White Paper

Technology for improving visibility “Visibility Optimizer” and Its Effect

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Product & Business Development Dept.

Product Technology Section

1. Introduction

We are engaged in the independent development of visibility improving technologies, including “Smart Insight,” a technology for improving visibility of dark areas.

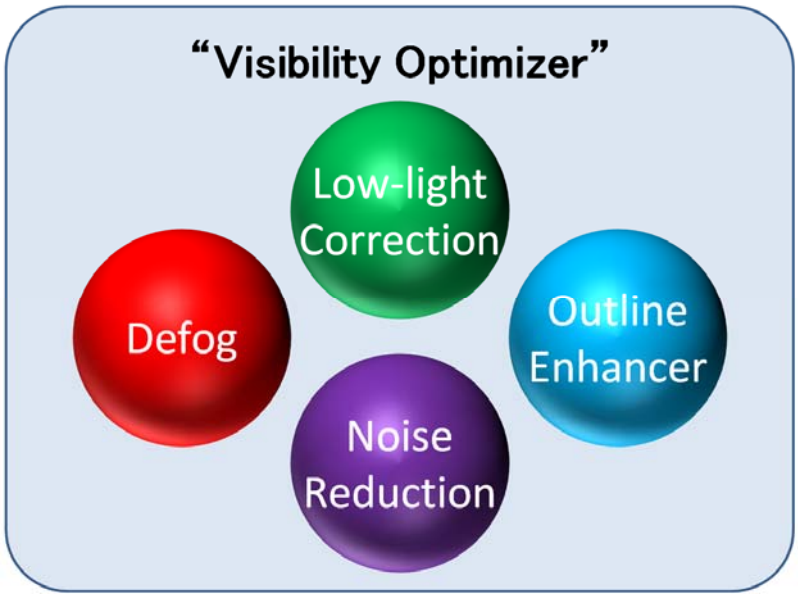
However, there are scenarios in video surveillance where high visibility is required. Specifically, these include easy-to-see display for checking surveillance video of dark scenes in nighttime monitoring or scenes where visibility is lowered by fog, smoke, snow, etc.

In this document, we provide an explanation of “Visibility Optimizer”. This function makes it possible to create the video that you would see if visual disturbances were not present by removing undesired information such as fog and smoke. The distinguishing characteristic of this function is that it can provide display in the optimal form for the viewer by extracting the essential information from the video source and making corrections based on the characteristics of the monitor. Moreover, the original video is untouched, with all corrections being made within the monitor.

▲DuraVision FDF2306W monitor with Visibility Optimizer

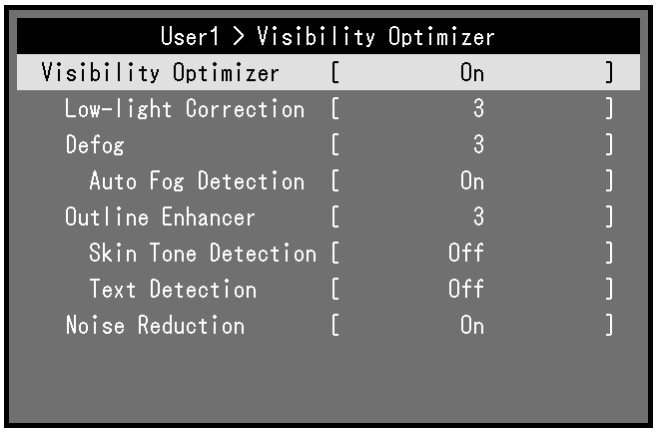
2. “Visibility Optimizer”

“Visibility Optimizer” optimizes the visibility of video displayed on the monitor by performing four corrections: “Low-light Correction,” “Defog,” “Outline Enhancer” and “Noise Reduction.” All corrections can be turned on and off using the “Visibility Optimization” option on the Visibility Optimizer Menu or the Visibility Optimizer ON/OFF button on the remote control. Below is an overview of each correction function and an explanation of their application.



▲Visibility Optimizer Components

▲Visibility Optimizer Direct Key



▲Visibility Optimizer Menu Screen

2-1. Low-light Correction

- **Function Overview**

The low-light correction function extracts the video's local contrast information by pixel and adjusts the brightness while preserving the information to correct the brightness while maintaining the original feel. Additionally, it detects the overall brightness of the video, tone bias and other characteristics within the frames and then adjusts the parameters in response to the scenes dynamically. Specifically, the amount of correction is adjusted, with more on dark scenes and less on bright scenes, so it is possible to view videos with the optimal amount of correction for various moving images.

- **Application**

By enabling this function when surveillance video is dark and hard to see, you can watch a brighter video. It is particularly effective for improving visibility of nighttime scenes where the whole screen is dark and scenes that are darkened by shadows.

(No correction) (Correction/Level 1) (Correction/Level 3) (Correction/Level 5)

- **Setting/Control**

By using the "Low-light Correction" option on the Visibility Optimizer Menu, you can adjust brightness at five different levels. The higher the level, the brighter the video will be. You can set it to the optimal brightness for visibility according to the video displayed and the monitor viewing environment.

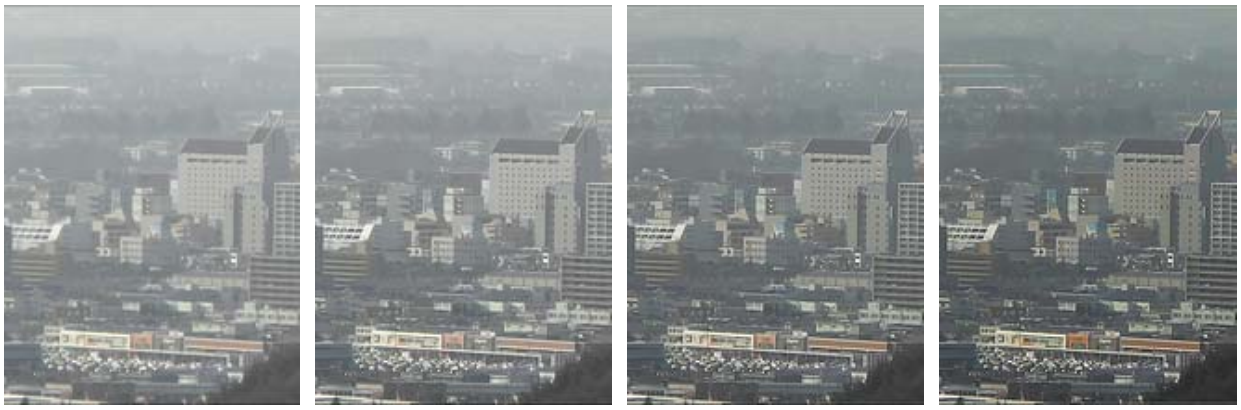
2-2. Defog

- **Function Overview**

The defog function corrects contrast and color saturation lost due to fog by analyzing the fog components included in the video by pixel and on the whole screen and removing them.

- **Application**

By enabling this function for scenes of surveillance video where the screen is whitish due to fog, smoke, snow, etc. and visibility is diminished, you can watch a video of higher visibility. It is particularly effective for scenes where fog or snow covers the whole screen.



(No correction) (Correction/Level 1) (Correction/Level 2) (Correction/Level 3)

On the other hand, if there is fog or snow on only one part of the video, the degree of defogging is suppressed. This is because the auto fog detection function estimates the fog concentration on the whole screen, and if there are parts where there is no fog, it determines that the fog concentration on the whole screen is low.

Additionally, when displaying the video using the surveillance viewer, the degree of defogging may be suppressed. This is because the fog concentration is estimated without background information as the viewer background is a solid color, but if there are stripes or other patterns in the background, the background affects the fog concentration estimate, and it is determined to be low as a result.
If you wish to perform defogging in such cases, you can disable auto fog detection to adjust the defog function. However, when auto fog detection is disabled, it will perform defogging on video that does not contain fog and on the viewer part, so there may be adverse effects such as changes in color density or over accentuation of the edges of the video.

▼Partial fog

(No correction)

(Correction/Auto fog detection on)

(Correction/Auto fog detection off)

▼Display using viewer

(No correction)

(Correction/Auto fog detection on)

(Correction/Auto fog detection on)

* Defog determines that the viewer part has a low fog concentration and that the video part has a high fog concentration, and as a result, it determines that there is a partial fog on the monitor.

- **Setting/Control**

By using the “Defog” option on the Visibility Optimizer Menu, you can adjust defogging with three levels. The recommended level is 3. If the edge, brightness and color saturation correction seems too intense at a correction level of 3, you can lower it to the desired level.

Additionally, you can configure whether or not to estimate fog concentration on the whole screen by using the “Auto Fog Detection” option or using the Auto Fog Detection button on the remote control.

2-3. Outline Enhancer

- **Function Overview**

The outline enhancer function does not simply emphasize edges but analyzes the input video and estimates the noise components and amount of blur to correct blur properly and sharpen the video.

Additionally, this function includes skin tone and text detection.
The skin tone detection function makes it possible to preserve natural skin appearance close to the original by detecting skin, which the outline enhancer tends to make appear unnatural, and reducing the correction.

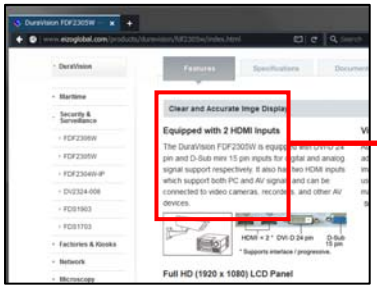
(Original image)

(Detection of skin area)

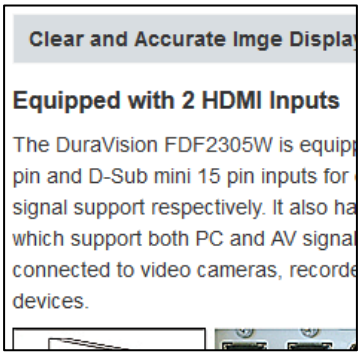
(Without skin tone detection:
Overemphasis of wrinkles
Lip discoloration)

(With skin tone detection:
Natural appearing enhancement)

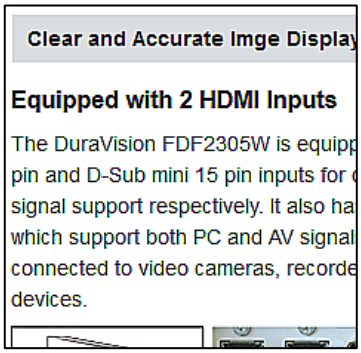
The text detection function detects text within the display screen and makes it possible to suppress the coloring of text and bleeding around it. If enhancement of text in the Viewer makes it hard to see, the enhancement can be suppressed by enabling the text detection function.



(Original image)



(With text detection:
No pseudo contours)



(Without text detection:
Pseudo contours generated)

- **Application**

By enabling this function for video surveillance when the images are blurry due to digital zoom or low camera resolution, you can watch a high-visibility video with detailed clarity.

(No correction)

(Correction/Level 1)

(Correction/Level 3)

(Correction/Level 5)

- **Setting/Control**

By using “Outline Enhancer” on the Visibility Optimizer Menu, you can adjust the degree of sharpness with five levels and can adjust it to the optimal setting according to the image magnification and blurriness.

Additionally, using the “Skin Tone Detection” and “Text Detection” options, you can make skin areas or periphery of text sharper.

2-4. Noise Reduction

- **Function Overview**

The noise reduction function reduces noise without making the video too blurry by analyzing the noise contained in the video and performing correction according to the noise characteristics. It is also possible to reduce noise by correcting grid-like noise called “block noise” generated during video compression.

- **Application**

Video from surveillance cameras is generally compressed during transmission, and noise is mixed in during compression. By enabling this function when noise reduces visibility making it difficult to monitor, you can reduce the noise.

Additionally, noise generated during compression and dark area noise generated during filming may be exaggerated by low-light correction, defog or outline enhancer. Enabling this function can reduce noise in those cases as well.

(Without correction)

(With correction)

- **Setting/Control**

By using “Noise Reduction” on the Visibility Optimizer Menu, you can turn this function on and off.

3. Summary

“Visibility Optimizer” makes it possible to improve poor visibility resulting from fog, smoke and other visual disturbances which was not possible with the previous “Smart Insight” technology for improving visibility of dark areas.

Each “Visibility Optimizer” function (low-light correction, defog, outline enhancer and noise reduction) facilitate the viewing of nighttime scenes and foggy scenes from outdoor surveillance, making it easier to check video footage. It also fixes noise generated during video compression and blur resulting from zooming. Moreover, the delay resulting from all of the processes of each function is very small at only a few lines, so it can also be used in real time surveillance.

As a “Visual Technology Company,” we will continue to promote development of image processing technology that draws out the essential information from video sources to achieve further improvement of visibility with “Visibility Optimizer” and offer optimal video display systems to meet our customers’ demands.