Image Enhancement in YIQ Space

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Abstract. In this paper, image enhancement approach is introduced. We firstly transform the RGB image to YIQ domain, then we selectively apply histogram equalization algorithm on Y channel, or separated each channel of Y, I, and Q channels. The simulation results show that the enhanced images look better than the original ones.

Keywords: image enhancement approach, transform, YIQ channel.

1 Introduction

The image enhancement is the procedure of tuning digital signals (the 2D signal is assumed as image) so that the results are more appropriate to analyze or exhibit. There are several examples of image enhancement. For instance, if we have dark image then we can make the image brightened. If we have an image with many noises, then we can remove noise (by denoising methods, median filters, or Wiener filtering) and make the image much easier to understand. If we have blurred image, then we can apply unsharp masking to easily identify the feature of the original image.

In this paper, we study image enhancement algorithm on YIQ domain. The article is organized as follows. In Section 2, YIQ color space is introduced. The image enhancement implementation is explained in Section 3. The simulation results are explained Section 4. We present our conclusions in Section 5.

2 Color Space: YIQ

The YIQ color space has been used in NTSC (National Television System Committee) color TV system and has been employed in USA, Canada, Japan and Korea. The Y stands for luminance components, and I and Q represent in-phase and quadrature amplitude modulation components. Thus, Y is the only component employed by black-and-white TV. On the other hand, I and Q stand for chrominance information for representing color.

3 Image Enhancement Implementation

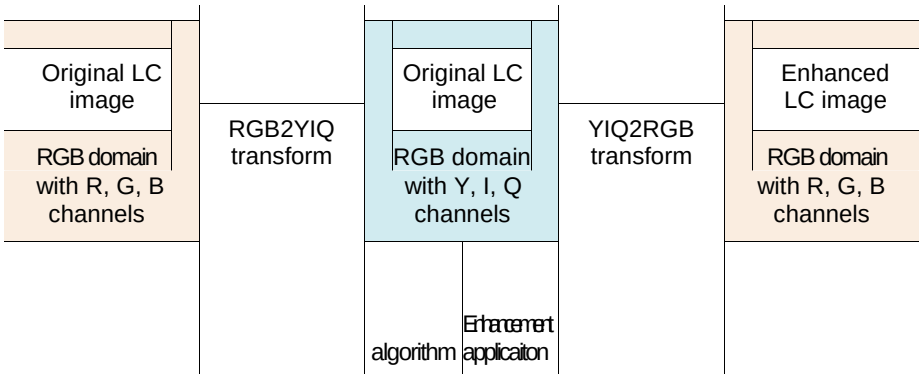


Fig. 1. Image enhancement process.

Figure 1 shows the image enhancement process in YIQ domain. The original color image contains three color channels, i.e. R, G, and B. This color image is transformed to YIQ channel by RGB2YIQ transform equation as shown in Eq. (1).

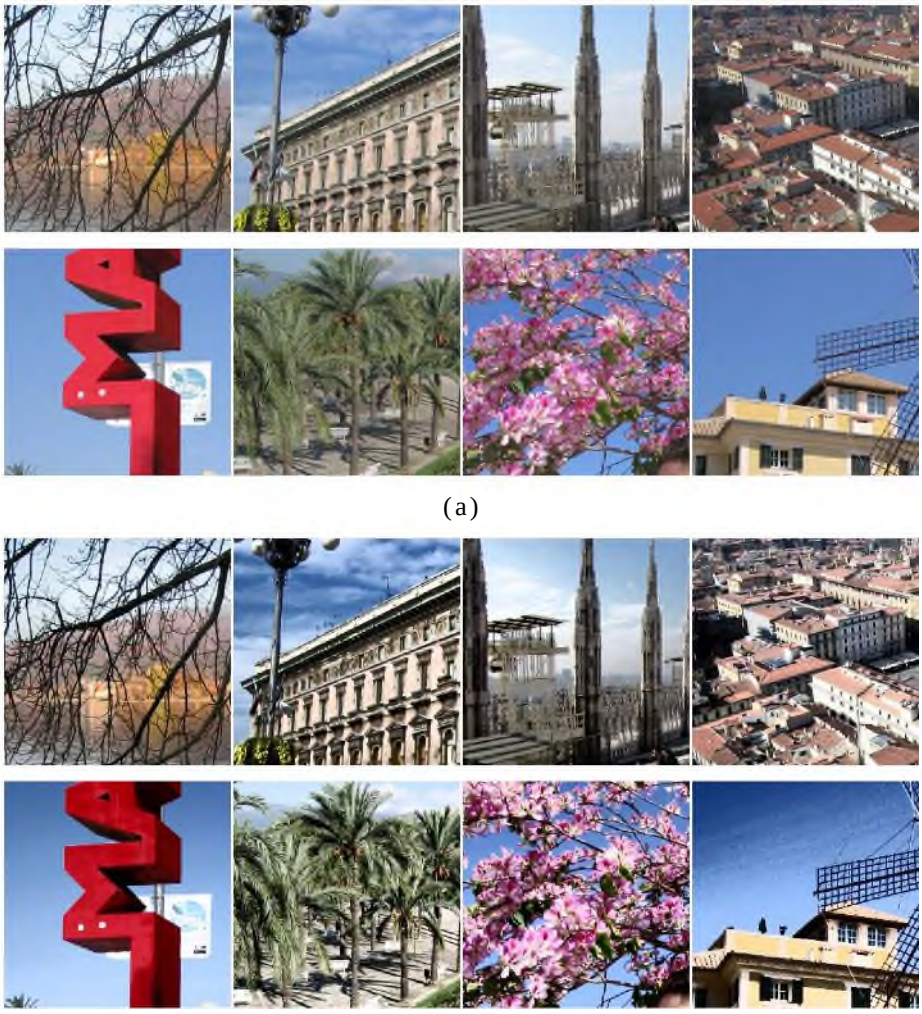
$$\begin{pmatrix} V \\ I \\ Q \end{pmatrix} = \begin{pmatrix} .299 & .587 & .114 \\ .596 & -.274 & -.321 \\ .211 & -.523 & .311 \end{pmatrix} \begin{pmatrix} R \\ G \\ B \end{pmatrix} \quad (1)$$

The image enhancement algorithm is applied in YIQ domain, and the result image is inverse-transformed to RGB with Eq. (2).

$$\begin{pmatrix} R \\ G \\ B \end{pmatrix} = \begin{pmatrix} 1 & .956 & .621 \\ 1 & -.272 & -.647 \\ 1 & -1.107 & 1.705 \end{pmatrix} \begin{pmatrix} V \\ I \\ Q \end{pmatrix} \quad (2)$$

4 Simulation Results

In this section, we show the conducted experimental results in Fig. 2.



(a)

(a)

Fig. 2. (a) Original LC images #54-61, (b) contrast enhanced images.

5 Conclusions

The image enhancement method is explained in this paper. We app transformed the RGB image to YIQ one, then we applied histogram equalization method on each channel. After then processing, we evaluated the performed by objective and subjective metrics. It was found that the proposed method is effective and makes images better.

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