ASCENDENT
TECHNOLOGY GROUP

White Paper

Thermal: Detection, recognition, and identification

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It is important to know just how far your camera can see under ideal conditions. Even though real life applications can give much different results, knowing how your cameras respond in ideal conditions gives you best case scenario limitations that you can design your system around.

I spy with my little eye...

One of the questions that we hear customers asking the most often is, "How far can I see?" The answer to this question depends on your environment, camera, sensor, and object of interest. This white paper will explain the largest factors that need to be considered when selecting a camera.

Size of the Object

The first question that you must answer is, how big is the object you are trying to see? Is it a human? A vehicle? A plane? How much detail are you trying to see on the object? The answer to this question is important when determining just how much zoom or how large of a sensor you will need.

The amount of detail you are trying to see can be classified as:

- Detection: An object, which is of the same size you wish to see, is present.
- Recognition: You are able to see the class of the object (car, human, building).
- Identification: The object is able to be more specifically detailed (gas station, plow truck, firefighter, etc).

For each level you will require different amounts of pixels to be visible. The more pixels on your object, the higher the chance that you'll be able to accurately asses the situation.

The Johnson Criteria

The Johnson Criteria is the standard that is used for DRI (Detection, Recognition, and Identification). It is calculated based on how many pixels are necessary in order to make an accurate evaluation of your object. The values are as follows:

- Detection: 2 vertical pixels of the target are visible
- Recognition: 8 vertical pixels of the target are visible
- Identification: 14 vertical pixels of the target are visible

Please also note that the Johnstone Criteria as based on a 50% accuracy rate.

Field of View (FOV)

The FOV refers to the areas that is visible through an optical instrument (such as a CCTV camera). There are three different elements which affect the FOV, they are lens, sensor, and zoom position. If you have a wide FOV this means that your object will most likely appear relatively small. For FOV tools click here.

Image Resolution

The term image resolution refers to the amount of detail that a given image holds. A higher resolution will yield you a more detailed image. Many of today's resolutions are as follows (horizontal x vertical):

- D1: 720 x 480
- 720p: 1280 x 720
- 1.3MP: 1280 x 1024
- 1080p: 1920 x 1080

The next step is to determine the Pixels on Target (PoT), this is a result of the combination of image resolution, cameras FOV, and the size of the object. Once we have completed our calculation we can apply the Johnston Criteria (explained above) to know just how far a camera will see.

Putting it all together

The following is a demonstration to show how DRI works under ideal conditions.

Specifications:

- Target: 5.5 ft (V) x 2 ft (H) (a person)
- Camera FOV: 260 ft (H) and 150 ft (V) (measured at 4,600 ft from camera)
- Image Resolution: 1280 (H) x 1024 (V) (1.3MP)

Calculations:

- Pixels per foot = image resolution / FOV
- Vertical Pixels = (1024 / 150) = 6.83
- Horizontal Pixels = (1280 / 260) = 4.92

Pixels on object = pixels per foot x object size

- VPoT = 6.83 x 2 ft = 13.65 VPoT
- HPot = 4.92 x 5.5 ft = 27.08 HPoT

Referring back to the Johnstone Criteria, we see that having just under 14 Vertical Pixels on Target would give us almost identification level of an image. Given that real world scenarios are almost always considered to be less than optimal conditions this would not suffice for identification, however it would probably be recognition level. This means that a 5.5 ft human who is 4,600 ft away would be accurately recognized, 50% of the time, with a 1.3MP sensor and FOV of 260 ft x 150 ft.

Ascendent offers full-scale customized solutions to provide detection, recognition, or identification at distances up to 30 kilometers, even at night. Call today for a free quote on any of our ultra long-range security solutions.

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