CHAPTER I

INTRODUCTION

Nowadays, digital cameras become very popular among photographers for both amateurs and professionals alike. The superiority of a digital camera over a conventional one is its expediency. Images taken with digital cameras can be viewed immediately and the digital images can be easily displayed and adjusted with a personal computer. Digital images with good quality should establish reasonable dynamic range (ability to show details of difference between the brightest and darkest areas in an image) and an appropriate distribution of pixel values, i.e. the lightness or color data should render such that image details are present. Thus, methods of image enhancement normally attempt to expand a dynamic range or to produce a better color rendering of an image. There have been several methods of image enhancement. Traditionally, the image enhancement methods will focus only on one aspect: either image appearance or color appearance. Recently, the image color appearance model bringing together a single model applicable to image appearance, image rendering, and color appearance has been proposed by Fairchild and Johnson [1]. The model coined iCAM has been successfully applied to predict a variety of color appearance phenomena such as chromatic adaptation (corresponding colors), simultaneous contrast, crispening, spreading [2]. It has also shown to be capable of rendering high dynamic range scene. The concept upon which iCAM has been built is solid and well established. Nonetheless, the model still needs further investigations so as to improve its performance for various applications. The inventors of iCAM have encouraged

researchers in the field of color imaging to work on the refinement and testing of the model [3]. One crucial step of the implementation of iCAM is in the step of image filtering. The type of filters utilized in this step affects the rendering of image data, and thus image appearance. The results from a previous study by Moroney and Tastl [4] showed that iCAM worked well for some types of images but for some other types, other methods of image enhancement could outperform iCAM. From these results, it could be deduced that iCAM needs to be implemented differently for different images in order to obtain the optimal performance. Hence, this implies that different types of filters should be applied for different images. The characteristics of low-pass filters used in iCAM vary with two parameters: size and sigma, σ. This study thus investigated the type of low-pass filters that are most appropriate to render image data by varying the two parameters that affect characteristics of the filter. The iCAM with appropriate types of low-pass filter, i.e. a suitable combination of size and sigma of the filter, would result in pleasing image appearance when applied to render images. The present study investigated two aspects of image quality after image enhancement with iCAM. These included image details and color appearance. Three different images were tested to determine the impact of image types on the type of filter used.

Objectives

1. To implement the image color appearance model, iCAM, to enhance images.

2. To specify filters that most appropriate to image enhancement using iCAM

Scope of research

1. An implementation of iCAM was done using MATLAB computer programming. In the source code, the input image data in sRGB space were first converted to XYZ tristimulus values. The following steps were carried out according to iCAM. The last step was to convert XYZ back to sRGB.

2. Three digital images with perfect quality were selected to use as reference images. These images were adjusted to lower their quality with respect to image details and overall brightness.

3. Three images with poor quality were enhanced using iCAM, whereby different types of filters were applied.

4. The most appropriate filters to be applied in iCAM to conduct image enhancement were determined by SSIM index.

5. The quality of images enhanced by iCAM was visually assessed on a LCD monitor in comparison with images enhanced by the function Imadjust available in MATLAB, together with the reference images and the original images (poor quality).

6. Normal color-vision observers performed a rank ordering in visual assessment of image quality with respect to image details and pleasing color.

Expected outcomes

1. Specific low-pass filters as part of iCAM, which yield best results in image enhancement using iCAM.

2. An understanding of applications of iCAM to different types of images.

Content of thesis

Chapter 2 deals with the theoretical considerations and literature reviews relevant to the present study.

In Chapter 3, the experimental procedures are described.

Chapter 4 contains the results and discussions of the research. Finally, the results are concluded in Chapter 5 with some suggestions.