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GSCI

Optical vs. Digital Magnification

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Introduction.

Is it worth paying more for a bigger lens and achieve higher optical magnification? Or having only digital zoom is enough to get the job done? These two parameters play an important role in Detection, Recognition and Identification capabilities of thermal imaging devices. Let's learn more and draw a thick borderline that will help us distinguish between optical and digital magnification.

So what's the difference?

Despite the seeming similarity between the terms *optical* and *digital magnification*, they are a whole lot different.

The history of optical zoom goes back centuries when people used polished concave pieces of glass, lenses, in first prototypes of micro– and telescopes. From the word "optical" one can guess that optical magnification, or zoom, uses a lens system in order to bring an object image closer. It guarantees "lossless" magnification. Every lens has a key characteristic related to optical zoom: its focal length. The bigger focal length of the lens, the greater the optical zoom.

Digital zoom is a relatively recent invention. It was first introduced in digital cameras to enhance their performance capabilities and can now be found in almost any thermal imaging device. Strictly speaking this is not "zoom" at all. It is just a *simulation* of optical zoom. Digital image is comprised of thousands of individual dots, pixels. When you switch from zoom X1 to, let's say, zoom X2 or zoom X4, what your device really does is it takes the central portion of the image and electronically enlarges it. Since the total number of pixels does not change, cropping and proportionally stretching the image makes the pixels bigger thus leading to poorer image quality.

If the detector (FPA) of your thermal imager has resolution of 384x288, then at digital zoom X4 the image you see will effectively have resolution of just 96x72 pixels. So it becomes clear why having and using digital zoom factors higher than X4 makes little or no sense.

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Special points of interest:

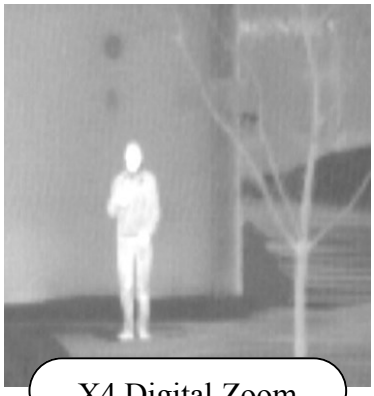
Combined Zoom.

For some devices manufacturers specify combined or total zoom. Combined zoom is calculated by multiplying maximum optical and maximum digital zoom.

Digital zoom: do big numbers mean better performance?

Some manufacturers implement really big digital zoom factors in their thermal imagers: X8, X16 or even more. It literally cost nothing for them to offer image scaling of any multiplicity. At the same time these large numbers make a false impression that you will be able to see more details and at longer range. But given the nature of digital magnification that we just discussed, what you will actually see with high digital zoom is just a few large pixels really. So if you wondered why your thermal image did not look that great at high digital zoom, now you know.

X4 Optical Zoom



X4 Digital Zoom

Optical Zoom

- (+) Crisp and ultimately sharp image at all times.
- (+) No image quality loss
- (−) Bigger lenses add size and weight, cost more

Digital Zoom

- (+) Requires no parts: preserves weight and dimensions. Implementing requires no cost.
- (−) High values cause significant and irreversible image quality degradation

Conclusion.

The best results in detection, recognition and identification can be achieved by choosing the optimal combination of optical and digital zoom. Most thermal imagers on the market have fixed focal length, and therefore optical zoom, but allow to vary digital magnification. So with a little aid of digital zoom you can achieve the best results in any environment.

Dare to Compare?

After reading this issue of "Dare to Compare" we hope you have got a deeper insight of digital and optical zoom and the key difference between the two terms. You have added one more piece of information to your "knowledge kit" and there is more to follow.

We always encourage everyone to compare quality and characteristics of GSCI night vision and thermal imaging systems to those from the next leading brands.

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Links to previous GSCI newsletters:

1. F-number Explained
2. Image Quality in Thermal Imaging: Resolution
3. Image Quality in Thermal Imaging: Sensitivity
4. Image Quality in Thermal Imaging: Refresh Rate
5. Deciphering Figure of Merit (FOM) in Night Vision
6. Thermal Image: Black-and-White or Colour?
7. Manual Gain Control in Night Vision Devices.
8. Thermal Imaging and Distances: Detection, Recognition and Identification.

References:

1. http://en.wikipedia.org/wiki/Digital_zoom
2. http://en.wikipedia.org/wiki/Zoom_lens
3. http://www.digitaltrends.com/photography/digital-cameras-digital-zoom-vs-optical-zoom/
4. http://www.diffen.com/difference/Digital_Zoom_vs_Optical_Zoom

GENERAL STARLIGHT COMPANY INC.

P.O. Box 32154
250 Harding Blvd. West
Richmond Hill, ON, L4C 9S3
CANADA

MADE IN CANADA

Phone: +1.905.850.0990
Web: www.nvoptics.com
E-mail: nvoptics@nvoptics.com

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