away.*

## 4.7 Cross Line Detection (i-VMD)

Cross Line Detection detects people or objects trespassing in restricted areas. When a network camera detects moving objects in its view, the camera starts tracking each one of them. Once the object crosses an imaginary line in pre-defined direction, incoming, outgoing or either direction, the camera sends an alarm to the operators and highlights them with frame. This helps the operator easily identify what crossed the line.

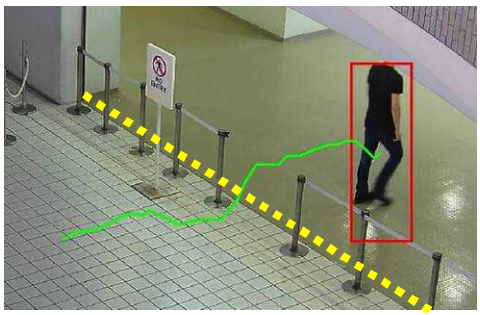

*Figure 11: Cross Line Detection. Pre-defined detection line is shown in yellow for explanation.*

## 4.8 Advanced Auto Tracking

Advanced Auto Tracking is an Intelligent Video feature combined with conventional video motion detection and PTZ control, running on Panasonic indoor and outdoor PTZ network cameras. When a network camera finds a moving object in its view, the camera automatically starts panning, tilting and zooming, and keeps the moving object displayed in the center of the monitor screen. The network camera tracks the moving object until the target passes from its view. When the target leaves its view, another camera uses Panasonic inter-camera notification protocol to resume the tracking.

*Figure 12: Advanced Auto Tracking and Scene Change Detection ( i-VMD). In this example, when a camera was tampered, another PTZ camera started tracking by Panasonic inter-camera notification protocol from the tampered camera.*

## 5. Face Recognition system

Based on the hybrid system architecture described in chapter 3, the Panasonic WV-ASF900 Facial Recognition Analytics Platform provides a high-performance, flexible and scalable Intelligent Video system. The WV-ASF900 system finds a target person from live and recorded videos. It receives clipped face images from a number of network cameras, extracts face characteris-

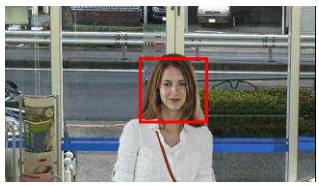

*Figure 13: Network cameras detect and clip a face.*

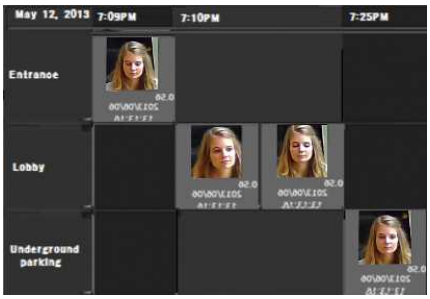


*Figure 14: Detected target persons by WV-ASF Face search. .*

tics, compares them with the target facial photos in the data-base and scores the similarity of them. When the system finds a person similar to the target, it sends an alarm to the operators. The WV-ASF900's face search enables operators to quickly identify where people have passed by and what they did. The operators can trace the people with a glance at the history table that shows when and where they were captured by cameras. History works with the Panasonic Network Video Recorders (NVRs) and provides easy playback.

The system is also useful to measure and improve marketing. The WV-ASF900 Face Recognition system estimates the age and gender of visitors from the captured face images. Combining this with sales data on Point-of-Sales (POS) selling systems enables better understanding the correlative relationships between customer behavior and marketing.

Additionally, Panasonic Network Video Recorders (NVRs) such as the WV-NV300 are simple and convenient solutions for small to medium installations. As well as video surveillance features, the IP-based NVRs provide optional easy-to-use Intelligent Video such as face matching , the people counting and the age and gender statistical reports.

## 6. Considerations for deploying i-VMD

Server-less, camera-based i-VMD enables introducing Intelligent Video systems easily at an affordable cost. Installing the cameras so that you obtain higher detection performance is important. This section describes the steps to properly deploy and run Panasonic i-VMD.

(1) Clear requirements

Purposes, targets, zones, operating times and environmental restrictions should be clarified at the planning stage. Based on these requirements, design the system with proper cameras and options.

(2) On-site survey

The detection performance is affected by factors such as the captured target size, shooting angle, light, weather and background. Typical camera settings may not be ideal for your requirements. Panasonic recommends implementing an on-site survey to confirm if the cameras detect targets as planned. If necessary, the design and/or settings should be revised.

(3) Installation

Good detection performance needs clear input. Cameras should be securely installed. Poor

mounting and other installation issues negatively affect image quality through vibration and/or swinging from poles, walls or the ground.

(4) Maintenance
Improper maintenance can lead to increase failure detections. Environment changing with the seasons may affect detection performance. Proper maintenance keeps i-VMD efficient.

## 7. Conclusion

With IP and high-definition video technology progress, Intelligent Video will make your video surveillance system smarter and smarter. As described in this paper, this progress will increase the quality and efficiency of your video surveillance. It will also add the competitive advantage to your business. Panasonic intelligent video technology offers easy-to-use and cost-effective solutions.

For more information about Panasonic video surveillance cameras and solutions, please visit us at http://security.panasonic.com.

## About Panasonic System Networks Co., Ltd

Panasonic System Networks Co., Ltd. is a subsidiary of Panasonic Corporation. The company was newly launched in 2013 by merging three companies: Panasonic System Networks Co., Ltd. and Panasonic System Solutions Infrastructure Co., Ltd., which were engaged in product development and manufacturing, and Panasonic System Solutions Japan Co., Ltd., which marketed a variety of system solutions.

The new company offers everything from development and manufacturing to sales, implementation and maintenance. By leveraging the full capabilities of this comprehensive enterprise to resolve customer problems and provide countermeasures, the new company is able to reinforce customer competitiveness while developing and expanding customer potential.

Our system proposals are based on our vast accumulation of image processing and communication technologies, backed by manufacturing knowhow, a versatile product range and IP expertise.

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