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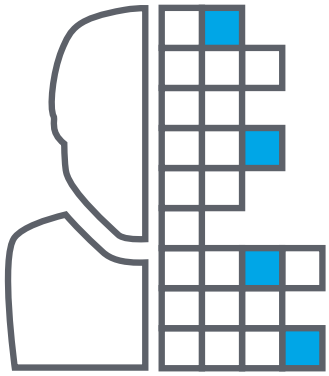


# THE MEGAPIXEL FALLACY IN VIDEO SECURITY SYSTEMS

## EXPERT TIP

by Orhan Yörükoğlu

MADE IN GERMANY

See more.

# DO MORE MEGAPIXELS MEAN A BETTER IMAGE?

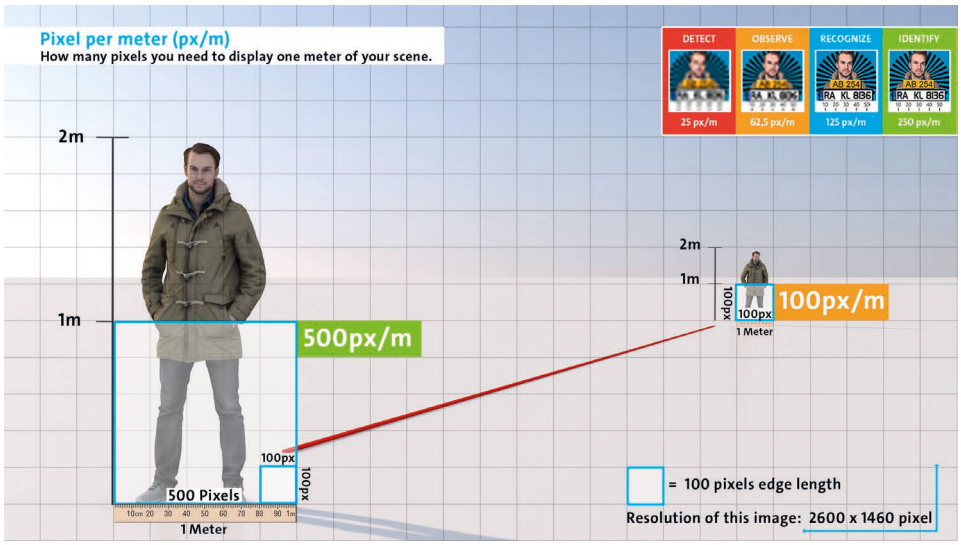
All cameras, including security cameras, are essentially photo cameras. The number of photos taken per second, called fps (frames per second), are viewed in sequence to create a video. Now a very widespread perception when it comes to image quality is that a video consisting of high-megapixel photos will be of “high quality”. However megapixel is actually only one of the factors. There are many other factors that directly determine quality such as the sensor of the camera, lens, structure of the lens, bit rate, ambient light and meteorological conditions.

# WHAT REALLY COUNTS: REPRESENTING REALITY

Based on the above information, if all factors other than megapixels are constant, what is the advantage of high megapixels?

High megapixels can partially prevent image degradation, known as “pixelation”, when you want to digitally zoom in on an image, but image degradation cannot be avoided when zooming in on objects that are more distant.

Therefore, when planning, the focus should not be on how many megapixels the product has, but on how much pixel density it can provide at certain distances. This density can be determined by the number of pixels per meter, expressed as ppm (pixel per meter) or px/m.




Not the amount of megapixels of the overall image will determine the proper image quality for the application in question. What counts is rather the minimum amount of pixels that is available to represent real objects in the OVERALL object space covered by the camera.

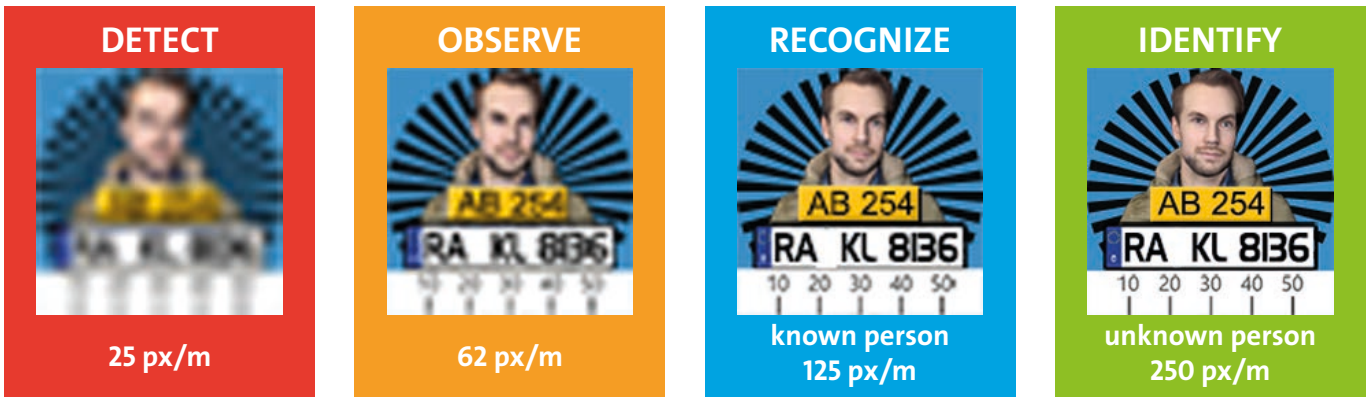
In simpler terms, the number of pixels that fit inside a 1-meter wide object determines the pixel density. As you move away from the camera, the number of pixels that fit inside the object decreases at the same rate because the image of the object shrinks as it moves away from the camera or the human eye.

# MINIMUM PIXEL DENSITY: DIN EN 62676

DIN EN 62676, which has become a global standard, provides recommendations and requirements for the selection, planning, installation, commissioning, maintenance and testing of Video Surveillance Systems (VSS) consisting of image capture and image processing devices for use in security applications.

Since 2015, DIN EN 62676 “Video Surveillance Systems for Security Applications and Code of Practice” has defined minimum requirements to help planners and users to define their requirements. It has also provided tools to objectively assess the performance of VSS.

In the image below, some examples have been made in line with this standard:

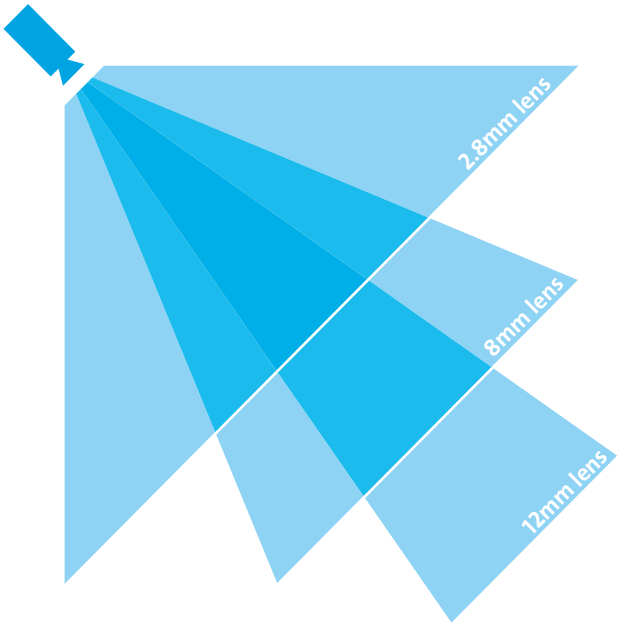



*To recognize known persons or offenders, 125 px/m are needed, to identify unknown persons, 250 px/m.*

Object classification of objects such as persons, bicycles or vehicles via video analysis typically requires at least 62,5 px/m. If the objects are smaller, higher pixel density is required.

# INCREASING THE PIXEL DENSITY WITH THE CAMERA LENS. IS THAT A SOLUTION?

Most of today's security cameras have so-called varifocal lenses, which is a lens whose focal length can be changed. With a varifocal lens, more distant objects can be magnified to increase pixel density at longer distances. Although some manufacturers offer this as a solution for long distances, it should be remembered that a lens focused at a long distance cannot take images at close range and creates blind spots.




*A lens in the 2.8 - 12 mm range can capture images at different angles and distances. If it is set to 12 mm, it will be able to provide sufficient pixel density at a distance, but as you can see from the image, the camera's field of view is significantly narrowed and blind spots are formed.*


*When the focal point of the lens is increased, although distant objects have a denser pixel ratio, the area that the camera can image is reduced and the camera can only take images after a certain distance.*

# PTZ CAMERA: ADVANTAGE OR DISADVANTAGE?

Another solution to avoid losing pixel density on distant objects is optical zoom. Cameras known as PTZ (pan-tilt-zoom) or speed dome can provide the user with sufficient pixel density in objects, regardless of whether they are near or far, through optical zoom.

However, despite to this significant advantage, the PTZ camera causes serious operational problems. To put it briefly, in order for a PTZ camera to provide sufficient pixel density in a remote incident, it must be directed to that area by an operator at the time of the incident. Working in some situations, this is sort of absurd in others, especially when there are multiple incidents at the same time. From a pure maintenance and "wear and tear" perspective, a PTZ camera operates with multiple, highly sensitive moving parts. Thus, a PTZ will always be more maintenance-intensive than a solution without moving parts.

For forensics, this has two major disadvantages: having to zoom in means that the operator has to be aware of the incident already – and that all the circumstances which led to the incident beforehand will literally be "in the dark" (or in low resolution at least). The second disadvantage is that all the areas that are not covered by the "zoom" will not be recorded at all or in very low resolution by some additional megapixel camera. Both will not suffice from a forensic perspective.

Another problem is that the PTZ camera can only record the image of the area it focuses on, so anything out of focus after this manual optical zoom is a blind spot and is not recorded. Not only is it critical to continuously record the entire scene in the camera's field of view without blind spots, but it is unsustainable for an operator to detect an incident and have to turn the PTZ camera to that area.

The only option for zooming into an area live and on record, independent of human effort, is to do it digitally. How this works with the required level of detail will be explored in the next chapter.

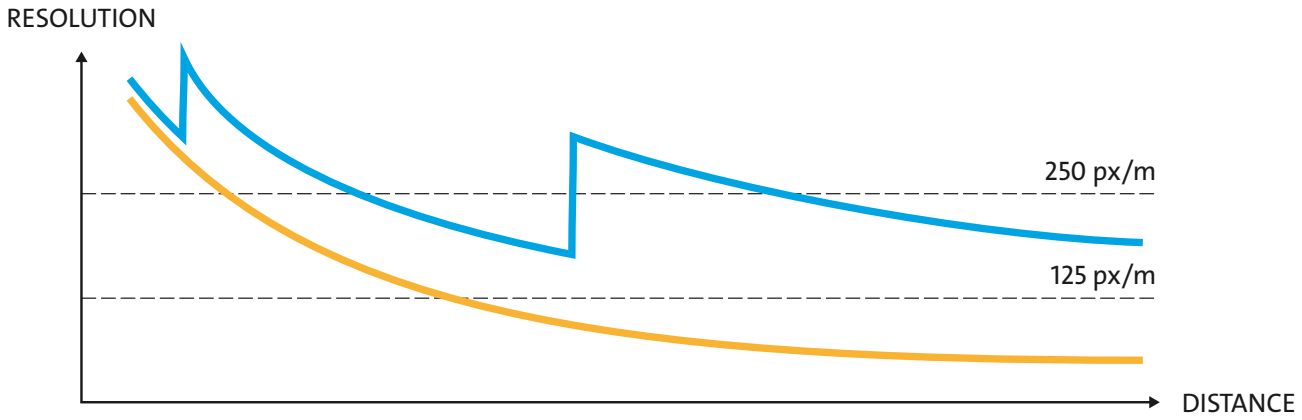
## PAN-TILT-ZOOM CAMERA


*While a PTZ camera can provide sufficient pixel density at long distances, anything outside its focus area is now a blind spot and not recorded.*

# SO WHAT IS THE RIGHT SOLUTION?

Image capture technology, like all other technologies, is increasing its capability every day and breakthroughs are being made to eliminate barriers in this field. As a 21st century solution, multifocal products help to eliminate many of the problems mentioned in this guide.

By combining lenses with different focal points, a multifocal camera is able to achieve the desired pixel density at any distance within the same image. In this way, digital zoom makes it possible to reach distant objects without "pixelation" and without sacrificing the camera's field of view and coverage.




*In megapixel cameras, indicated in **orange**, pixel density decreases steadily at the same rate as the distance increases, while in a multifocal camera, indicated in **blue**, the density that starts to decrease can be maintained at any distance as the other lens comes into play.*

## MULTIFOCAL-SENSOR CAMERA

Overview | Detail View

# THE BENEFITS OF A MULTIFOCAL-SENSOR CAMERA

A multifocal camera can provide the pixel density desired in project planning at any distance, as well as many other operational and infrastructural benefits.

**Intelligent use of image resolution**
Unlike a single-sensor camera, which offers the same megapixel resolution at every point in the photo, the planable pixel density of a multifocal camera eliminates unnecessary high resolution that is not needed at close distances, enabling high fps and network traffic optimization.

**Significantly fewer cameras**
Since the multifocal camera can provide the desired pixel density at both near and far distances, an area of hundreds of meters can be covered with a single mounting point. This significantly reduces the number of cameras to be used and has massive positive cost effects on the infrastructure and labor cost involved.

**Less complexity**
With the decreasing number of cameras, many infrastructural needs such as poles, cabling, field cabinets, network switches, excavation works, etc. are also decreasing at the same rate.

**High resolution digital zoom**
Because a multifocal camera can offer digital zoom without pixelation, this zoom capability can also be achieved through recording. This means that, unlike a PTZ camera with optical zoom, long distances can be examined not only live but also in the recorded image.

**Unlimited number of operators**
Again, thanks to digital applications, an unlimited number of users can use a multifocal camera without interfering with each other, while a PTZ camera can only be controlled by one person at a time.

**Highly dynamic**
While a single-sensor megapixel camera has to apply light enhancement technologies to the entire image, a multifocal camera can improve night performance by optimizing itself for different lighting conditions in each region.

**Reduced Total Cost of Ownership (TCO)**
Operation and maintenance costs, which are an important item in the cost of ownership, also provide significant savings with the reduced need for cameras and infrastructure.

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