CHAPERT V

CONCLUSIONS

5.1 Conclusions

Image acquisition through digital process is becoming popular due to the advantage of digital images. The qualities of digital images are easily improved through a process of image enhancement. Digital images taken with improper light exposure will contain no detail in shadow, or in highlight. For example, images taken indoors with low illumination have high image contrast but poor image rendering. The same case goes to silhouettes, i.e. images taken when the source of light is behind the subject. To enhance these images, some method of rendering image data is required. This thesis has outlined the use of an image appearance model iCAM for rendering images. The aim was to define the types of Gaussian filter used in the model. Two parameters affecting the characteristics of filter were varied. They were filter size and sigma value. Two sizes of filter were varied: the size of the image size and half the size of image size. The sigma values were varied between 1 – 500. This parameter varying was applied for Gaussian filter used in two different steps in iCAM. The first filter was used in the step of obtaining chromatic adaptation information. The second filter was in the step of luminance adaptation. A combination of appropriate filters would provide good quality of images enhanced with iCAM. Three different types of digital images were tested, i.e. Boat, Japan and Party. The resulting images from iCAM were compared to the reference images, which were considered to have perfect quality, using the SSIM index. The quality of the input

(original) images and the images enhanced by Imadjust function was also compared to the reference images using the SSIM index. Finally, visual experiments were conducted to assess the quality of the enhanced images in comparison with the reference and the original images. The results can be concluded as follows:

- The size of filter had little effect on the characteristics of Gaussian filter. Two different sizes yielded very similar results for both first and second filters that account for chromatic and luminance adaptation, respectively.

- The appropriate size of filter found in this study was the size of images tested.

- The sigma of filter had significant impact on the characteristics of Gaussian filter. The small value of sigma gave narrow distribution of filter data with a high peak in the center. On the contrary, filter data produced from the large value of sigma spreaded broadly over the filter size with a low peak in the center.

- The sigma of the first filter should be a small value, so that when filtering an image, each pixel value of the image is largely modified. In contrast, the sigma of the second filter should be a larger value, so as to obtain luminance adaptation information from the low-pass image.

- Different types of filters were required for different types of images.

- The same size of filter was applied to both filters in iCAM. The sigma of the first filter should be around 50. The sigma of the second filter could vary from 200 – 500.

- The appropriate sigmas found in this study for the first filter were 50 for Boat (fine-detail image), and 55 for Japan (low-key image) and Party (high-key image).

- For the second filter, the appropriate sigmas found in this study were 200 for Boat, 500 for Japan, and 300 for Party.

- For low-key image (containing mainly shadow areas), a high value of sigma for the second filter might be applied.

- The performance of iCAM in images enhancement depends on an appropriate combination of the types of the first and second filters.

- The use of iCAM with appropriate filters could improve quality of the input images in terms of image detail. Image data of iCAM images spreaded out from shadow to highlight on the lightness scale, showing good image rendering.

- The iCAM did not perform well in terms of color because iCAM produced low saturated colors.

- The iCAM could enhance detail in shadow area of image but failed to enhance detail in highlight area. It therefore did not work well for bright or high-key images.

- The use of iCAM with appropriate filters is suitable for rendering dark or low-key images, and images that contain a lot of fine details.

5.2 Suggestions

- The type of digital images tested should be a high dynamic range image with bit depth more than 8 bit per channel in order to have enough image data for image enhancement

- More types of images or more numbers of images in the same type should be tested in order to define the types of Gaussian filter used in the model.

- Other parameters required in iCAM should also be investigated in order to improve the model's performance.