A New Controller for Improvement of Response Time by Data Compression Using Color Space Conversion

Sung-Jo Koo, Chang-Gon Kim, Jong-Ki An, Man-Hyo Park, Sang-Deog Yeo
Platform Design 3, LG.PHILIPS LCD, 643-2, Jinpyung-dong, Kumi-city, Kyungbuk, 730-726 Korea,
+82-54-478-5784, sjkoo@lgphilips-lcd.com

Abstract

In recent years, we use overdriving scheme to improve the response time of the liquid crystal. Since conventional overdriving scheme uses memory to perform ideal processing, it is desired to reduce system cost by decreasing the data stored in these SDRAMs. As a general compression method, quantization, sub-sampling and Block Truncation Coding (BTC) are used, which process data in block base and cause block effect. So we proposed new data compression method by color space conversion. Because this method compresses luminance and chrominance signal by different ratio, it can efficiently reduce error of block effect in decompression image.

1. Introduction

TFT-LCD applied to display device such as notebook PC and PC monitor. LCD are increasingly used to show moving images. However, moving images become blurred in LCD panel because of the slow reaction of the LC cell to a change in the pixel value. Overdriving technique enlarges the desired change in the pixel value to force the LC material to react faster[1]. For each combination of the pixel value of the current frame and the previous frame, the look-up table (LUT) provides the overdriven pixel value that is supplied to the LCD panel. The pixel values of the previous frame are stored in a frame memory. A simple block diagram of general overdriving circuit is shown in figure 1. Overdriving technique uses two or more SDRAMs. But it is demanded to reduce system cost by decreasing data stored in memory as much as possible[2,3]. Since compression method used in overdriving technique codes image divided into block, it causes image deterioration. Therefore we propose data compression using color space conversion to reduce block effect.

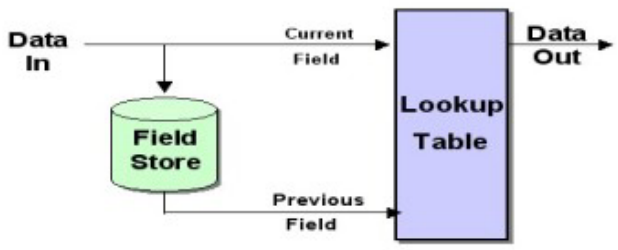

Figure 1. Block diagram of general overdriving circuit

2. Image Compression for Overdriving Circuit

Many data compression methods for still picture exist. As general data reduction method, quantization, sub-sampling and block truncation coding (BTC) are used. Block diagrams of overdriving circuit using by BTC are shown in figure 2. But these methods cause block effect in decompressed image. Sub-sampling and BTC divided image to N x M block and compress image by block unit[4]. So these methods occurred deterioration by block effect in image. For avoiding decompression error by block effect, we propose a new compression method using color space conversion. This method reduces block effect more than general compression methods.

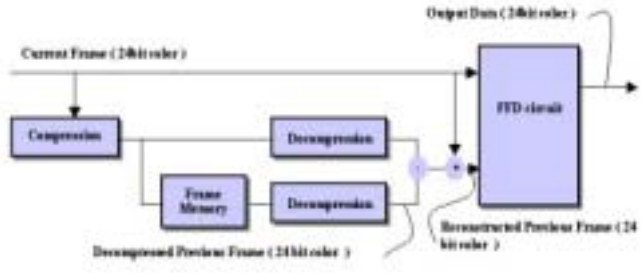

Figure 2. Block diagram of overdriving circuit using BTC

3. Compression Overdriving Circuit Using Color Space Conversion

General compression methods have different result for each image pattern because of coding by block base in RGB domain. To prevent block effect, we propose compression method by color space conversion in YUV domain.

Human vision is sensitive to luminance signal and insensitive to chrominance signal. Using this human vision characteristic, Y and UV signals are compressed by different ratio respectively. In other words, Y signal compresses low ratio and UV signal compress high ratio because of human vision characteristic. A block diagram of proposed method is shown in figure 4. This compression algorithm would reduce decompression error by block effect less than general compression methods.

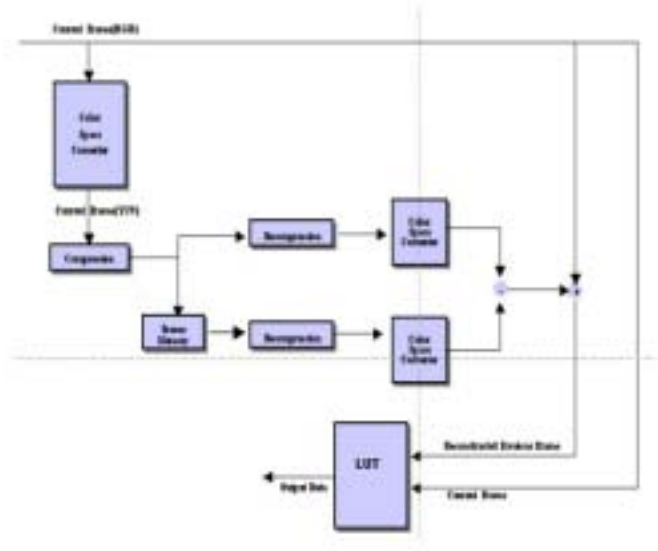

Figure 3. Block diagram of overdriving circuit using color space conversion

4. Result

The result of errors contained in the overdriving data for sub-sampling, BTC and proposed method is shown in Table 1. This reveal that PSNR of proposed method is higher by 6~7dB in comparison with sub-sampling and higher 2~2.5dB in comparison with BTC. For more correct, we simulate BTC and proposed method with various test images. The result of errors in the overdriving data for BTC and proposed method is shown in Table 2. For various test images, proposed method is higher by 5dB on average.

	Sub-sampling	BTC	Proposed method
Flower	35.66dB	40.28dB	42.81dB
Fruit	34.93dB	39.07dB	40.90dB

Table 2. Evaluation Result of Overdriving Data

	BTC	Proposed method
Bike1	33.88 dB	40.37dB
Bike2	36.05 dB	39.98 dB
Cafe1	35.93 dB	41.59 dB
Cafe2	32.91 dB	38.49 dB
Candle	35.98 dB	43.35 dB
Music	36.69 dB	41.33 dB
Port	43.83 dB	43.44 dB
Wine	35.07 dB	41.97dB

Table 3. Evaluation Result of Overdriving Data by Various Test Images

5. Conclusion

We have proposed a new compression method for overdriving circuit. Simulation result shows that proposed method is more accurate of overdriving data. This method can efficiently reduce the amount of image data stored in the frame memory and error of block effect in decompression image by using luminance and chrominance signal.

References

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