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# An Investigation into the effect of the compression algorithm in the presence of shifting and cropping on image quality

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by

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## Abstract

Image compression is a form of data compression frequently used in digital imaging applications to improve the efficiency of transmission and storage. In order to have a manageable file size, the data compression is lossy, i.e. image information is lost. Lossy compression algorithms such as Baseline JPEG use the insensitivity of the human eye to high frequency information as a basis for the compression. Discrete cosine transforms (DCT) are performed on the data followed by variable quantization. And the image blocking has no exact regulations for the spatial variation. Using this technique, information is lost and the decompressed image is a distorted version of the original. It is known that simple repeated compressions do not influence image quality, which is determined by the initial compression. Considering practical use, this study extends JPEG operation to the repeated DCT block rearrangement operation of the JPEG baseline scheme. In particular image placement and translation are discussed. Objectively and subjectively analytical results are presented. It is now shown that these operations affect total image quality. The error of the JPEG image quality tends to increase with the number of repetitive DCT rearrangement operations, and this increase is dependent on the image frequencies (error is concentrated in the image's high frequency regions). Also, the artifacts become worse with lower quality levels of compression, or higher compression ratios. If the JPEG scheme could be modified to recognize the translations by compensating for the crop or translation, the artifacts due to this translation would be eliminated. Consequently, this research will attempt to investigate the error resulting from such translations.

# Chapter 1

## Introduction

At present, there are many ways in which images can be compressed for meager storage or faster data transmission, and they can be broadly classified into two classes: Lossless and Lossy. Lossless methods are able to restore the data identical to the original, normally but compromise quality for a lower transmission rate by quantizing to minimize irrelevant information. This method is considered desirable if the decrease in compressed size is relatively larger than the amount of loss in quality.

One of the most widely used methods that has been developed is the JPEG image compression. JPEG stands for Joint Photographic Expert Group, the original name of the committee that wrote the standard. JPEG is lossy and designed for compressing either full-color or gray scale images of natural, real word scenes. It works well on photographs, naturalistic artwork, and similar material; not so well on lettering or line drawings. It handles only still image, but there is a related standard called MPEG for motion picture. It is also designed to exploit known limitations of human eye, notably the fact that small color changes are perceived less accurately than small changes in brightness. And the information attributed to higher spatial frequencies is discarded because the human visual system is less sensitive to it than lower spatial frequencies. Thus, JPEG is intended for compressing images that will be looked at by the humans. JPEG features a simple lossy technique known as the baseline process. The baseline process has been the most widely implemented version and is the de facto standard JPEG scheme. One of JPEG' s goals is to achieve a significant compression ratio without visibly affecting image quality. There has been considerable discussion on the influence of the compression ratio on the final

image quality after decompression. The processed image looks like the original image under suitable compression conditions. The compression factor is selectable. This means that we can trade off file size against output image quality. However, The final image quality and compression ratio can vary considerably, depending on the source image characteristics and the scene content. Professor Kaji[1] has shown by experiments that :

(1) a 24-bit color image achieved compression ratios of 10:1 to 20:1 without any image degradation that is visible to the human eye at normal magnification.

(2) the recommended (optimum) compression ratio depends largely on the density distribution of the original image data.

**Statement of the problem**

In the field of graphic arts, desktop publishing, and many other digital image areas, making image files smaller is necessary for transmitting files across networks and for archiving libraries of images, and storing full color information: 24 bits/pixel (16 million colors). JPEG algorithm is an important part of compression technologies. However, for example, in image transmission systems, and image library systems, the images will be used repeatedly and iteratively. In this case, the stored image must have a reuse capability. There are many possible image-processing operations on a JPEG compressed image; i.e., cropping, clipping, composition, rendering tone and translation or shift, so that the image data will be processed by compression and decompression repeatedly. Reference the report[3] , *Image quality with reiterative JPEG compression*, it was shown that repetition factor had no influence on the final image quality, and the initial compression established the base image quality. Also, it has been demonstrated that recompression of a JPEG image using JPEG compression at the same quality factor (QF) results in relatively little further degradation.[2] However, what happens if the JPEG image is cropped or translation, so that the image data no longer line up perfectly with the 8x8 blocks of pixel? Since the JPEG scheme uses block sampling; the image is divided into numbers of 8x8 sample blocks. Each block is coded by forward discrete cosine transform (FDCT)

independently. Since JPEG processes image in small blocks, if the reconstructed image is offsetted by a small number of pixels, and then recompressed, further degradation may be introduced into the image. This degradation seems to be additional blockiness in the reconstruction of the shift, recompressed JPEG image. In other words, some of the new zero values will merge into the data when the image is reconstructed. Because of the blocking scheme in JPEG compression, even a single pixel shift will introduce additional artifacts. In this case, it is difficult to retain the initial conditions of the block arrangement, as the image is multiply processed by the JPEG scheme. Normally, for monochrome images, each pixel is only represented by a luminance (or intensity) level. On the other hand, color image have multiple components. Each pixel of a color image can be represented by luminance and chrominance components.

This thesis will study the color image quality under the influence of changing DCT block arrangements and repetitive JPEG operations. Because information of interest may be lost, a repeatable or reproducible means of quantifying the nature and extent of information loss is desirable. Two general classes of criteria are used as the basis for such an assessment: (1) objective criteria and (2) subjective criteria.

One common objective measurement method is the root mean squared error (RMSE) between an input and output image. It can be expressed as a function of the original or input image and the compressed and subsequently decompressed output image. Although objective criteria offers a simple and convenient mechanism for evaluating information loss, most decompressed images finally are viewed by human beings. Consequently, measuring image quality by the subjective evaluations of a human observer often is more appropriate. This can be accomplished by showing a typical decompressed image to an appropriate cross section of viewers and averaging their evaluations.

## End Notes


1. M. Kaji, H. Furuta, and H. Kurakami. "The evaluation of JPEG compression using SCID images." *The Dunn Report XIII(9)*: 3-7 (1994).
2. Kinoshita H., and T. Yamamuro. "Image Quality with Reiterative JPEG compression." *Imaging Science Technology 39* (1995): 306-312.
3. *JPEG Image compression FAQ* [Online]. (n.d). Available: http://www.cis.ohio- state.edu/hypertext/faq/usenet/jpeg-faq/part1/faq.html

# Chapter 2

## Theoretical Bases of the study

The purpose of this section is to discuss the basic fundamentals underlying JPEG compression. JPEG is a very extensive standard offering a large number of both lossless and lossy. However, this thesis will concentrate on the best known implementation, known as baseline JPEG. This method uses DCT compression of 8x8 blocks of pixels, followed by the quantization of the DCT coefficients and entropy encoding of the results.

**Baseline JPEG**

One of the major objectives of the JPEG committee was to create a basic compression technique for use throughout the industry. A method that would be compatible with all of the various types of hardware and software that would be performing image compression. To accomplish this goal, the committee developed the baseline JPEG algorithm. Additional changes could then be made to the baseline algorithm due to the individual users preferences, but only the baseline algorithm would be universally implemented and utilized. This algorithm was designed to accept 8 bits per pixel images. The term pixel is used to mean either a single monochrome pixel or a single channel of a color pixel. JPEG is based on the relative inability of human vision to distinguish among small variations in color. Consequently, the JPEG-compressed images will look good to human eyes because the loss of some original data is not noticeable.

The Baseline JPEG algorithm is composed of the compressions steps and the major decompression sites. This is shown in flowchart form in Fig. 2.1 on the following page.

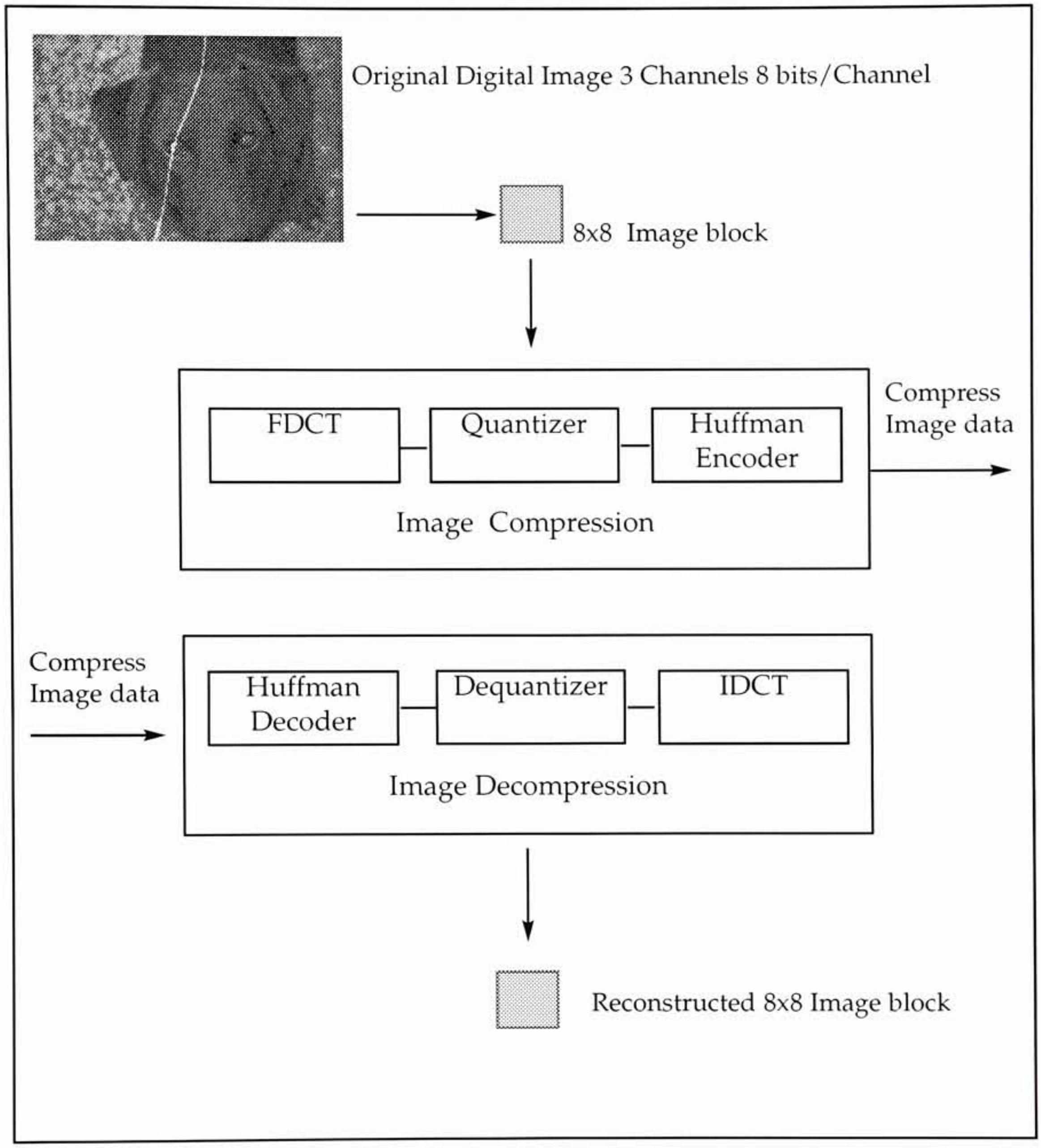



**Figure 2.1 Flowchart for Baseline JPEG Algorithm**

The first step in the process is sampling. The pixel data is converted from the RGB to the YCbCr color space and down sampling into eight by eight pixel blocks is performed.each block is then operated on separately. Instead of separating into red, green and blue channels, the image is converted into YCbCr color space. Because YCbCr provides a closer model for how the human eye perceives visual information. Chrominance has two components, Cb and Cr, which define the color of a given pixel. In most case, the human eye is unable to detect the difference between the original image and an image that has some CbCr components deleted. On the other hand, the luminance component, which is Y, defines the relative intensity of a given pixel. The eye is much more sensitive to the Y component than the CbCr components. This mean that the chrominance channels(CbCr) can be more compressed than the luminance channel(Y). On the other word, by doing this, greater compression of the color components can be achieved, with less perceivable loss of overall image quality. Then these blocks are sent into the JPEG algorithm. The steps in the compression algorithm are a transformation from a spatial representation to a frequency representation, systematic quantization and statistical encoding.

The first operation performed is a **Discrete Cosine Transform (DCT)** which maps the 64 pixel values into 64 output coefficients. DCT is the mathematical transformation used in the JPEG algorithm for changing from a spatial representation of the pixels to a frequency representation. The encoder uses the FDCT to convert 8x8 blocks of samples into DCT coefficients, while the decoder uses the IDCT to map these coefficients back into samples.

The coefficients FDCT of an 8x8 block samples: $S_{yx}$ (y, x = 0, 1, ..., 7) is defined by:

$$S_{uv} = \frac{1}{4} C_u C_v \sum_{x=0}^{7} \sum_{y=0}^{7} S_{yx} \cos \frac{(2x+1)u\pi}{16} \cos \frac{(2y+1)v\pi}{16}$$

where $C_m = 1/2^{(1/2)}$ for m = 0; 1 otherwise

The two cosine terms are responsible for generating the two-dimensional patterns

that are the basis functions.

The inverse discrete cosine transform (IDCT) transforms an eight by eight blocks of DCT coefficients to a reconstructed eight by eight block of pixels. In this case, frequency information is being transformed back into a spatial representation. The 8x8 IDCT is defined by

$$S_{yx} = \frac{1}{4} \sum_{x=0}^{7} \sum_{y=0}^{7} C_u C_v S_{vu} \cos \frac{(2x+1)u\pi}{16} \cos \frac{(2y+1)v\pi}{16}$$

where $C_m = 1/2^{(1/2)}$ for $m = 0$
$\qquad\qquad 1$ otherwise

Both of FDCT and IDCT are lossless. This transform only concentrates a large portion of the signal in the lower frequencies. As a results, the DCT does not compress the information but it does compact it considerably. The transform output, performed into two dimensions, is ordered so that the mean value (known as the dc coefficient) is in the upper-left corner of the 8x8 block. Higher frequencies progress in rows and columns towards the lower right. The other values in the block are called ac coefficients.

The next stage, called **quantization**, reduces the magnitude of the frequency coefficients and increases the number of coefficients that are equal to zero. Early on the JPEG committee recognized that color information could be quantitized differently than luminance information. The largest difference was that chrominance or color information could be quantized more coarsely than the luminance or tone reproduction. This scheme was based on the physiological properties of the visual system. Consequently, This step is accomplished by dividing each ac coefficient by a constant value based on the position of the 8x8 block. A *quantization table (Q-table)*, the position-dependent constants locating in a structure, was designed to optimize the resultant values for human vision. The JPEG committee has not provided any Q-tables for use as standards. They have provided two example tables, shown in Fig. 2.2. One table is for quantizing luminance information and

the other is for chrominance quantization. It has been commented that there are some irregularities in these two tables The results are then rounded to the nearest integer. In other words, quantization is the major lossy component of JPEG compression. DCT transformation only reorganize the information into different form.

**JPEG Luminance Q-Table**

| | | | | | | |
|---|---|---|---|---|---|---|
| 16 | 11 | 10 | 16 | 24 | 40 | 51 |
| 12 | 12 | 14 | 19 | 26 | 58 | 60 |
| 14 | 13 | 16 | 24 | 40 | 57 | 69 |
| 14 | 17 | 22 | 29 | 51 | 87 | 80 |
| 18 | 22 | 37 | 56 | 68 | 109 | 103 |
| 24 | 35 | 55 | 64 | 81 | 104 | 113 |
| 49 | 64 | 78 | 87 | 103 | 121 | 120 |
| 72 | 92 | 95 | 98 | 112 | 100 | 103 |

**JPEG Chrominance Q-Table**

| | | | | | | |
|---|---|---|---|---|---|---|
| 17 | 18 | 24 | 47 | 99 | 99 | 99 |
| 18 | 21 | 26 | 66 | 99 | 99 | 99 |
| 24 | 26 | 56 | 99 | 99 | 99 | 99 |
| 47 | 66 | 99 | 99 | 99 | 99 | 99 |
| 99 | 99 | 99 | 99 | 99 | 99 | 99 |
| 99 | 99 | 99 | 99 | 99 | 99 | 99 |
| 99 | 99 | 99 | 99 | 99 | 99 | 99 |
| 99 | 99 | 99 | 99 | 99 | 99 | 99 |

**Fig. 2.2 Example Luminance and Chrominance Q - Tables**

The last stage of the process is encoding the data according to image statistics so that they will take up even less space or lossless compression. The 8x8 data block that is created from the quantization stage is scanned in the zigzag pattern shown in Fig 2.3

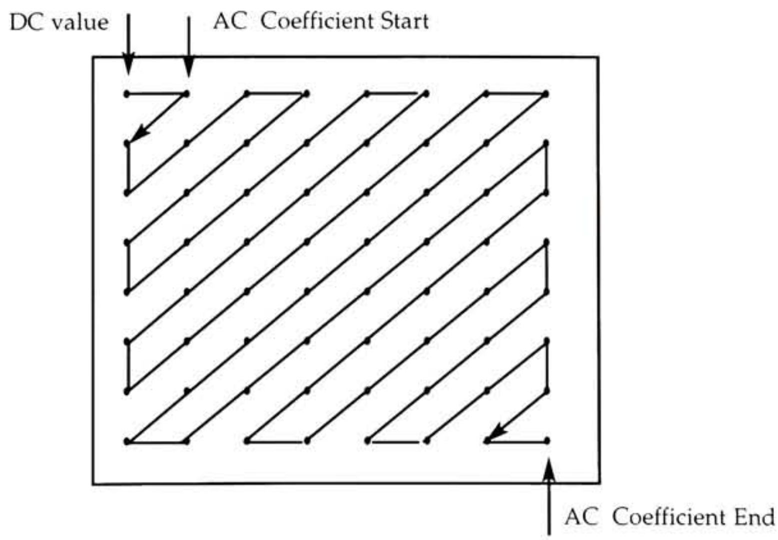



**Fig. 2.3 The zig zag pattern (JPEG scan order)**

Due to the processing done to the data thus far, the ac coefficients will tend to increase in value along the path. **A Huffman coding** is used to save the data within a block, which greatly reduces space. The difference between the dc coefficients of adjacent blocks is small, so a technique called differentiatial pulse code modulation (DPCM) is used to store only the differences or deltas, between them; this will require fewer bits.

To decompress or reconstruct the image involves decoding of the Huffman coding data and computing the inverse DCT (IDCT) to retrieve a facsimile of the original block. Because high frequency data are lost in the quantization step, the reconstruction is missing the high spatial frequency information in the reconstructed 8x8 block. On the other word, to decompress the image, the inverse of each process is performed. At this point, the image can be stored or transmitted as needed.

**Color or grayscale** [1]

The JFIF standard allows either three-component color images or one-component (y) grayscale images. A JPEG encoder can be written so that it always uses three components, but the drawback is that the grayscale images will be a bit larger and the processing required to decode them significantly more than necessary. In the RGB color space, shades of gray are represented with component values where R = G = B. If we look at the RGB-to-YCbCr conversion, with 8-bit samples, for any grayscale color (R = X, G = X, B = X), the corresponding YCbCr color representation is Y = X, Cb = 128, Cr = 128. Since 128 is subtracted from the component values before the DCT is performed, the coefficients for the Cb and Cr components in a grayscale image will all be zero. In a grayscale image the Cb and Cr components obtain outstanding compression since each data unit requires only 2-bits to encode. While the amount of compressed data from the Cb and Cr components is relatively small, it is still completely useless.

**Image Compression**[2]

The degree of data reduction achieved by a compression process or algorithm is called **Compression ratio**.

$$\text{Compression Ratio} = \frac{\text{Bits in Original Image}}{\text{Bits in Compressed Image}}$$

However, the Compression Ratio, and hence the quality of the reconstructed image is controlled by scaling the quantization matrix. One benefit of JPEG compression is that its parameters can be altered to suit the particular needs of the application, allowing users to make size&quality and quality&speed trade offs. In other words, higher compression ratios can be achieved if the application can accept low quality images.

## End Notes


1. Miano, J. *Compressed Image file formats: JPEG, PNG, GIF, XBM, BMP.* New York: Addison-Wesley (1999): 110.
2. Kou, W. *Digital Image Compression Algorithms and Standards.* Massachusetts: Klumar Academic (1995):4.

# Chapter 3

## Review of Literature

Digital images are big. A typical photographic quality color image ( a continuous tone image with a color depth of 8 bits per color component and a spatial resolution of 300 dpi), 10 x 8 inches in size, will consume around 20 megabytes of computer memory. This illustrates the need for image compression. Image compression is a specialized form of data compression frequently used in digital imaging applications to improve the efficiency of transmission and storage. Data compression aims to reduce or eliminate redundancy in the way data describes image formation. Image compression techniques use two approaches to reduce the required data. Efficiency of data compression may be improved by using knowledge of the typical structure of an image. On the other hand, when data compression techniques provide insufficient reduction in data, the amount of information to compress may be selectively reduced. Using this technique of *lossy compression,* information is lost and the decompressed image is a distorted version of the original.[1]

For the purpose of this thesis, it shall concentrate on the Joint Photographic Experts Group (JPEG) Baseline standard for continuous tone still image compression. This is because JPEG is an internationally agreed standard, it is also in widespread use and is implemented within the public domain. In the field of graphic art, we usually use a huge memory environment. These image applications thus require a reasonable and standard memory-saving environment. Moreover, the image data will be used repeatedly and iteratively. There are also many possible image-processing operations on a JPEG compressed image; i.e., cropping, clipping, translation, or shift, so that the image data

will be processed by compression and decompression iteratively. For example, when working with an image intended to be posted on the internet, and only viewed on a computer screen, the low resolution (typically 72 dpi) tends to magnify any JPEG artifacts that might be present in the image. If downloaded, edited, and incorporated into another web document, the image would most likely not be cropped along the original JPEG blocks. When this image is then saved on the web page, the artifacts are introduced. In this case, the image requires reuse capability.

In 1995, A.M. Ford, R.E. Jacobson, and G.G. Attridge[2] conducted an experiment to study the effects of image compression on image quality. Their conclusion is that

1. Various structural effects of applying DCT based JPEG compression have been identified.
2. Image quality is dependent on viewing conditions, image size and pictorial content, in addition to the type and degree of compression applied.
3. RMS error is reasonably suitable for objective measurements.
4. In some circumstances JPEG compression produces noticeable changes in color reproduction.

In 1995, H. Kinoshita and T. Yamamuro[3] studied the image quality with reiterative JPEG compression. This study described the relationship between the visual evaluation and the reiterative operation by the JPEG baseline scheme. The experimental results showed that the iterative factor of the repetitive JPEG operation had no influence on image quality and the first compression determined base image quality.

In 1998, Keith Jacoby[4] conducted the experiment in an effort to characterize the effects of spatial translations on JPEG-compressed image. He performed the experiment to learn what happens to the image data of a monochrome JPEG image when it is shifted and recompressed. There were 7 levels of shifts and 10 levels of quality factor (QF),

making a total of 70 treatments in this two factor study. As the amount of shift increases, the mean pixel value of the error image increases and is at its maximum at 4 pixels. Beyond 4 pixels, the mean error decreases, virtually mirroring the behavior of a decreasing shift from 4 to 1 pixels. Also, there was probably some additional interaction between factor level effects because of the fact that the difference between mean responses (the mean pixel value difference) was very similar for all levels of the shift factor.

In 1999, A.M. Ford, R.B. Fagard-Jenkin and R.E. Jacobson[5] studied the information loss in image compression. This study highlights sources of information loss in lossy image compression algorithms. Using baseline JPEG as an example, this process contains a number of sources of information loss. Conversion of color representation from red green blue (RGB) to a luminance-chrominance space, typically YCbCr, is designed to separate luminance from chrominance information. This conversion uses a set of coefficients which assume the RGB primaries used are those of a fixed standard[6]. However, the RGB of most acquisition and display devices do not conform to this standard, with the result that the YCbCr conversion does not truly separate luminance and chrominance information. The quantization of the DCT coefficients is based on assumptions about what they represent. This is because the quantization matrix is based on a physical property of the eye while the pixel-based DCT coefficients have no physical meaning. Assumptions must therefore be made about the device used to display the decompressed image. An image in CRT display will have lower resolution than that produced on high resolution printer with a correspondingly different set of optimal quantization coefficients. Quantization also produces artifacts such as "banding" and "contouring" as well as a loss of intensity levels. These effects are further magnified by the need to compress the image as a series of subimage blocks due to the complexity of the DCT algorithm. At higher compression rates the combination of these effects and discontinuities can lead to visible "blocking" artifacts. Further effects are caused by the need to represent edge information. The DCT attempts to reconstruct the edge into a series of cosine functions.

The edge can never be completely represented in this manner, with the result that decompressed edges exhibit "ringing" artifacts. In addition, information is lost throughout the process due to rounding errors resulting from an implementation in 8 bit integer precision.

## End Notes


1. Shannon, C.E. "A Mathematical Theory of Communication." *The Bell System's Technical Journal XXXII(3)*: 379-423 (1948).
2. Gonzalez, R.C. and Woods R.E. *Digital Image Processing*. New York: Addison Wesley (1992): 110.
3. Ford A.M., Jacobson R.E., and G.G. Attridge. "Effects of Image Compression on Image Quality." *Photographic Science 43* (1995): 52-57.
4. Kinoshita H., and T. Yamamuro. "Image Quality with Reiterative JPEG compression." *Imaging Science Technology 39* (1995): 306-312.
5. Jacobby, K. *Characterization of the effects of Spatial translations on JPEG-compressed image.* (Rochester, New York: Senior Project, Rochester Institute of Technology, 1998).
6. Ford A.M., Fagard-Jenkin R.B. and R.E. Jacobsen. "Information Loss in Image Compression." *Imaging Science 46* (1998): 159-160.

# Chapter 4

## Hypothesis

Image quality with the joint Photographic Experts Group (JPEG) repetitive compression combined with DCT block rearrangement operationis was evaluated by performing observer tests. The influence of the simple repetition of JPEG operations was studied as described in the introduction. It was evident that repetition factor had no influence on the final image quality, and thus the initial compression established the base image quality. So, it was clear that one can use a compressed image repeatedly. However, two different image-composing operations may not always fit the same block arrangements, as defined by the DCT operation. In this case, it is difficult to retain the initial conditions of the block arrangement, as the image is multiply processed by the JPEG scheme. It is reasonable to think that there will be additional error in the form of artifacts. Furthermore, four hypotheses were stated:

$H_1$: There will be no significant difference in image quality by shifting the image data relative to the original JPEG compression's blocking pattern.

$H_2$: There will be no significant difference in image quality by reiterative JPEG compression with DCT block rearrangement operation.

$H_3$: There will be no significant difference in the amount of the density distribution of the original image by shifting the image data relative to the original JPEG compression's blocking pattern.

$H_4$: There will be no significant difference in the amount of the density distribution of the original image by reiterative JPEG compression with DCT block rearrangement operation.

The rejection and acceptance of the hypotheses will be evaluated with ANOVA and F-test with 0.05 level of significance as test statistic.

# Chapter 5

## Methodology

The objective of this thesis is to investigate the effects of the repetition and DCT block rearrangement on JPEG images. Due to the 8x8 blocks of the DCT, there are certain restrictions on the kinds of manipulations that can be done on JPEG image. When a JPEG image is cropped, translated, or shifted, the image data are moved relative to the original position of the image according to the first compressed JPEG. Each block is coded by forward discrete cosine transform (FDCT) independently. On the other hand, the image-composing operations do not always fit the same block arrangements, as defined by the DCT operation. A second JPEG compression will transform and arrange many 8x8 blocks of pixels. So the edges of the original blocks will not line up with the blocks of the subsequent compression. Because there is now an edge that exists in the 8x8 block, the DCT operation interprets this edge as a high frequency component, and thus the DCT of the coefficients changes. Of course, when the recompressed file is recomposed into the image, the reconstructed 8x8 block of pixels now differs to some degree from the original JPEG image. The degree of difference depends on several factors. One factor that effects the difference is the compression ratio given to the JPEG compression routine. Another is the frequency content of the image. The objective method to determine the difference between two images is to calculate the root mean squared error (RMSE) for each pixel and the correlation coefficient, and then summarize statistically. The pixel values of the error image show how much an image changed due to an operation.

**Experiment Procedure and Data Collection**

The following was the step to measure the artifacts of the DCT block rearrangement for JPEG repetitive operation.

1. Compression conditions were decided. Compressed color space was RGB.
Subsampling ratio was (1:1:1).

2. Sample evaluation images were made by repetitive JPEG operation and offsetting image data for considering DCT block rearrangement. Samples were made by color proof system.

3. Observer and analytical evaluation were done. The basic analytical evaluations were measured i.e. root mean square error (RMSE) and correlation coefficient.

**Sample images**

Two sample color images, which were named "salad" and "egg" are digital files. The image Salad had high-frequency components, and ice cream had low-frequency components. Each image was converted to R, G, B color channels. These digital images were resampled to 416 x 416 pixels. After the resizing and resampling, the images were saved as TIFF format. These TIFF images provided a baseline image from which a test suite of images were accounted for varying degrees of compression. Then the images were processed with 25, 50, 75 and 100 quality factors (QF) by using MATLAB (See in Appendix A). It had built-in functions that allowed several image file formats to be read into 2-dimensional matrices. It also provided many processing functions, several of which were combined and used to analyze the images. The four resulting JPEG images of each image made up the test suite for that particular image.

Figure 5.1 showed the JPEG repetitive operation scheme. The original image were coded (sampled and quantized) and moved, and the image data were offsetted to change the DCT block sampling and were decoded repeatedly alone up to the designated number. In the present study, the number of offsetted pixels for the image data operations are 0, 1, 2, ...., 8 pixels and the direction was (1,1). The moving pixel unit number leaded to DCT sampling block size 8x8 pixel. The number of repeated operation was 1, 5, ..., 25.

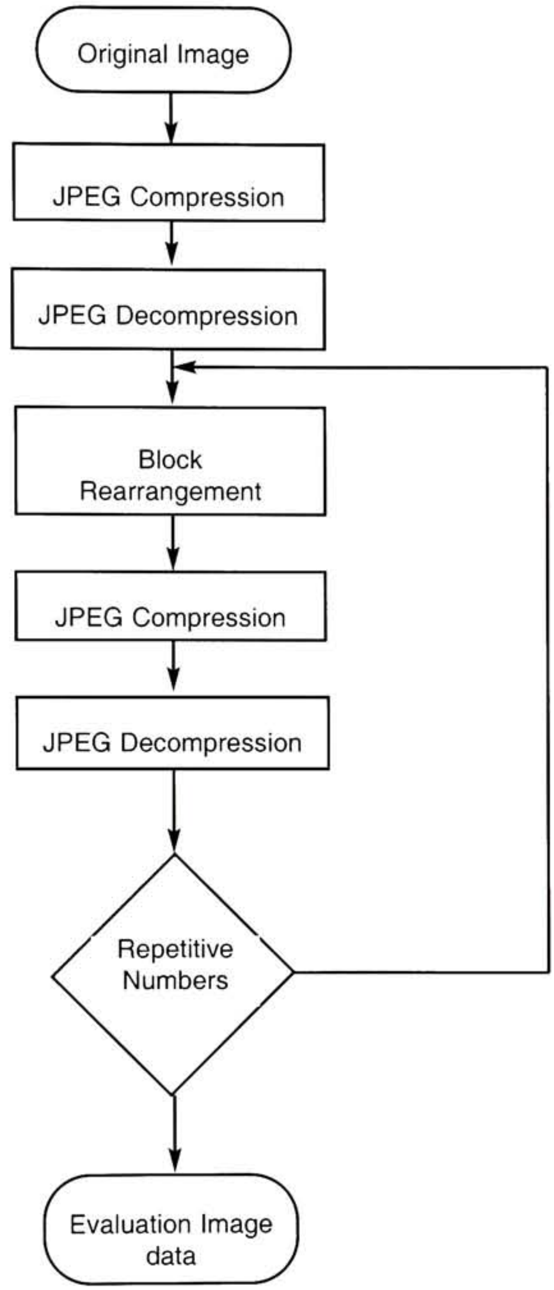



Figure 5.1 A model of JPEG repetitive operation with DCT block rearrangement operation.

**Objective Measurements**[1]

The root mean square error(RMSE), the RMS of an error image, was used for objective measurement. It was calculated using and implemented with the Semper image processing system.[2]

$$\mathrm{RMS} = \sqrt{\frac{1}{xy} \sum_{x=0}^{x} \sum_{y=0}^{y} [e(x,y)]^2}$$

where x is the number of horizontal pixels, y is the number of vertical pixels

$e(x,y) = f'(x,y) - f(x,y)$ where $f(x,y)$ represent an input image and $f'(x,y)$ denote an estimate of $f(x,y)$ that results from compressing and subsequently decompressing the input.

The error image was produced by calculating a difference image from the original JPEG image and a recompressed JPEG image. The RMS value was calculated for red, green, and blue channels separately and a single figure evaluated as
0.299 Red + 0.587 Green + 0.144 Blue.[3]

The correlation coefficient was a measure of the degree of sameness of the two images. It meaned that the relation of new data and old data if both data were the same in every thing the value of coefficient. would be 1.

**Subjective Measurements**

for subjective assessment, images were printed out by Kodak Approval with resolution of 416 by 416 pixels. Total of 8 image data offset steps (1, 2, 3,..., 8 pixels) for the DCT block rearrangement, 1 level of quality factor (QF = 75, the default), and 4 levels of repetition (1, 5, 15, 25), were used. During the visual evaluations, one original image was added as dummy data ( the image with specific quality factor before offsetting image data). There were, then 40 evaluation prints produced for each scene.

Two kinds of scenes were used. Pairs of prints, one for reference and the other for evaluation, were shown, in a random order; one at a time, to observers in a viewing booth which is under 5000 kevin illumination (CIE Illuminant D50).

The scene samples were reviewed by a group of 15 observers. This group of observers were people working in the field of printing or studying in the School of Printing Management and Sciences (SPMS), Rochester Institute of Technology (RIT).

In this observer rating evaluation, the original print was used as a reference print. Other target prints were presented with the reference. In comparing, the two images, observers rated target prints by the use of opinion score. Table 5.1 showed the opinion score for magnitude estimations. These scores range from 1 to 4, representing lowest and highest assessment of the attribute under estimation.

| Opinion score | Opinion criterion |
|---|---|
| 4 | The same as reference |
| 3 | Almost same |
| 2 | Perceptible, slightly worse |
| 1 | Worse |

**Table 5.1 Opinion Score**

## End notes

1. Ford A.M., Jacobson R.E., and A.A. Attridge. "Effects of Image Compression on Image Quality." *Photographic Science 43* (1995): 52-57.
2. Klein S.A., Silverstein A.D., and T. Carney. "Relevance of Human Vision to JPEG-DCT Compression." *Human Vision, Visual Processing and Digital Display III.* SP{IE, 1992: 200-215.
3. Sproson, W.N. *Color Science in Television and Display Systems.* Adam Hilger, 1993: 78.

# Chapter 6

# The Results

## Histogram Analysis of Error Image Results

In assessing how the quantization matrix was associated with image quality two questions could be raised:

1) how much of the perceptually visible
2) how much of the compression is image dependent

In order to answer these questions, it was useful to express the Root Mean Square Error (RMSE). The delta histograms of RMSE was a measured as an error magnitude; these were based on individual pixel differential between the repeatedly decompressed image and the initial decompressed one.

The usual formula for RMSE of an multiply 8 x 8 pixel image was

$$RMSE_{image} = \sqrt{\frac{1}{xy} \sum_{x=0}^{x} \sum_{y=0}^{y} (e_{x,y})^2}$$

where $e_{x,y}$ is the difference between the original and the processed image

RMSE went from a value of 0 in the case of a perfect match between original and processed image, to a value of 128 for the case in which all pixels in the original block had a value of 0. Severe quantization causes all values of the processed block to be at the mean level of 128. Each pixel would then have the maximum discrepancy of 128.

pixel value.

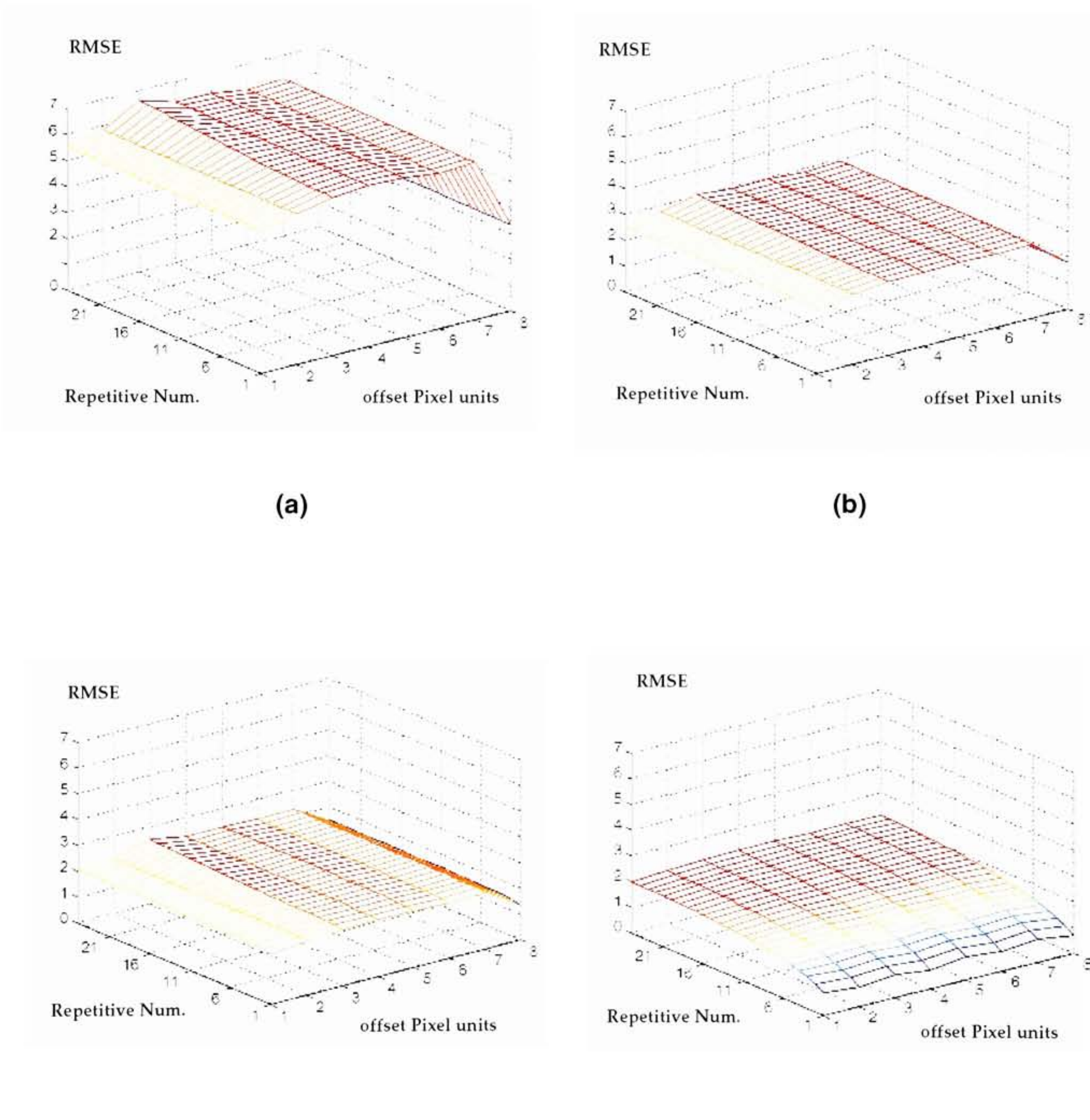
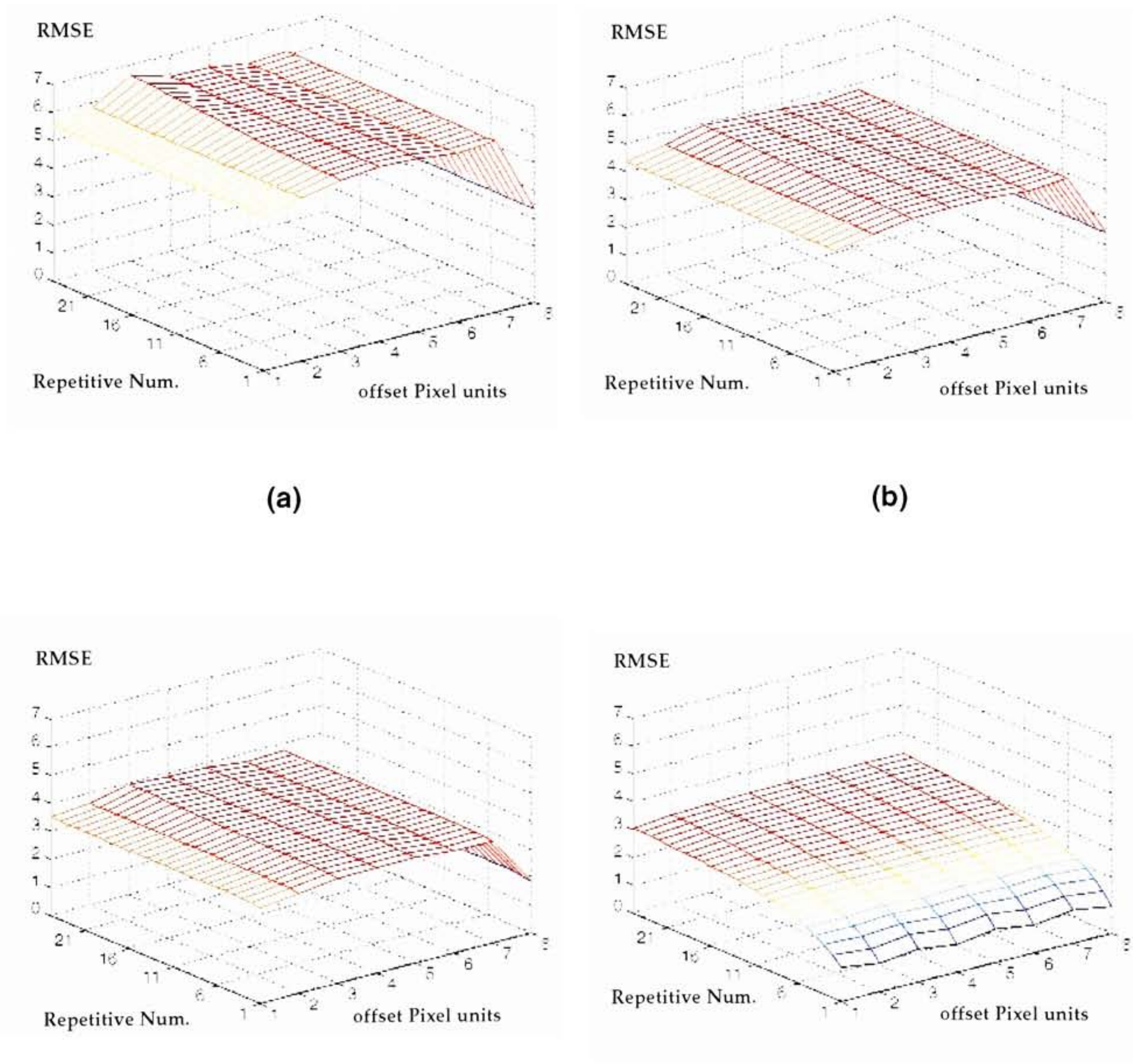



**Figure 6.1** Relationship between offset pixel units and repeated operations.
Data: Egg (Low-frequency image components)
Quality Factor: (a) 25; (b) 50; (c) 75; (d) 100




(a) (b) (c) (d)

**Figure 6.2** Relationship between offset pixel units and repeated operations.
Data: Salad (High- frequency image components)
Quality Factor: (a) 25; (b) 50; (c) 75; (d) 100

Figure 6.1 (Egg data) and 6.2 (Salad data) showed the RMSE, the image offset operation for the DCT block rearrangement as a function of offset pixel unit, and repeated operations for each quality factor (QF). These measurement are shown in appendix C. The histogram analysis of error images provided the most significant statistical relationship for the experimental factors. As the amount of offset increased from 1 pixel to 4 pixel, the RMSE increased. Beyond 4 pixels (5, 6, 7, and 8 pixel offsets), the RMSE of the error image decreased. Especially in 8 pixel offsets, the RMSE of the error image was the least value. Also, the RMSE values from offsetting 5, 6, and 7 pixels were virtually mirroring the behavior of a decreasing offset from 4 to 1 pixels. Since an offset of 1 pixel in one direction is the same, relative to the 8 by 8 blocking scheme of the DCT in JPEG,1 was equal to the offset of 7 pixels in the opposite direction. The same can be said of an offset of 2 pixels and an opposite offset of 6 pixels, and 3 and 5. However, when setting QF was equal to 100, the results were different from the others. Furthermore, those of offsetting even number pixels (2, 4, 6, and 8) were nearly the same. However, offsetting the odd pixel numbers showed lower RMSE values than those of odd pixel numbers. For increasing quality factors, the pixel differences decreased for each image. Basically, the pixel difference level was different from the image structure. High-frequency image components demonstrate considerable pixel failure due to the JPEG operation.

From those figures, the repetitive operation number meant the difference between a repeated operation and the original one; for example, repetitive number 25 means individual pixel differential between the 25th repetitive JPEG operation and the 1st repetition. When setting the QF equal to 25, 50, and 75, all curves showed that the image quality tended to deteriorate with increasing repetitive numbers but not much different. On the other hand, setting the QF equal to 100, the curve showed that the more iterative numbers, the higher pixel differences.

From the evaluation, the combination of repeated JPEG compression and block-image -rearrangement operations would have a bad influence on the image quality. As the image offset unist were equal to the size of the DCT block size or an integer times

block size, the pixel differences were kept first coded image quality without repetitive JPEG conditions. In the case of DCT block size rearrangement unit (8 pixels), the influence of the pixel difference was weak because of the relation with the harmonic of DCT block sampling.

The question was if these observations had enough significance to accept or reject the hypotheses stated in chapter four. The statistical software MINITAB was used to determine the significance of the parameters.

**Table 6.1 Two way Analysis of Variance from Histogram Analysis of Error Images (Egg data)**

Analysis of Variance for EggQF25

| Source | DF | SS | MS | F | P |
|---|---|---|---|---|---|
| Offset | 7 | 38.78967 | 5.54138 | 6878.02 | 0.000 |
| Repetition | 24 | 0.02805 | 0.00117 | 1.45 | 0.09 |
| Error | 168 | 0.13535 | 0.00081 | | |
| Total | 199 | 38.95307 | | | |

Analysis of Variance for EggQF50

| Source | DF | SS | MS | F | P |
|---|---|---|---|---|---|
| Offset | 7 | 27.16017 | 3.88002 | 7419.23 | 0.000 |
| Repetition | 24 | 0.04413 | 0.00184 | 3.52 | 0.000 |
| Error | 168 | 0.08786 | 0.00052 | | |
| Total | 199 | 27.29216 | | | |

Analysis of Variance for EggQF75

| Source | DF | SS | MS | F | P |
|---|---|---|---|---|---|
| Offset | 7 | 13.60182 | 1.94312 | 2351.10 | 0.000 |
| Repetition | 24 | 0.10974 | 0.00457 | 5.53 | 0.000 |
| Error | 168 | 0.13885 | 0.00083 | | |
| Total | 199 | 3.85040 | | | |

Analysis of Variance for EggQF100

| Source | DF | SS | MS | F | P |
|---|---|---|---|---|---|
| Offset | 7 | 0.29984 | 0.04283 | 40.93 | 0.000 |
| Repetition | 24 | 25.31243 | 1.05468 | 1007.80 | 0.000 |
| Error | 168 | 0.17581 | 0.00105 | | |
| Total | 199 | 25.78808 | | | |

**Table 6.2 Two way Analysis of Variance from Histogram Analysis of Error Images (Salad data)**

Analysis of Variance for SaladQF25

| Source | DF | SS | MS | F | P |
|---|---|---|---|---|---|
| Offset | 7 | 172.5220 | 24.6460 | 7555.02 | 0.000 |
| Repetition | 24 | 0.0880 | 0.0037 | 1.12 | 0.323 |
| Error | 168 | 0.5481 | 0.0033 | | |
| Total | 199 | 173.1581 | | | |

Analysis of Variance for SaladQF50

| Source | DF | SS | MS | F | P |
|---|---|---|---|---|---|
| Offset | 7 | 114.6195 | 16.3742 | 4.6E+04 | 0.000 |
| Repetition | 24 | 0.0208 | 0.0009 | 2.42 | 0.001 |
| Error | 168 | 0.0601 | 0.0004 | | |
| Total | 199 | 114.7004 | | | |

Analysis of Variance for SaladQF75

| Source | DF | SS | MS | F | P |
|---|---|---|---|---|---|
| Offset | 7 | 71.33180 | 10.19026 | 3.0E+04 | 0.000 |
| Repetition | 24 | 0.06510 | 0.00271 | 8.10 | 0.000 |
| Error | 168 | 0.05628 | 0.0003 | | |
| Total | 199 | 71.45318 | | | |

Analysis of Variance for SaladQF100

| Source | DF | SS | MS | F | P |
|---|---|---|---|---|---|
| Offset | 7 | 0.35793 | 0.05113 | 35.24 | 0.000 |
| Repetition | 24 | 63.09463 | 2.62894 | 1811.78 | 0.000 |
| Error | 168 | 0.24377 | 0.00145 | | |
| Total | 199 | 63.69633 | | | |

From the Table 6.1 and 6.2, the results showed that there is a significant difference in image quality by shifting the image data. It is also a significant difference in image quality by reiterate JPEG compress with DCT block rearrangement operation. Except, at QF equal to 25 (the high compression ratio) for both image data that the image data did not deteriorate with the number of repeated DCT JPEG operations.

**Table 6.3 Analysis of Variance from Histogram Analysis of Error Images**

Analysis of Variance (Balanced Designs)

| Factor | Type | Levels | Values |
|---|---|---|---|
| QF | fixed | 4 | 25 50 75 100 |
| Offset | fixed | 8 | 1 2 3 4 5 6 7 8 |
| Image | fixed | 2 | egg salad |

Analysis of Variance for RMSE

| Source | DF | SS | MS | F | P |
|---|---|---|---|---|---|
| QF | 3 | 1360.03 | 453.34 | 2550.51 | 0.000 |
| Offset | 7 | 282.71 | 40.39 | 227.22 | 0.000 |
| Image | 1 | 917.30 | 917.30 | 5160.72 | 0.000 |
| Offset*Image | 7 | 40.15 | 5.74 | 32.27 | 0.000 |
| Error | 1581 | 281.02 | 0.18 | | |
| Total | 1599 | 2881.21 | | | |

Analysis of Variance (Balanced Designs)

| Factor | Type | Levels | Values |
|---|---|---|---|
| QF | random | 4 | 25 50 75 100 |
| Repetition | fixed | 25 | 1 2 3 4 5 6 7<br>8 9 10 11 12 13 14<br>15 16 17 18 19 20 21<br>22 23 24 25 |
| Image | fixed | 2 | egg salad |

Analysis of Variance for RMSE

| Source | DF | SS | MS | F | P |
|---|---|---|---|---|---|
| QF | 3 | 1360.030 | 453.343 | 1214.86 | 0.000 |
| Repetition | 24 | 25.559 | 1.065 | 2.85 | 0.000 |
| Image | 1 | 917.299 | 917.299 | 2458.16 | 0.000 |
| Repetition *Image | 24 | 1.035 | 0.043 | 0.12 | 1.000 |
| Error | 547 | 577.287 | 0.373 | | |
| Total | 1599 | 2881.211 | | | |

From table 6.3, the analysis of various indicated that there was a significance in the density distribution of the image by shifting the image data. It was also no significance the density distribution of the image by reiterate JPEG compress with DCT block rearrangement operation.

**Sample Image Evaluation**

This evaluation was done in order to determine the image quality under the influence of repetitive JPEG compressions with DCT block rearrangement units , using the JPEG baseline scheme as a lossy image-compression method at quality factor 75 (default).

Figure 6.3 and 6.4 shows the relationships between the number of block rearrangement units and the observer ratings. The scores range from 1 to 4, representing lowest and highest assessment of the attribute under the estimation.(See table 5.1)

**Figure 6.3 Relationship between observer rating and repetitive JPEG operation numbers (Egg data)**

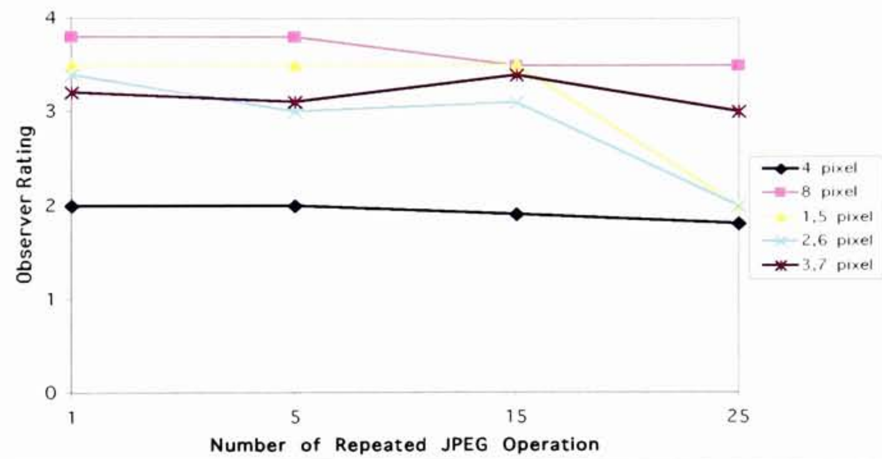
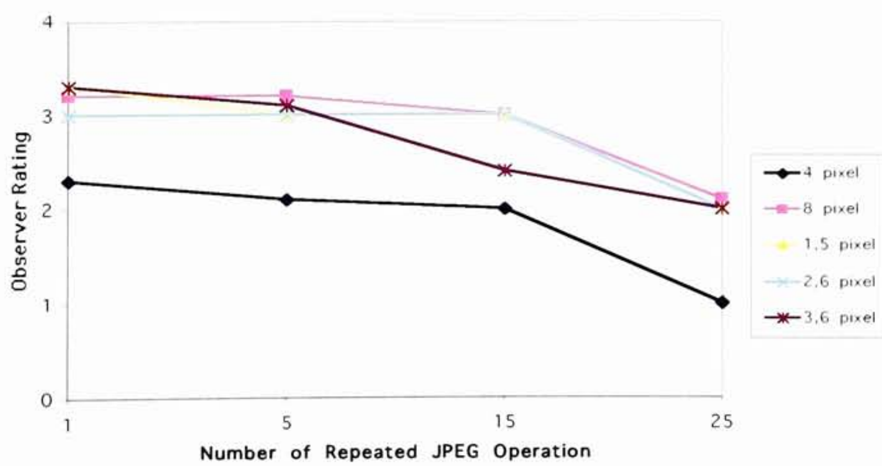



**Figure 6.4 Relationship between observer rating and repetitive JPEG operation numbers (Salad data)**



Figures 6.3 and 6.4 suggest that the images do not maintain the original quality. The image quality coded by JPEG scheme was likely to deteriorate through a combination of rearrangement DCT block operations and JPEG repetitive coding.These figures shows that the moving pixel differed the image quality while the results of image quality tended to deteriorate with the number of repeated JPEG operations but not much differ. Finally, the image consisting of high-frequency components shows more error than the low-frequency component image. And the images showed the degradations such as blockiness, ringing, and blur.

# Chapter 7

# Conclusion

This thesis investigated the effect of the compression algorithm in the presence of translation and cropping on image quality, using the JPEG baseline scheme as a lossy comoression method. This was the combination of repeated JPEG and the DCT block rearrangement operation. Since as described in the introduction, it was clear that the JPEG image quality was affected by the compression ratio and the image tranform scheme, and the simple repeated JPEG compression was not influence on image quailty. Consequently, this research showed that it was important to measure image quality under the influence of changing DCT block rearrangements and repeating the compression operations.

In this research three hypothese were stated:

$H_1$: *There will be no significant difference in image quality by shifting the image data relative to the original JPEG compression's blocking pattern.*
This hypothesis could be rejected.

$H_2$: *There will be no significant difference in image quality by reiterative JPEG compression with DCT block rearrangement operation.*
This hypothesis could be rejected.

$H_3$: *There will be no significant difference in the amount of the density distribution of the original image by shifting the image data relative to the original JPEG compression's blocking pattern.*

This hypothesis could be rejected.

$H_4$: *There will be no significant difference in the amount of the density distribution of the original image by reiterative JPEG compression with DCT block rearrangement operation.*

This hypothesis could be accepted.

The discrete cosine transform (DCT), used by JPEG, has been the predominant transformation used for digital raster image compression. Two of the important reasons for this are:

- The DCT has a fast algorithm for implementing the transform.
- Previous extensive testing has shown that the DCT gives visually better quality better quality images at higher compression ratio than the other transformation schemes.

The forward DCT (FDCT) transforms a block of original data into a new set of values. The inverse DCT(IDCT) reverses this process and restores the original data values. In theory, no information is lost when it is transformed and then restored. However, in practice, there is some information loss due to two factors;

1) The cosine values can not be calculated exactly because they are transcendental numbers.

2) Repeated calculations using limited precision numbers introduce round-off errors into the final result.

However, the variance between the errored data values and the original data values are typically small.

In this research, investigating the effect of the compression algorithm in the presence of translation and cropping on image quality combining repeated JPEG operations. The experiment shows that the combination of image offset operations had affected the total image quality. However, under the simple repeated JPEG operation, the iterative factor has not afftected the image quality. And it is clear that JPEG image quality was affected by both the compression ratio and the image transform scheme. The JPEG scheme has block coding by DCT operation. The image blocking has no regulations for the spatial variations. For the JPEG baseline scheme, the DCT data length is an 8-bit integer and the DCT data length is a 12-bit integer, thus the DCT was calculated with real precision. Also, using a uniform quantizer, the counting error of the rounding operation was included in the combined operations. The variance of the observer rating with repetitive numbers is low in relation to the actual iterative image compression simulation. This means that the error image by the first compression operations had determined a base image quality. Consequently,under the repeated JPEG operation, the iterative factor has not much afftected the image quality.The image consisting of high-frequency components shows more error than that present in the low-frequency-component image. However, The first compression much accounted for the most of the image information loss by JPEG compression.

The most frequently used instrumental measures, the root mean square errors (RMSE) used in this research is based on the statistical distribution of pixel value differences between the original and the degraded image. However, it does not correlate well with subjective quality measure, espcially not when quality is determined by multiple attributes. These objective measures represent the image quality as a single scalar value which does not reveal the effect of the seperate impairments on image quality.

The results of the observer evaluation showed that the combined operations have influenced the image quality althouth it is known that at low compression ratio has no influence on visual quality. However, the repeated operations has not much affected on visual quality. And as the visual assessment of the images can be indentified a number of distortions caused by JPEG compression. At higher compression rates a block pattern is produced in images. It is caused by the fact that sub-image blocks are compressed independently and so the blockiness artifacts are visible as discontinuities at adjacent 8x8 block boundaries.distortion introduced is discontinuous between blocks. Quantization of the low frequencies and high frequencies cause images blur and loss of detail.If there is little detail in the sub-image then most of the of the energy will be concentrated in the mean(DC) coefficient and the changes in mean luminance and the changes im mean luminance and the regular structure of the effect will be increasingly visible. The ringing artifacts appear asrings to arise at sharp, edges in the original image. The rings are caused by Gibb's phenomenon, an effect produced by inability of the DCT cosine basis functions to exactly reproduce square wave functions.JPEG images have two effects on color and tone reproduction. First rounding errors, and errors produced by quantization, reduce the precision of the reconstructed image. This can cause shifts in tone. Second, although the presence of ringing at boundaries may be imperceptible to observers, an additional effect of the rings is to change the local contrast of the edge.

The graphic arts industry has been considerable interested in the standard data compression technology. JPEG was a dominant standard in imaging applications. It can be implemented in either hardware or software. There is possible that users will involuntarily combine already JPEG-coded images as source images for image processing. Although color images are data intensive, the JPEG image is the space variant for the JPEG scheme. This thesis investigated the image quality of a simple combination of operations. For practical use, for example in the image material archives coding scheme and in finished image archives, thus JPEG usage guidelines will be needed.

## Bibliography


Bill, T., A. Moffat, and I. Witten. *Managing Gigabytes.* New York: Van Nostrand Reinhold, 1994.

Champion, M. "Genetic algorithm and tabu search approaches to quantization for DCT-based image compression." Master's thesis, Rochester Institute of Technology, 1999.

Eskicioglu, A, and P. Fisher. "Image quality masures and their performance." *IEEE Transactions on Communications* Vol. 43(12), pp. 2959 - 2965, 1995.

Gonzalez, C., and E. Woods. *Digital Image Processing.* Massachusetts: Addison - Wesley, 1992.

Goodenow, D. "A reference guide to JPEG compression." Master's thesis, Rochester Institute of Technology, 1993.

Horne, R., and S. Sangwine. *The Color Image Processing Handbook.* New York: Chapman & Hill, 1998.

Jones, P. and M. Rabbani. *Digital Image compression Techniques.* Washington: A publication of SPIE, 1991.

Kou, W. *Digital Image Compression Algorithms and standards.* Massachusetts: Klumar Academic, 1995.

Marchand, P. *Graphics and GUIs with MATLAB.* New York: CRC Press, 1996.

Martens, J. and L. Meesters. "Blockiness in JPEG - coded images." *Human Vision and Electronic Imaging IV.* Washington: A publication of SPIE, 1999.

Miano, J. *Compressed image file formats: JPEG, PNG, GIF, XBM, BMP.* Massachusetts: Addison - Wesley, 1999.

Moroney, N. "Color space selection for JPEG compression." Master's thesis, Rochester Institute of Technology, 1993.

Pennebaker, W. *JPEG still image data compression standard.* New York: Van Nostrand Reinhold, 1993.

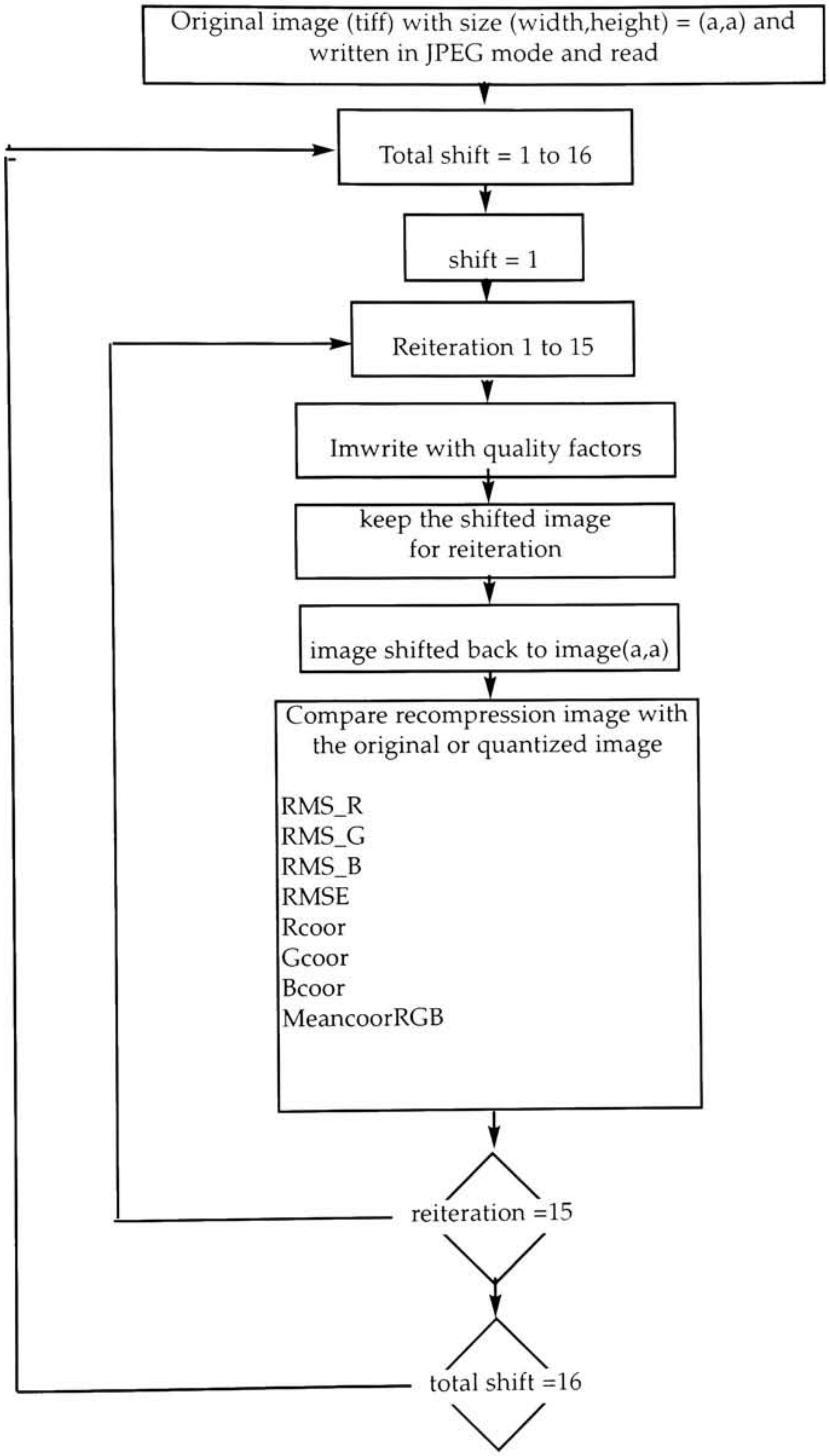
Romano, F., and R. Romano. *Encyclopedia of Graphic communication.* New Jersey: Graphic Arts Technical Foundation, 1998.

Sproson, N. *Color Science in Television and Display Systems.* Bristol: Hilger, 1983

## Appendix A: MatLab Routines

```
%    this program used to measure the image quality under the influence of changing DCT
%    block rearrangement and repetitive JPEG operations, and to evaluate the resulting
%    encoding error

IMG=imread('salad.tif','tif');
imwrite(IMG,'salad.jpg','jpg');
IMG1=imread('salad.jpg','jpg');           % original picture
totalshift = 16                           % test with the shifted picture both column and row
fprintf('\n Total shift from 1 to  %2.0f time \n',totalshift)
for k =1:totalshift
shift=k
cellwidth = 416 + shift % column
cellheight = 416 + shift % row
A1=zeros(416,416);                        % zeros(row,column)
B1=zeros(416,416);
C1=zeros(416,416);
A2=zeros(416,416);
B2=zeros(416,416);
C2=zeros(416,416);
%IMGinp=imread('space1.jpg','jpg');
%IMGinp(:,:,:)=0 ;
IMGinput=zeros(cellwidth,cellheight,3);
IMGinp =uint8(IMGinput);
T1=zeros(cellheight,cellwidth);
T2=zeros(cellheight,cellwidth);
T3=zeros(cellheight,cellwidth);
P1=zeros(cellheight,cellwidth);
P2=zeros(cellheight,cellwidth);
P3=zeros(cellheight,cellwidth);

for i =1:416
  for j = 1:416
    A1(i,j) =IMG1(i,j,1);
    B1(i,j) =IMG1(i,j,2);
    C1(i,j) =IMG1(i,j,3);
    IMGinp(i,j+shift,1) =IMG1(i,j,1);
    IMGinp(i,j+shift,2) =IMG1(i,j,2);
    IMGinp(i,j+shift,3) =IMG1(i,j,3);
  end
end
```

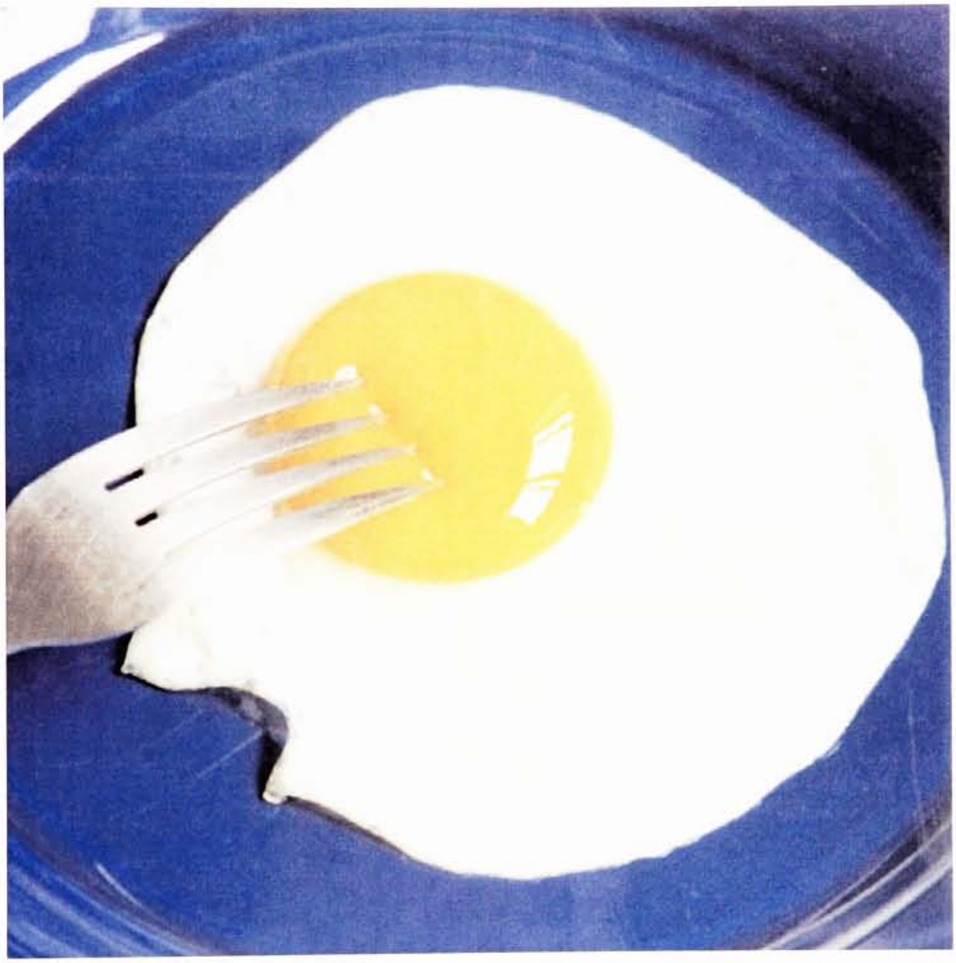
```
IMGstart=IMGinp ;
for m = 1:3                    % if need to change the reiterate time changing :3 to other value
  imwrite(IMGstart,'egg75.jpg','jpg','quality',75);
  IMG1QF=imread('egg75.jpg','jpg');
for i =1:cellheight
  for j = 1:cellwidth
    P1(i,j) =IMG1QF(i,j,1);
    P2(i,j) =IMG1QF(i,j,2);
    P3(i,j) =IMG1QF(i,j,3);
  end
end
for i =1:416
  for j = 1 : 416

    A2(i,j)=P1(i,j+shift) ;
    B2(i,j)=P2(i,j+shift) ;
    C2(i,j)=P3(i,j+shift) ;
  end
end
IMGstart=IMG1QF ;
D1=A1-A2 ;
D2=B1-B2 ;
D3=C1-C2 ;
fprintf('\n The %2.0f reiteratation of DCT \n',m)
RMS_red =sqrt(sum(sum(D1.^2))/(416*416))
%RMS_red
RMS_green =sqrt(sum(sum(D2.^2))/(416*416))
%RMS_green
RMS_blue =sqrt(sum(sum(D3.^2))/(416*416))
%RMS_blue
RMSE = 0.299*RMS_red+0.587*RMS_green+0.114*RMS_blue
Rcorr=corr2(A1,A2);
Rcorr
Gcorr=corr2(B1,B2);
Gcorr
Bcorr=corr2(C1,C2);
Bcorr
meanRGBcorr=(Rcorr+Gcorr+Bcorr)/3
end
end
```




**This is the flowchart for MATLAB routines**

## Appendix B: Images

Salad (High frequency image data)



Egg (Low frequency image data)

# Appendix C

**Table C(1)-1. Raw data of RMSE on Egg data at QF. 25**

| | Offset Num. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|
| | cellwidth | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 |
| | cellheight | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 |
| 1 | reiteration | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | RMSE | 3.2080 | 3.5965 | 3.8462 | 3.9993 | 3.9194 | 3.9221 | 3.8591 | 2.6923 |
| | meanRGBcor | 0.9991 | 0.9987 | 0.9984 | 0.9983 | 0.9984 | 0.9984 | 0.9983 | 0.9989 |
| 2 | reiteration | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | RMSE | 3.2147 | 3.6020 | 3.8713 | 4.0051 | 3.9197 | 3.9303 | 3.8661 | 2.7003 |
| | meanRGBcor | 0.9991 | 0.9987 | 0.9984 | 0.9983 | 0.9984 | 0.9984 | 0.9983 | 0.9989 |
| 3 | reiteration | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | RMSE | 3.2154 | 3.6076 | 3.8771 | 4.0070 | 3.9213 | 3.9354 | 3.8694 | 2.7003 |
| | meanRGBcor | 0.9991 | 0.9987 | 0.9984 | 0.9983 | 0.9984 | 0.9984 | 0.9983 | 0.9989 |
| 4 | reiteration | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| | RMSE | 3.2150 | 3.6082 | 3.8833 | 4.0090 | 3.9213 | 3.9362 | 3.8710 | 2.7003 |
| | meanRGBcor | 0.9991 | 0.9987 | 0.9984 | 0.9983 | 0.9984 | 0.9984 | 0.9983 | 0.9989 |
| 5 | reiteration | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| | RMSE | 3.2124 | 3.6082 | 3.8903 | 4.0113 | 3.9213 | 3.9362 | 3.8710 | 2.7003 |
| | meanRGBcor | 0.9991 | 0.9987 | 0.9984 | 0.9983 | 0.9984 | 0.9984 | 0.9983 | 0.9989 |
| 6 | reiteration | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| | RMSE | 3.2122 | 3.6082 | 3.8985 | 4.0145 | 3.9213 | 3.9362 | 3.8710 | 2.7003 |
| | meanRGBcor | 0.9991 | 0.9987 | 0.9984 | 0.9983 | 0.9984 | 0.9984 | 0.9983 | 0.9989 |
| 7 | reiteration | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| | RMSE | 3.2120 | 3.6082 | 3.9085 | 4.0183 | 3.9213 | 3.9362 | 3.8710 | 2.7003 |
| | meanRGBcor | 0.9991 | 0.9987 | 0.9984 | 0.9983 | 0.9984 | 0.9984 | 0.9983 | 0.9989 |
| 8 | reiteration | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| | RMSE | 3.2121 | 3.6082 | 3.9201 | 4.0230 | 3.9213 | 3.9362 | 3.8710 | 2.7003 |
| | meanRGBcor | 0.9991 | 0.9987 | 0.9984 | 0.9983 | 0.9984 | 0.9984 | 0.9983 | 0.9989 |
| 9 | reiteration | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 |
| | RMSE | 3.2120 | 3.6082 | 3.9334 | 4.0283 | 3.9213 | 3.9362 | 3.8710 | 2.7003 |
| | meanRGBcor | 0.9991 | 0.9987 | 0.9984 | 0.9983 | 0.9984 | 0.9984 | 0.9983 | 0.9989 |
| 10 | reiteration | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| | RMSE | 3.2120 | 3.6082 | 3.9484 | 4.0339 | 3.9213 | 3.9362 | 3.8710 | 2.7003 |
| | meanRGBcor | 0.9991 | 0.9987 | 0.9984 | 0.9983 | 0.9984 | 0.9984 | 0.9983 | 0.9989 |
| 11 | reiteration | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 |
| | RMSE | 3.2120 | 3.6082 | 3.9650 | 4.0339 | 3.9213 | 3.9362 | 3.8710 | 2.7003 |
| | meanRGBcor | 0.9991 | 0.9987 | 0.9984 | 0.9983 | 0.9984 | 0.9984 | 0.9983 | 0.9989 |

| | Offset Num. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|
| | cellwidth | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 |
| | cellheight | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 |
| 12 | reiteration | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| | RMSE | 3.2120 | 3.6082 | 3.9826 | 4.0339 | 3.9213 | 3.9362 | 3.8710 | 2.7003 |
| | meanRGBcor | 0.9991 | 0.9987 | 0.9984 | 0.9983 | 0.9984 | 0.9984 | 0.9983 | 0.9989 |
| 13 | reiteration | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 |
| | RMSE | 3.2120 | 3.6082 | 3.9942 | 4.0339 | 3.9213 | 3.9362 | 3.8710 | 2.7003 |
| | meanRGBcor | 0.9991 | 0.9987 | 0.9983 | 0.9983 | 0.9984 | 0.9984 | 0.9983 | 0.9989 |
| 14 | reiteration | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 |
| | RMSE | 3.2121 | 3.6082 | 4.0011 | 4.0339 | 3.9213 | 3.9362 | 3.8710 | 2.7003 |
| | meanRGBcor | 0.9991 | 0.9987 | 0.9983 | 0.9983 | 0.9984 | 0.9984 | 0.9983 | 0.9989 |
| 15 | reiteration | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| | RMSE | 3.2121 | 3.6082 | 4.0103 | 4.0339 | 3.9213 | 3.9362 | 3.8710 | 2.7003 |
| | meanRGBcor | 0.9991 | 0.9987 | 0.9983 | 0.9983 | 0.9984 | 0.9984 | 0.9983 | 0.9989 |
| 16 | reiteration | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 |
| | RMSE | 3.2121 | 3.6082 | 4.0186 | 4.0339 | 3.9213 | 3.9362 | 3.8710 | 2.7003 |
| | meanRGBcor | 0.9991 | 0.9987 | 0.9983 | 0.9983 | 0.9984 | 0.9984 | 0.9983 | 0.9989 |
| 17 | reiteration | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 17 |
| | RMSE | 3.2121 | 3.6082 | 4.0275 | 4.0339 | 3.9213 | 3.9362 | 3.8710 | 2.7003 |
| | meanRGBcor | 0.9991 | 0.9987 | 0.9983 | 0.9983 | 0.9984 | 0.9984 | 0.9983 | 0.9989 |
| 18 | reiteration | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 |
| | RMSE | 3.2121 | 3.6082 | 4.0368 | 4.0339 | 3.9213 | 3.9362 | 3.8710 | 2.7003 |
| | meanRGBcor | 0.9991 | 0.9987 | 0.9983 | 0.9983 | 0.9984 | 0.9984 | 0.9983 | 0.9989 |
| 19 | reiteration | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 |
| | RMSE | 3.2121 | 3.6082 | 4.0467 | 4.0339 | 3.9213 | 3.9362 | 3.8710 | 2.7003 |
| | meanRGBcor | 0.9991 | 0.9987 | 0.9983 | 0.9983 | 0.9984 | 0.9984 | 0.9983 | 0.9989 |
| 20 | reiteration | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| | RMSE | 3.2121 | 3.6082 | 4.0572 | 4.0339 | 3.9213 | 3.9362 | 3.8710 | 2.7003 |
| | meanRGBcor | 0.9991 | 0.9987 | 0.9983 | 0.9983 | 0.9984 | 0.9984 | 0.9983 | 0.9989 |
| 21 | reiteration | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 |
| | RMSE | 3.2121 | 3.6082 | 4.0681 | 4.0339 | 3.9213 | 3.9362 | 3.8710 | 2.7003 |
| | meanRGBcor | 0.9991 | 0.9987 | 0.9983 | 0.9983 | 0.9984 | 0.9984 | 0.9983 | 0.9989 |
| 22 | reiteration | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 |
| | RMSE | 3.2121 | 3.6082 | 4.0796 | 4.0339 | 3.9213 | 3.9362 | 3.8710 | 2.7003 |
| | meanRGBcor | 0.9991 | 0.9987 | 0.9983 | 0.9983 | 0.9984 | 0.9984 | 0.9983 | 0.9989 |
| 23 | reiteration | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 |
| | RMSE | 3.2121 | 3.6082 | 4.0916 | 4.0339 | 3.9213 | 3.9362 | 3.8710 | 2.7003 |
| | meanRGBcor | 0.9991 | 0.9987 | 0.9983 | 0.9983 | 0.9984 | 0.9984 | 0.9983 | 0.9989 |
| 24 | reiteration | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 |
| | RMSE | 3.2121 | 3.6082 | 4.1041 | 4.0339 | 3.9213 | 3.9362 | 3.8710 | 2.7003 |
| | meanRGBcor | 0.9991 | 0.9987 | 0.9983 | 0.9983 | 0.9984 | 0.9984 | 0.9983 | 0.9989 |
| 25 | reiteration | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | RMSE | 3.2121 | 3.6082 | 4.1172 | 4.0339 | 3.9213 | 3.9362 | 3.8710 | 2.7003 |
| | meanRGBcor | 0.9991 | 0.9987 | 0.9983 | 0.9983 | 0.9984 | 0.9984 | 0.9983 | 0.9989 |

Table C(1)-2. Raw data of RMSE on Egg data at QF. 50

| | Offset Num. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|
| | cellwidth | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 |
| | cellheight | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 |
| 1 | reiteration | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | RMSE | 2.4819 | 2.7223 | 2.8505 | 2.8972 | 2.9036 | 2.8501 | 2.8707 | 1.7955 |
| | meanRGBcor | 0.9994 | 0.9992 | 0.9991 | 0.9991 | 0.9991 | 0.9991 | 0.9991 | 0.9995 |
| 2 | reiteration | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | RMSE | 2.5230 | 2.7469 | 2.8720 | 2.9097 | 2.9172 | 2.8650 | 2.8872 | 1.8068 |
| | meanRGBcor | 0.9994 | 0.9992 | 0.9991 | 0.9991 | 0.9991 | 0.9991 | 0.9991 | 0.9995 |
| 3 | reiteration | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | RMSE | 2.5261 | 2.7514 | 2.8777 | 2.9158 | 2.9234 | 2.8745 | 2.8979 | 1.8095 |
| | meanRGBcor | 0.9994 | 0.9992 | 0.9991 | 0.9991 | 0.9991 | 0.9991 | 0.9991 | 0.9995 |
| 4 | reiteration | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| | RMSE | 2.5303 | 2.7508 | 2.8821 | 2.9176 | 2.9266 | 2.8809 | 2.9051 | 1.8111 |
| | meanRGBcor | 0.9994 | 0.9992 | 0.9991 | 0.9991 | 0.9991 | 0.9991 | 0.9991 | 0.9994 |
| 5 | reiteration | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| | RMSE | 2.5331 | 2.7504 | 2.8876 | 2.9189 | 2.9275 | 2.8831 | 2.9145 | 1.8111 |
| | meanRGBcor | 0.9994 | 0.9992 | 0.9991 | 0.9991 | 0.9991 | 0.9991 | 0.9991 | 0.9994 |
| 6 | reiteration | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| | RMSE | 2.5327 | 2.7501 | 2.8943 | 2.9204 | 2.9288 | 2.8835 | 2.9220 | 1.8111 |
| | meanRGBcor | 0.9994 | 0.9992 | 0.9991 | 0.9991 | 0.9991 | 0.9991 | 0.9991 | 0.9994 |
| 7 | reiteration | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| | RMSE | 2.5312 | 2.7496 | 2.9022 | 2.9214 | 2.9303 | 2.8846 | 2.9265 | 1.8111 |
| | meanRGBcor | 0.9994 | 0.9992 | 0.9991 | 0.9991 | 0.9991 | 0.9991 | 0.9990 | 0.9994 |
| 8 | reiteration | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| | RMSE | 2.5305 | 2.7495 | 2.9115 | 2.9223 | 2.9321 | 2.8846 | 2.9307 | 1.8111 |
| | meanRGBcor | 0.9994 | 0.9992 | 0.9991 | 0.9991 | 0.9991 | 0.9991 | 0.9990 | 0.9994 |
| 9 | reiteration | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 |
| | RMSE | 2.5294 | 2.7490 | 2.9220 | 2.9232 | 2.9342 | 2.8846 | 2.9348 | 1.8111 |
| | meanRGBcor | 0.9994 | 0.9992 | 0.9991 | 0.9991 | 0.9991 | 0.9991 | 0.9990 | 0.9994 |
| 10 | reiteration | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| | RMSE | 2.5290 | 2.7493 | 2.9339 | 2.9243 | 2.9364 | 2.8846 | 2.9365 | 1.8111 |
| | meanRGBcor | 0.9994 | 0.9992 | 0.9991 | 0.9991 | 0.9991 | 0.9991 | 0.9990 | 0.9994 |
| 11 | reiteration | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 |
| | RMSE | 2.5282 | 2.7492 | 2.9471 | 2.9255 | 2.9390 | 2.8846 | 2.9365 | 1.8111 |
| | meanRGBcor | 0.9994 | 0.9992 | 0.9991 | 0.9991 | 0.9991 | 0.9991 | 0.9990 | 0.9994 |
| 12 | reiteration | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| | RMSE | 2.5277 | 2.7492 | 2.9613 | 2.9269 | 2.9417 | 2.8846 | 2.9365 | 1.8111 |
| | meanRGBcor | 0.9994 | 0.9992 | 0.9991 | 0.9991 | 0.9991 | 0.9991 | 0.9990 | 0.9994 |

| | Offset Num. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|
| | cellwidth | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 |
| | cellheight | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 |
| 13 | reiteration | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 |
| | RMSE | 2.5274 | 2.7492 | 2.9718 | 2.9285 | 2.9447 | 2.8846 | 2.9365 | 1.8111 |
| | meanRGBcor | 0.9994 | 0.9992 | 0.9991 | 0.9991 | 0.9991 | 0.9991 | 0.9990 | 0.9994 |
| 14 | reiteration | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 |
| | RMSE | 2.5272 | 2.7492 | 2.9813 | 2.9302 | 2.9478 | 2.8846 | 2.9365 | 1.8111 |
| | meanRGBcor | 0.9994 | 0.9992 | 0.9991 | 0.9991 | 0.9991 | 0.9991 | 0.9990 | 0.9994 |
| 15 | reiteration | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| | RMSE | 2.5271 | 2.7492 | 2.9919 | 2.9320 | 2.9478 | 2.8846 | 2.9365 | 1.8111 |
| | meanRGBcor | 0.9994 | 0.9992 | 0.9991 | 0.9991 | 0.9991 | 0.9991 | 0.9990 | 0.9994 |
| 16 | reiteration | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 |
| | RMSE | 2.5271 | 2.7492 | 2.9993 | 2.9340 | 2.9478 | 2.8846 | 2.9365 | 1.8111 |
| | meanRGBcor | 0.9994 | 0.9992 | 0.9991 | 0.9991 | 0.9991 | 0.9991 | 0.9990 | 0.9994 |
| 17 | reiteration | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 17 |
| | RMSE | 2.5270 | 2.7492 | 3.0061 | 2.9362 | 2.9478 | 2.8846 | 2.9365 | 1.8111 |
| | meanRGBcor | 0.9994 | 0.9992 | 0.9991 | 0.9991 | 0.9991 | 0.9991 | 0.9990 | 0.9994 |
| 18 | reiteration | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 |
| | RMSE | 2.5270 | 2.7492 | 3.0152 | 2.9382 | 2.9478 | 2.8846 | 2.9365 | 1.8111 |
| | meanRGBcor | 0.9994 | 0.9992 | 0.9991 | 0.9991 | 0.9991 | 0.9991 | 0.9990 | 0.9994 |
| 19 | reiteration | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 |
| | RMSE | 2.5270 | 2.7492 | 3.0248 | 2.9407 | 2.9478 | 2.8846 | 2.9365 | 1.8111 |
| | meanRGBcor | 0.9994 | 0.9992 | 0.9991 | 0.9991 | 0.9991 | 0.9991 | 0.9990 | 0.9994 |
| 20 | reiteration | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| | RMSE | 2.5270 | 2.7492 | 3.0310 | 2.9430 | 2.9478 | 2.8846 | 2.9365 | 1.8111 |
| | meanRGBcor | 0.9994 | 0.9992 | 0.9991 | 0.9991 | 0.9991 | 0.9991 | 0.9990 | 0.9994 |
| 21 | reiteration | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 |
| | RMSE | 2.5270 | 2.7492 | 3.0390 | 2.9430 | 2.9478 | 2.8846 | 2.9365 | 1.8111 |
| | meanRGBcor | 0.9994 | 0.9992 | 0.9991 | 0.9991 | 0.9991 | 0.9991 | 0.9990 | 0.9994 |
| 22 | reiteration | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 |
| | RMSE | 2.5270 | 2.7492 | 3.0466 | 2.9430 | 2.9478 | 2.8846 | 2.9365 | 1.8111 |
| | meanRGBcor | 0.9994 | 0.9992 | 0.9990 | 0.9991 | 0.9991 | 0.9991 | 0.9990 | 0.9994 |
| 23 | reiteration | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 |
| | RMSE | 2.5270 | 2.7492 | 3.0545 | 2.9430 | 2.9478 | 2.8846 | 2.9365 | 1.8111 |
| | meanRGBcor | 0.9994 | 0.9992 | 0.9990 | 0.9991 | 0.9991 | 0.9991 | 0.9990 | 0.9994 |
| 24 | reiteration | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 |
| | RMSE | 2.5270 | 2.7492 | 3.0628 | 2.9430 | 2.9478 | 2.8846 | 2.9365 | 1.8111 |
| | meanRGBcor | 0.9994 | 0.9992 | 0.9990 | 0.9991 | 0.9991 | 0.9991 | 0.9990 | 0.9994 |
| 25 | reiteration | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | RMSE | 2.5270 | 2.7492 | 3.0714 | 2.9430 | 2.9478 | 2.8846 | 2.9365 | 1.8111 |
| | meanRGBcor | 0.9994 | 0.9992 | 0.9990 | 0.9991 | 0.9991 | 0.9991 | 0.9990 | 0.9994 |

Table C(1)-3. Raw data of RMSE on Egg data at QF. 75

| Offset Num. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| cellwidth | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 |
| cellheight | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 |
| 1 reiteration | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| RMSE | 1.9625 | 2.0833 | 2.1926 | 2.2016 | 2.2037 | 2.1570 | 2.1852 | 1.3778 |
| meanRGBcor | 0.9996 | 0.9995 | 0.9995 | 0.9995 | 0.9995 | 0.9995 | 0.9995 | 0.9997 |
| 2 reiteration | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| RMSE | 2.0247 | 2.1148 | 2.2343 | 2.2368 | 2.2485 | 2.1881 | 2.2348 | 1.4355 |
| meanRGBcor | 0.9996 | 0.9995 | 0.9994 | 0.9995 | 0.9994 | 0.9995 | 0.9994 | 0.9997 |
| 3 reiteration | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| RMSE | 2.0428 | 2.1297 | 2.2560 | 2.2539 | 2.2694 | 2.2046 | 2.2526 | 1.4538 |
| meanRGBcor | 0.9996 | 0.9995 | 0.9994 | 0.9994 | 0.9994 | 0.9994 | 0.9994 | 0.9996 |
| 4 reiteration | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| RMSE | 2.0527 | 2.1378 | 2.2679 | 2.2682 | 2.2787 | 2.2141 | 2.2622 | 1.4666 |
| meanRGBcor | 0.9996 | 0.9995 | 0.9994 | 0.9994 | 0.9994 | 0.9994 | 0.9994 | 0.9996 |
| 5 reiteration | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| RMSE | 2.0539 | 2.1377 | 2.2737 | 2.2711 | 2.2847 | 2.2189 | 2.2660 | 1.4738 |
| meanRGBcor | 0.9996 | 0.9995 | 0.9994 | 0.9994 | 0.9994 | 0.9994 | 0.9994 | 0.9996 |
| 6 reiteration | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| RMSE | 2.0537 | 2.1378 | 2.2781 | 2.2715 | 2.2876 | 2.2212 | 2.2673 | 1.4791 |
| meanRGBcor | 0.9996 | 0.9995 | 0.9994 | 0.9994 | 0.9994 | 0.9994 | 0.9994 | 0.9996 |
| 7 reiteration | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| RMSE | 2.0529 | 2.1365 | 2.2832 | 2.2718 | 2.2899 | 2.2236 | 2.2678 | 1.4877 |
| meanRGBcor | 0.9996 | 0.9995 | 0.9994 | 0.9994 | 0.9994 | 0.9994 | 0.9994 | 0.9996 |
| 8 reiteration | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| RMSE | 2.0527 | 2.1351 | 2.2895 | 2.2718 | 2.2938 | 2.2249 | 2.2685 | 1.4946 |
| meanRGBcor | 0.9996 | 0.9995 | 0.9994 | 0.9994 | 0.9994 | 0.9994 | 0.9994 | 0.9996 |
| 9 reiteration | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 |
| RMSE | 2.0517 | 2.1341 | 2.2965 | 2.2718 | 2.2968 | 2.2260 | 2.2683 | 1.4969 |
| meanRGBcor | 0.9996 | 0.9995 | 0.9994 | 0.9994 | 0.9994 | 0.9994 | 0.9994 | 0.9996 |
| 10 reiteration | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| RMSE | 2.0504 | 2.1335 | 2.3042 | 2.2718 | 2.3004 | 2.2271 | 2.2680 | 1.4972 |
| meanRGBcor | 0.9996 | 0.9995 | 0.9994 | 0.9994 | 0.9994 | 0.9994 | 0.9994 | 0.9996 |
| 11 reiteration | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 |
| RMSE | 2.0500 | 2.1326 | 2.3129 | 2.2718 | 2.3043 | 2.2280 | 2.2678 | 1.4978 |
| meanRGBcor | 0.9996 | 0.9995 | 0.9994 | 0.9994 | 0.9994 | 0.9994 | 0.9994 | 0.9996 |
| 12 reiteration | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| RMSE | 2.0494 | 2.1319 | 2.3224 | 2.2718 | 2.3081 | 2.2277 | 2.2676 | 1.4981 |
| meanRGBcor | 0.9996 | 0.9995 | 0.9994 | 0.9994 | 0.9994 | 0.9994 | 0.9994 | 0.9996 |

| | Offset Num. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|
| | cellwidth | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 |
| | cellheight | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 |
| 13 | reiteration | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 |
| | RMSE | 2.0490 | 2.1314 | 2.3327 | 2.2718 | 2.3105 | 2.2277 | 2.2673 | 1.4981 |
| | meanRGBcor | 0.9996 | 0.9995 | 0.9994 | 0.9994 | 0.9994 | 0.9994 | 0.9994 | 0.9996 |
| 14 | reiteration | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 |
| | RMSE | 2.0482 | 2.1309 | 2.3439 | 2.2718 | 2.3138 | 2.2277 | 2.2672 | 1.4980 |
| | meanRGBcor | 0.9996 | 0.9995 | 0.9994 | 0.9994 | 0.9994 | 0.9994 | 0.9994 | 0.9996 |
| 15 | reiteration | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| | RMSE | 2.0474 | 2.1306 | 2.3562 | 2.2718 | 2.3159 | 2.2277 | 2.2672 | 1.4980 |
| | meanRGBcor | 0.9996 | 0.9995 | 0.9994 | 0.9994 | 0.9994 | 0.9994 | 0.9994 | 0.9996 |
| 16 | reiteration | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 |
| | RMSE | 2.0471 | 2.1303 | 2.3690 | 2.2718 | 2.3159 | 2.2277 | 2.2671 | 1.4980 |
| | meanRGBcor | 0.9996 | 0.9995 | 0.9994 | 0.9994 | 0.9994 | 0.9994 | 0.9994 | 0.9996 |
| 17 | reiteration | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 17 |
| | RMSE | 2.0468 | 2.1300 | 2.3830 | 2.2718 | 2.3159 | 2.2277 | 2.2671 | 1.4980 |
| | meanRGBcor | 0.9996 | 0.9995 | 0.9994 | 0.9994 | 0.9994 | 0.9994 | 0.9994 | 0.9996 |
| 18 | reiteration | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 |
| | RMSE | 2.0466 | 2.1300 | 2.3976 | 2.2718 | 2.3158 | 2.2277 | 2.2670 | 1.4979 |
| | meanRGBcor | 0.9996 | 0.9995 | 0.9994 | 0.9994 | 0.9994 | 0.9994 | 0.9994 | 0.9996 |
| 19 | reiteration | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 |
| | RMSE | 2.0465 | 2.1300 | 2.4131 | 2.2718 | 2.3158 | 2.2277 | 2.2670 | 1.4979 |
| | meanRGBcor | 0.9996 | 0.9995 | 0.9994 | 0.9994 | 0.9994 | 0.9994 | 0.9994 | 0.9996 |
| 20 | reiteration | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| | RMSE | 2.0461 | 2.1298 | 2.4293 | 2.2718 | 2.3155 | 2.2277 | 2.2670 | 1.4976 |
| | meanRGBcor | 0.9996 | 0.9995 | 0.9994 | 0.9994 | 0.9994 | 0.9994 | 0.9994 | 0.9996 |
| 21 | reiteration | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 |
| | RMSE | 2.0458 | 2.1298 | 2.4460 | 2.2718 | 2.3155 | 2.2277 | 2.2670 | 1.4976 |
| | meanRGBcor | 0.9996 | 0.9995 | 0.9994 | 0.9994 | 0.9994 | 0.9994 | 0.9994 | 0.9996 |
| 22 | reiteration | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 |
| | RMSE | 2.0455 | 2.1298 | 2.4636 | 2.2718 | 2.3154 | 2.2277 | 2.2670 | 1.4976 |
| | meanRGBcor | 0.9996 | 0.9995 | 0.9993 | 0.9994 | 0.9994 | 0.9994 | 0.9994 | 0.9996 |
| 23 | reiteration | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 |
| | RMSE | 2.0454 | 2.1298 | 2.4819 | 2.2718 | 2.3154 | 2.2277 | 2.2670 | 1.4975 |
| | meanRGBcor | 0.9996 | 0.9995 | 0.9993 | 0.9994 | 0.9994 | 0.9994 | 0.9994 | 0.9996 |
| 24 | reiteration | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 |
| | RMSE | 2.0453 | 2.1298 | 2.4992 | 2.2718 | 2.3154 | 2.2277 | 2.2670 | 1.4975 |
| | meanRGBcor | 0.9996 | 0.9995 | 0.9993 | 0.9994 | 0.9994 | 0.9994 | 0.9994 | 0.9996 |
| 25 | reiteration | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | RMSE | 2.0452 | 2.1298 | 2.5161 | 2.2718 | 2.3153 | 2.2277 | 2.2670 | 1.4975 |
| | meanRGBcor | 0.9996 | 0.9995 | 0.9993 | 0.9994 | 0.9994 | 0.9994 | 0.9994 | 0.9996 |

Table C(1)-4. Raw data of RMSE on Egg data at QF. 100

| | offsett Num. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|
| | cellwidth | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 |
| | cellheight | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 |
| 1 | reiteration | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | RMSE | 0.8959 | 0.7555 | 0.8969 | 0.7421 | 0.8954 | 0.7554 | 0.8964 | 0.7009 |
| | meanRGBcor | 0.9999 | 0.9999 | 0.9999 | 0.9999 | 0.9999 | 0.9999 | 0.9999 | 0.9999 |
| 2 | reiteration | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | RMSE | 1.0957 | 0.9830 | 1.1105 | 0.9637 | 1.1059 | 0.9849 | 1.1080 | 0.9216 |
| | meanRGBcor | 0.9998 | 0.9998 | 0.9998 | 0.9998 | 0.9998 | 0.9998 | 0.9998 | 0.9998 |
| 3 | reiteration | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | RMSE | 1.2379 | 1.1614 | 1.2637 | 1.1406 | 1.2612 | 1.1639 | 1.2601 | 1.0970 |
| | meanRGBcor | 0.9997 | 0.9997 | 0.9997 | 0.9997 | 0.9997 | 0.9997 | 0.9997 | 0.9998 |
| 4 | reiteration | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| | RMSE | 1.3518 | 1.3035 | 1.3850 | 1.2789 | 1.3868 | 1.3047 | 1.3782 | 1.2381 |
| | meanRGBcor | 0.9997 | 0.9997 | 0.9996 | 0.9997 | 0.9996 | 0.9997 | 0.9996 | 0.9997 |
| 5 | reiteration | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| | RMSE | 1.4425 | 1.4207 | 1.4881 | 1.3951 | 1.4885 | 1.4216 | 1.4810 | 1.3557 |
| | meanRGBcor | 0.9996 | 0.9996 | 0.9995 | 0.9996 | 0.9995 | 0.9996 | 0.9996 | 0.9996 |
| 6 | reiteration | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| | RMSE | 1.5213 | 1.5199 | 1.5792 | 1.4939 | 1.5788 | 1.5203 | 1.5711 | 1.4579 |
| | meanRGBcor | 0.9995 | 0.9995 | 0.9995 | 0.9995 | 0.9995 | 0.9995 | 0.9995 | 0.9995 |
| 7 | reiteration | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| | RMSE | 1.5885 | 1.6020 | 1.6568 | 1.5825 | 1.6539 | 1.6037 | 1.6496 | 1.5449 |
| | meanRGBcor | 0.9995 | 0.9994 | 0.9994 | 0.9994 | 0.9994 | 0.9994 | 0.9994 | 0.9994 |
| 8 | reiteration | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| | RMSE | 1.6436 | 1.6688 | 1.7233 | 1.6584 | 1.7205 | 1.6761 | 1.7169 | 1.6184 |
| | meanRGBcor | 0.9994 | 0.9994 | 0.9994 | 0.9994 | 0.9994 | 0.9994 | 0.9993 | 0.9994 |
| 9 | reiteration | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 |
| | RMSE | 1.6892 | 1.7267 | 1.7821 | 1.7218 | 1.7794 | 1.7387 | 1.7784 | 1.6818 |
| | meanRGBcor | 0.9994 | 0.9993 | 0.9993 | 0.9993 | 0.9993 | 0.9993 | 0.9993 | 0.9993 |
| 10 | reiteration | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| | RMSE | 1.7283 | 1.7757 | 1.8315 | 1.7770 | 1.8301 | 1.7933 | 1.8317 | 1.7385 |
| | meanRGBcor | 0.9993 | 0.9993 | 0.9992 | 0.9993 | 0.9992 | 0.9993 | 0.9992 | 0.9993 |
| 11 | reiteration | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 |
| | RMSE | 1.7647 | 1.8191 | 1.8741 | 1.8251 | 1.8727 | 1.8409 | 1.8762 | 1.7871 |
| | meanRGBcor | 0.9993 | 0.9992 | 0.9992 | 0.9992 | 0.9992 | 0.9992 | 0.9992 | 0.9992 |
| 12 | reiteration | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| | RMSE | 1.7968 | 1.8588 | 1.9126 | 1.8707 | 1.9115 | 1.8808 | 1.9140 | 1.8296 |
| | meanRGBcor | 0.9993 | 0.9992 | 0.9992 | 0.9992 | 0.9992 | 0.9992 | 0.9992 | 0.9992 |

| | offsett Num. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|
| | cellwidth | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 |
| | cellheight | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 |
| 13 | reiteration | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 |
| | RMSE | 1.8233 | 1.8928 | 1.9458 | 1.9096 | 1.9458 | 1.9179 | 1.9511 | 1.8715 |
| | meanRGBcor | 0.9992 | 0.9992 | 0.9991 | 0.9991 | 0.9991 | 0.9991 | 0.9991 | 0.9991 |
| 14 | reiteration | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 |
| | RMSE | 1.8475 | 1.9221 | 1.9766 | 1.9454 | 1.9766 | 1.9475 | 1.9820 | 1.9062 |
| | meanRGBcor | 0.9992 | 0.9991 | 0.9991 | 0.9991 | 0.9991 | 0.9991 | 0.9991 | 0.9991 |
| 15 | reiteration | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| | RMSE | 1.8711 | 1.9478 | 2.0030 | 1.9762 | 2.0042 | 1.9751 | 2.0094 | 1.9383 |
| | meanRGBcor | 0.9992 | 0.9991 | 0.9991 | 0.9991 | 0.9991 | 0.9991 | 0.9990 | 0.9991 |
| 16 | reiteration | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 |
| | RMSE | 1.8898 | 1.9694 | 2.0245 | 2.0056 | 2.0298 | 2.0001 | 2.0327 | 1.9624 |
| | meanRGBcor | 0.9991 | 0.9991 | 0.9990 | 0.9990 | 0.9990 | 0.9990 | 0.9990 | 0.9990 |
| 17 | reiteration | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 17 |
| | RMSE | 1.9081 | 1.9889 | 2.0434 | 2.0314 | 2.0512 | 2.0210 | 2.0526 | 1.9877 |
| | meanRGBcor | 0.9991 | 0.9991 | 0.9990 | 0.9990 | 0.9990 | 0.9990 | 0.9990 | 0.9990 |
| 18 | reiteration | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 |
| | RMSE | 1.9222 | 2.0074 | 2.0609 | 2.0523 | 2.0697 | 2.0413 | 2.0711 | 2.0108 |
| | meanRGBcor | 0.9991 | 0.9990 | 0.9990 | 0.9990 | 0.9990 | 0.9990 | 0.9990 | 0.9990 |
| 19 | reiteration | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 |
| | RMSE | 1.9365 | 2.0237 | 2.0763 | 2.0716 | 2.0893 | 2.0582 | 2.0876 | 2.0336 |
| | meanRGBcor | 0.9991 | 0.9990 | 0.9990 | 0.9990 | 0.9990 | 0.9990 | 0.9989 | 0.9990 |
| 20 | reiteration | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| | RMSE | 1.9498 | 2.0392 | 2.0916 | 2.0888 | 2.1043 | 2.0750 | 2.1041 | 2.0533 |
| | meanRGBcor | 0.9991 | 0.9990 | 0.9990 | 0.9989 | 0.9989 | 0.9989 | 0.9989 | 0.9989 |
| 21 | reiteration | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 |
| | RMSE | 1.9618 | 2.0502 | 2.1045 | 2.1048 | 2.1196 | 2.0933 | 2.1175 | 2.0705 |
| | meanRGBcor | 0.9990 | 0.9990 | 0.9989 | 0.9989 | 0.9989 | 0.9989 | 0.9989 | 0.9989 |
| 22 | reiteration | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 |
| | RMSE | 1.9708 | 2.0616 | 2.1172 | 2.1181 | 2.1337 | 2.1078 | 2.1324 | 2.0880 |
| | meanRGBcor | 0.9990 | 0.9990 | 0.9989 | 0.9989 | 0.9989 | 0.9989 | 0.9989 | 0.9989 |
| 23 | reiteration | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 |
| | RMSE | 1.9822 | 2.0741 | 2.1285 | 2.1293 | 2.1455 | 2.1213 | 2.1419 | 2.1025 |
| | meanRGBcor | 0.9990 | 0.9990 | 0.9989 | 0.9989 | 0.9989 | 0.9989 | 0.9989 | 0.9989 |
| 24 | reiteration | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 |
| | RMSE | 1.9931 | 2.0840 | 2.1391 | 2.1411 | 2.1573 | 2.1335 | 2.1522 | 2.1163 |
| | meanRGBcor | 0.9990 | 0.9989 | 0.9989 | 0.9989 | 0.9989 | 0.9989 | 0.9989 | 0.9989 |
| 25 | reiteration | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | RMSE | 2.0046 | 2.0945 | 2.1467 | 2.1517 | 2.1693 | 2.1436 | 2.1616 | 2.1281 |
| | meanRGBcor | 0.9990 | 0.9989 | 0.9989 | 0.9989 | 0.9989 | 0.9989 | 0.9988 | 0.9989 |

Table C(2)-1. Raw data of RMSE on Salad data at QF. 25

| | Offset Num. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|
| | cellwidth | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 |
| | cellheight | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 |
| 1 | reiteration | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | RMS_red | 5.6289 | 6.1151 | 6.5008 | 6.5974 | 6.5751 | 6.4288 | 6.5820 | 4.2716 |
| | RMS_green | 5.6289 | 6.1151 | 6.5008 | 6.5974 | 6.5751 | 6.4288 | 6.5820 | 4.2716 |
| | RMS_blue | 5.6289 | 6.1151 | 6.5008 | 6.5974 | 6.5751 | 6.4288 | 6.5820 | 4.2716 |
| | RMSE | 5.4917 | 5.8374 | 6.1424 | 6.2526 | 6.2182 | 6.0305 | 6.1207 | 3.3549 |
| | Rcorr | 0.9965 | 0.9958 | 0.9953 | 0.9952 | 0.9952 | 0.9954 | 0.9952 | 0.9980 |
| | Gcorr | 0.9955 | 0.9952 | 0.9949 | 0.9947 | 0.9947 | 0.9951 | 0.9951 | 0.9991 |
| | Bcorr | 0.9943 | 0.9920 | 0.9906 | 0.9904 | 0.9903 | 0.9906 | 0.9902 | 0.9941 |
| | meanRGBcor | 0.9954 | 0.9944 | 0.9936 | 0.9934 | 0.9934 | 0.9937 | 0.9935 | 0.9971 |
| 2 | reiteration | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | RMS_red | 5.6387 | 6.1060 | 6.4960 | 6.5882 | 6.5715 | 6.4292 | 6.5752 | 4.2729 |
| | RMS_green | 5.6387 | 6.1060 | 6.4960 | 6.5882 | 6.5715 | 6.4292 | 6.5752 | 4.2729 |
| | RMS_blue | 5.6387 | 6.1060 | 6.4960 | 6.5882 | 6.5715 | 6.4292 | 6.5752 | 4.2729 |
| | RMSE | 5.5094 | 5.8499 | 6.1674 | 6.2673 | 6.2330 | 6.0422 | 6.1262 | 3.3588 |
| | Rcorr | 0.9965 | 0.9958 | 0.9953 | 0.9952 | 0.9952 | 0.9954 | 0.9952 | 0.9980 |
| | Gcorr | 0.9954 | 0.9952 | 0.9948 | 0.9946 | 0.9947 | 0.9951 | 0.9950 | 0.9991 |
| | Bcorr | 0.9942 | 0.9920 | 0.9905 | 0.9903 | 0.9902 | 0.9906 | 0.9902 | 0.9941 |
| | meanRGBcor | 0.9954 | 0.9943 | 0.9935 | 0.9934 | 0.9934 | 0.9937 | 0.9935 | 0.9971 |
| 3 | reiteration | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | RMS_red | 5.6414 | 6.1004 | 6.4995 | 6.5887 | 6.5713 | 6.4159 | 6.5670 | 4.2729 |
| | RMS_green | 5.6414 | 6.1004 | 6.4995 | 6.5887 | 6.5713 | 6.4159 | 6.5670 | 4.2729 |
| | RMS_blue | 5.6414 | 6.1004 | 6.4995 | 6.5887 | 6.5713 | 6.4159 | 6.5670 | 4.2729 |
| | RMSE | 5.5123 | 5.8549 | 6.1790 | 6.2685 | 6.2367 | 6.0479 | 6.1314 | 3.3588 |
| | Rcorr | 0.9965 | 0.9959 | 0.9953 | 0.9952 | 0.9952 | 0.9954 | 0.9952 | 0.9980 |
| | Gcorr | 0.9954 | 0.9952 | 0.9948 | 0.9946 | 0.9947 | 0.9951 | 0.9950 | 0.9991 |
| | Bcorr | 0.9942 | 0.9919 | 0.9904 | 0.9903 | 0.9902 | 0.9905 | 0.9902 | 0.9941 |
| | meanRGBcor | 0.9954 | 0.9943 | 0.9935 | 0.9934 | 0.9934 | 0.9937 | 0.9935 | 0.9971 |
| 4 | reiteration | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| | RMS_red | 5.6411 | 6.1004 | 6.5056 | 6.5889 | 6.5733 | 6.4156 | 6.5664 | 4.2729 |
| | RMS_green | 5.6411 | 6.1004 | 6.5056 | 6.5889 | 6.5733 | 6.4156 | 6.5664 | 4.2729 |
| | RMS_blue | 5.6411 | 6.1004 | 6.5056 | 6.5889 | 6.5733 | 6.4156 | 6.5664 | 4.2729 |
| | RMSE | 5.5121 | 5.8549 | 6.1857 | 6.2687 | 6.2372 | 6.0483 | 6.1317 | 3.3588 |
| | Rcorr | 0.9965 | 0.9959 | 0.9953 | 0.9952 | 0.9952 | 0.9954 | 0.9952 | 0.9980 |
| | Gcorr | 0.9954 | 0.9952 | 0.9948 | 0.9946 | 0.9947 | 0.9951 | 0.9950 | 0.9991 |
| | Bcorr | 0.9942 | 0.9919 | 0.9904 | 0.9903 | 0.9902 | 0.9905 | 0.9902 | 0.9941 |
| | meanRGBcor | 0.9954 | 0.9943 | 0.9935 | 0.9934 | 0.9934 | 0.9937 | 0.9935 | 0.9971 |

| | Offset Num. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|
| | cellwidth | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 |
| | cellheight | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 |
| 5 | reiteration | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| | RMS_red | 5.6411 | 6.1004 | 6.5139 | 6.5893 | 6.5733 | 6.4156 | 6.5664 | 4.2729 |
| | RMS_green | 5.6411 | 6.1004 | 6.5139 | 6.5893 | 6.5733 | 6.4156 | 6.5664 | 4.2729 |
| | RMS_blue | 5.6411 | 6.1004 | 6.5139 | 6.5893 | 6.5733 | 6.4156 | 6.5664 | 4.2729 |
| | RMSE | 5.5121 | 5.8549 | 6.1949 | 6.2689 | 6.2372 | 6.0483 | 6.1317 | 3.3588 |
| | Rcorr | 0.9965 | 0.9959 | 0.9953 | 0.9952 | 0.9952 | 0.9954 | 0.9952 | 0.9980 |
| | Gcorr | 0.9954 | 0.9952 | 0.9947 | 0.9946 | 0.9947 | 0.9951 | 0.9950 | 0.9991 |
| | Bcorr | 0.9942 | 0.9919 | 0.9904 | 0.9903 | 0.9902 | 0.9905 | 0.9902 | 0.9941 |
| | meanRGBcor | 0.9954 | 0.9943 | 0.9935 | 0.9934 | 0.9934 | 0.9937 | 0.9935 | 0.9971 |
| 6 | reiteration | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| | RMS_red | 5.6411 | 6.1004 | 6.5244 | 6.5893 | 6.5733 | 6.4156 | 6.5664 | 4.2729 |
| | RMS_green | 5.6411 | 6.1004 | 6.5244 | 6.5893 | 6.5733 | 6.4156 | 6.5664 | 4.2729 |
| | RMS_blue | 5.6411 | 6.1004 | 6.5244 | 6.5893 | 6.5733 | 6.4156 | 6.5664 | 4.2729 |
| | RMSE | 5.5121 | 5.8549 | 6.2062 | 6.2689 | 6.2372 | 6.0483 | 6.1317 | 3.3588 |
| | Rcorr | 0.9965 | 0.9959 | 0.9953 | 0.9952 | 0.9952 | 0.9954 | 0.9952 | 0.9980 |
| | Gcorr | 0.9954 | 0.9952 | 0.9947 | 0.9946 | 0.9947 | 0.9951 | 0.9950 | 0.9991 |
| | Bcorr | 0.9942 | 0.9919 | 0.9904 | 0.9903 | 0.9902 | 0.9905 | 0.9902 | 0.9941 |
| | meanRGBcor | 0.9954 | 0.9943 | 0.9934 | 0.9934 | 0.9934 | 0.9937 | 0.9935 | 0.9971 |
| 7 | reiteration | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| | RMS_red | 5.6411 | 6.1004 | 6.5370 | 6.5893 | 6.5733 | 6.4156 | 6.5664 | 4.2729 |
| | RMS_green | 5.6411 | 6.1004 | 6.5370 | 6.5893 | 6.5733 | 6.4156 | 6.5664 | 4.2729 |
| | RMS_blue | 5.6411 | 6.1004 | 6.5370 | 6.5893 | 6.5733 | 6.4156 | 6.5664 | 4.2729 |
| | RMSE | 5.5121 | 5.8549 | 6.2199 | 6.2689 | 6.2372 | 6.0483 | 6.1317 | 3.3588 |
| | Rcorr | 0.9965 | 0.9959 | 0.9952 | 0.9952 | 0.9952 | 0.9954 | 0.9952 | 0.9980 |
| | Gcorr | 0.9954 | 0.9952 | 0.9947 | 0.9946 | 0.9947 | 0.9951 | 0.9950 | 0.9991 |
| | Bcorr | 0.9942 | 0.9919 | 0.9903 | 0.9903 | 0.9902 | 0.9905 | 0.9902 | 0.9941 |
| | meanRGBcor | 0.9954 | 0.9943 | 0.9934 | 0.9934 | 0.9934 | 0.9937 | 0.9935 | 0.9971 |
| 8 | reiteration | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| | RMS_red | 5.6411 | 6.1004 | 6.5527 | 6.5893 | 6.5733 | 6.4156 | 6.5664 | 4.2729 |
| | RMS_green | 5.6411 | 6.1004 | 6.5527 | 6.5893 | 6.5733 | 6.4156 | 6.5664 | 4.2729 |
| | RMS_blue | 5.6411 | 6.1004 | 6.5527 | 6.5893 | 6.5733 | 6.4156 | 6.5664 | 4.2729 |
| | RMSE | 5.5121 | 5.8549 | 6.2367 | 6.2689 | 6.2372 | 6.0483 | 6.1317 | 3.3588 |
| | Rcorr | 0.9965 | 0.9959 | 0.9952 | 0.9952 | 0.9952 | 0.9954 | 0.9952 | 0.9980 |
| | Gcorr | 0.9954 | 0.9952 | 0.9947 | 0.9946 | 0.9947 | 0.9951 | 0.9950 | 0.9991 |
| | Bcorr | 0.9942 | 0.9919 | 0.9903 | 0.9903 | 0.9902 | 0.9905 | 0.9902 | 0.9941 |
| | meanRGBcor | 0.9954 | 0.9943 | 0.9934 | 0.9934 | 0.9934 | 0.9937 | 0.9935 | 0.9971 |

| | Offset Num. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|
| | cellwidth | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 |
| | cellheight | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 |
| 9 | reiteration | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 |
| | RMS_red | 5.6411 | 6.1004 | 6.5697 | 6.5893 | 6.5733 | 6.4156 | 6.5664 | 4.2729 |
| | RMS_green | 5.6411 | 6.1004 | 6.5697 | 6.5893 | 6.5733 | 6.4156 | 6.5664 | 4.2729 |
| | RMS_blue | 5.6411 | 6.1004 | 6.5697 | 6.5893 | 6.5733 | 6.4156 | 6.5664 | 4.2729 |
| | RMSE | 5.5121 | 5.8549 | 6.2549 | 6.2689 | 6.2372 | 6.0483 | 6.1317 | 3.3588 |
| | Rcorr | 0.9965 | 0.9959 | 0.9952 | 0.9952 | 0.9952 | 0.9954 | 0.9952 | 0.9980 |
| | Gcorr | 0.9954 | 0.9952 | 0.9946 | 0.9946 | 0.9947 | 0.9951 | 0.9950 | 0.9991 |
| | Bcorr | 0.9942 | 0.9919 | 0.9903 | 0.9903 | 0.9902 | 0.9905 | 0.9902 | 0.9941 |
| | meanRGBcor | 0.9954 | 0.9943 | 0.9934 | 0.9934 | 0.9934 | 0.9937 | 0.9935 | 0.9971 |
| 10 | reiteration | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| | RMS_red | 5.6411 | 6.1004 | 6.5888 | 6.5893 | 6.5733 | 6.4156 | 6.5664 | 4.2729 |
| | RMS_green | 5.6411 | 6.1004 | 6.5888 | 6.5893 | 6.5733 | 6.4156 | 6.5664 | 4.2729 |
| | RMS_blue | 5.6411 | 6.1004 | 6.5888 | 6.5893 | 6.5733 | 6.4156 | 6.5664 | 4.2729 |
| | RMSE | 5.5121 | 5.8549 | 6.2754 | 6.2689 | 6.2372 | 6.0483 | 6.1317 | 3.3588 |
| | Rcorr | 0.9965 | 0.9959 | 0.9952 | 0.9952 | 0.9952 | 0.9954 | 0.9952 | 0.9980 |
| | Gcorr | 0.9954 | 0.9952 | 0.9946 | 0.9946 | 0.9947 | 0.9951 | 0.9950 | 0.9991 |
| | Bcorr | 0.9942 | 0.9919 | 0.9902 | 0.9903 | 0.9902 | 0.9905 | 0.9902 | 0.9941 |
| | meanRGBcor | 0.9954 | 0.9943 | 0.9933 | 0.9934 | 0.9934 | 0.9937 | 0.9935 | 0.9971 |
| 11 | reiteration | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 |
| | RMS_red | 5.6411 | 6.1004 | 6.6100 | 6.5893 | 6.5733 | 6.4156 | 6.5664 | 4.2729 |
| | RMS_green | 5.6411 | 6.1004 | 6.6100 | 6.5893 | 6.5733 | 6.4156 | 6.5664 | 4.2729 |
| | RMS_blue | 5.6411 | 6.1004 | 6.6100 | 6.5893 | 6.5733 | 6.4156 | 6.5664 | 4.2729 |
| | RMSE | 5.5121 | 5.8549 | 6.2979 | 6.2689 | 6.2372 | 6.0483 | 6.1317 | 3.3588 |
| | Rcorr | 0.9965 | 0.9959 | 0.9951 | 0.9952 | 0.9952 | 0.9954 | 0.9952 | 0.9980 |
| | Gcorr | 0.9954 | 0.9952 | 0.9945 | 0.9946 | 0.9947 | 0.9951 | 0.9950 | 0.9991 |
| | Bcorr | 0.9942 | 0.9919 | 0.9902 | 0.9903 | 0.9902 | 0.9905 | 0.9902 | 0.9941 |
| | meanRGBcor | 0.9954 | 0.9943 | 0.9933 | 0.9934 | 0.9934 | 0.9937 | 0.9935 | 0.9971 |
| 12 | reiteration | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| | RMS_red | 5.6411 | 6.1004 | 6.6320 | 6.5893 | 6.5733 | 6.4156 | 6.5664 | 4.2729 |
| | RMS_green | 5.6411 | 6.1004 | 6.6320 | 6.5893 | 6.5733 | 6.4156 | 6.5664 | 4.2729 |
| | RMS_blue | 5.6411 | 6.1004 | 6.6320 | 6.5893 | 6.5733 | 6.4156 | 6.5664 | 4.2729 |
| | RMSE | 5.5121 | 5.8549 | 6.3217 | 6.2689 | 6.2372 | 6.0483 | 6.1317 | 3.3588 |
| | Rcorr | 0.9965 | 0.9959 | 0.9951 | 0.9952 | 0.9952 | 0.9954 | 0.9952 | 0.9980 |
| | Gcorr | 0.9954 | 0.9952 | 0.9945 | 0.9946 | 0.9947 | 0.9951 | 0.9950 | 0.9991 |
| | Bcorr | 0.9942 | 0.9919 | 0.9901 | 0.9903 | 0.9902 | 0.9905 | 0.9902 | 0.9941 |
| | meanRGBcor | 0.9954 | 0.9943 | 0.9932 | 0.9934 | 0.9934 | 0.9937 | 0.9935 | 0.9971 |

| | Offset Num. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|
| | cellwidth | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 |
| | cellheight | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 |
| 13 | reiteration | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 |
| | RMS_red | 5.6411 | 6.1004 | 6.6574 | 6.5893 | 6.5733 | 6.4156 | 6.5664 | 4.2729 |
| | RMS_green | 5.6411 | 6.1004 | 6.6574 | 6.5893 | 6.5733 | 6.4156 | 6.5664 | 4.2729 |
| | RMS_blue | 5.6411 | 6.1004 | 6.6574 | 6.5893 | 6.5733 | 6.4156 | 6.5664 | 4.2729 |
| | RMSE | 5.5121 | 5.8549 | 6.3485 | 6.2689 | 6.2372 | 6.0483 | 6.1317 | 3.3588 |
| | Rcorr | 0.9965 | 0.9959 | 0.9951 | 0.9952 | 0.9952 | 0.9954 | 0.9952 | 0.9980 |
| | Gcorr | 0.9954 | 0.9952 | 0.9944 | 0.9946 | 0.9947 | 0.9951 | 0.9950 | 0.9991 |
| | Bcorr | 0.9942 | 0.9919 | 0.9901 | 0.9903 | 0.9902 | 0.9905 | 0.9902 | 0.9941 |
| | meanRGBcor | 0.9954 | 0.9943 | 0.9932 | 0.9934 | 0.9934 | 0.9937 | 0.9935 | 0.9971 |
| 14 | reiteration | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 |
| | RMS_red | 5.6411 | 6.1004 | 6.6816 | 6.5893 | 6.5733 | 6.4156 | 6.5664 | 4.2729 |
| | RMS_green | 5.6411 | 6.1004 | 6.6816 | 6.5893 | 6.5733 | 6.4156 | 6.5664 | 4.2729 |
| | RMS_blue | 5.6411 | 6.1004 | 6.6816 | 6.5893 | 6.5733 | 6.4156 | 6.5664 | 4.2729 |
| | RMSE | 5.5121 | 5.8549 | 6.3742 | 6.2689 | 6.2372 | 6.0483 | 6.1317 | 3.3588 |
| | Rcorr | 0.9965 | 0.9959 | 0.9950 | 0.9952 | 0.9952 | 0.9954 | 0.9952 | 0.9980 |
| | Gcorr | 0.9954 | 0.9952 | 0.9944 | 0.9946 | 0.9947 | 0.9951 | 0.9950 | 0.9991 |
| | Bcorr | 0.9942 | 0.9919 | 0.9900 | 0.9903 | 0.9902 | 0.9905 | 0.9902 | 0.9941 |
| | meanRGBcor | 0.9954 | 0.9943 | 0.9931 | 0.9934 | 0.9934 | 0.9937 | 0.9935 | 0.9971 |
| 15 | reiteration | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| | RMS_red | 5.6411 | 6.1004 | 6.7053 | 6.5893 | 6.5733 | 6.4156 | 6.5664 | 4.2729 |
| | RMS_green | 5.6411 | 6.1004 | 6.7053 | 6.5893 | 6.5733 | 6.4156 | 6.5664 | 4.2729 |
| | RMS_blue | 5.6411 | 6.1004 | 6.7053 | 6.5893 | 6.5733 | 6.4156 | 6.5664 | 4.2729 |
| | RMSE | 5.5121 | 5.8549 | 6.3995 | 6.2689 | 6.2372 | 6.0483 | 6.1317 | 3.3588 |
| | Rcorr | 0.9965 | 0.9959 | 0.9950 | 0.9952 | 0.9952 | 0.9954 | 0.9952 | 0.9980 |
| | Gcorr | 0.9954 | 0.9952 | 0.9943 | 0.9946 | 0.9947 | 0.9951 | 0.9950 | 0.9991 |
| | Bcorr | 0.9942 | 0.9919 | 0.9900 | 0.9903 | 0.9902 | 0.9905 | 0.9902 | 0.9941 |
| | meanRGBcor | 0.9954 | 0.9943 | 0.9931 | 0.9934 | 0.9934 | 0.9937 | 0.9935 | 0.9971 |
| 16 | reiteration | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 |
| | RMS_red | 5.6411 | 6.1004 | 6.7295 | 6.5893 | 6.5733 | 6.4156 | 6.5664 | 4.2729 |
| | RMS_green | 5.6411 | 6.1004 | 6.7295 | 6.5893 | 6.5733 | 6.4156 | 6.5664 | 4.2729 |
| | RMS_blue | 5.6411 | 6.1004 | 6.7295 | 6.5893 | 6.5733 | 6.4156 | 6.5664 | 4.2729 |
| | RMSE | 5.5121 | 5.8549 | 6.4253 | 6.2689 | 6.2372 | 6.0483 | 6.1317 | 3.3588 |
| | Rcorr | 0.9965 | 0.9959 | 0.9950 | 0.9952 | 0.9952 | 0.9954 | 0.9952 | 0.9980 |
| | Gcorr | 0.9954 | 0.9952 | 0.9943 | 0.9946 | 0.9947 | 0.9951 | 0.9950 | 0.9991 |
| | Bcorr | 0.9942 | 0.9919 | 0.9899 | 0.9903 | 0.9902 | 0.9905 | 0.9902 | 0.9941 |
| | meanRGBcor | 0.9954 | 0.9943 | 0.9930 | 0.9934 | 0.9934 | 0.9937 | 0.9935 | 0.9971 |

|  | Offset Num. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|
|  | cellwidth | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 |
|  | cellheight | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 |
| 17 | reiteration | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 17 |
|  | RMS_red | 5.6411 | 6.1004 | 6.7552 | 6.5893 | 6.5733 | 6.4156 | 6.5664 | 4.2729 |
|  | RMS_green | 5.6411 | 6.1004 | 6.7552 | 6.5893 | 6.5733 | 6.4156 | 6.5664 | 4.2729 |
|  | RMS_blue | 5.6411 | 6.1004 | 6.7552 | 6.5893 | 6.5733 | 6.4156 | 6.5664 | 4.2729 |
|  | RMSE | 5.5121 | 5.8549 | 6.4525 | 6.2689 | 6.2372 | 6.0483 | 6.1317 | 3.3588 |
|  | Rcorr | 0.9965 | 0.9959 | 0.9949 | 0.9952 | 0.9952 | 0.9954 | 0.9952 | 0.9980 |
|  | Gcorr | 0.9954 | 0.9952 | 0.9942 | 0.9946 | 0.9947 | 0.9951 | 0.9950 | 0.9991 |
|  | Bcorr | 0.9942 | 0.9919 | 0.9898 | 0.9903 | 0.9902 | 0.9905 | 0.9902 | 0.9941 |
|  | meanRGBcor | 0.9954 | 0.9943 | 0.9930 | 0.9934 | 0.9934 | 0.9937 | 0.9935 | 0.9971 |
| 18 | reiteration | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 |
|  | RMS_red | 5.6411 | 6.5893 | 6.7774 | 6.5893 | 6.5733 | 6.4156 | 6.5664 | 4.2729 |
|  | RMS_green | 5.6411 | 6.5893 | 6.7774 | 6.5893 | 6.5733 | 6.4156 | 6.5664 | 4.2729 |
|  | RMS_blue | 5.6411 | 6.5893 | 6.7774 | 6.5893 | 6.5733 | 6.4156 | 6.5664 | 4.2729 |
|  | RMSE | 5.5121 | 6.2689 | 6.4759 | 6.2689 | 6.2372 | 6.0483 | 6.1317 | 3.3588 |
|  | Rcorr | 0.9965 | 0.9952 | 0.9949 | 0.9952 | 0.9952 | 0.9954 | 0.9952 | 0.9980 |
|  | Gcorr | 0.9954 | 0.9946 | 0.9942 | 0.9946 | 0.9947 | 0.9951 | 0.9950 | 0.9991 |
|  | Bcorr | 0.9942 | 0.9903 | 0.9898 | 0.9903 | 0.9902 | 0.9905 | 0.9902 | 0.9941 |
|  | meanRGBcor | 0.9954 | 0.9934 | 0.9929 | 0.9934 | 0.9934 | 0.9937 | 0.9935 | 0.9971 |
| 19 | reiteration | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 |
|  | RMS_red | 5.6411 | 6.5893 | 6.8008 | 6.5893 | 6.5733 | 6.4156 | 6.5664 | 4.2729 |
|  | RMS_green | 5.6411 | 6.5893 | 6.8008 | 6.5893 | 6.5733 | 6.4156 | 6.5664 | 4.2729 |
|  | RMS_blue | 5.6411 | 6.5893 | 6.8008 | 6.5893 | 6.5733 | 6.4156 | 6.5664 | 4.2729 |
|  | RMSE | 5.5121 | 6.2689 | 6.5006 | 6.2689 | 6.2372 | 6.0483 | 6.1317 | 3.3588 |
|  | Rcorr | 0.9965 | 0.9952 | 0.9948 | 0.9952 | 0.9952 | 0.9954 | 0.9952 | 0.9980 |
|  | Gcorr | 0.9954 | 0.9946 | 0.9941 | 0.9946 | 0.9947 | 0.9951 | 0.9950 | 0.9991 |
|  | Bcorr | 0.9942 | 0.9903 | 0.9897 | 0.9903 | 0.9902 | 0.9905 | 0.9902 | 0.9941 |
|  | meanRGBcor | 0.9954 | 0.9934 | 0.9929 | 0.9934 | 0.9934 | 0.9937 | 0.9935 | 0.9971 |
| 20 | reiteration | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
|  | RMS_red | 5.6411 | 6.5893 | 6.8255 | 6.5893 | 6.5733 | 6.4156 | 6.5664 | 4.2729 |
|  | RMS_green | 5.6411 | 6.5893 | 6.8255 | 6.5893 | 6.5733 | 6.4156 | 6.5664 | 4.2729 |
|  | RMS_blue | 5.6411 | 6.5893 | 6.8255 | 6.5893 | 6.5733 | 6.4156 | 6.5664 | 4.2729 |
|  | RMSE | 5.5121 | 6.2689 | 6.5266 | 6.2689 | 6.2372 | 6.0483 | 6.1317 | 3.3588 |
|  | Rcorr | 0.9965 | 0.9952 | 0.9948 | 0.9952 | 0.9952 | 0.9954 | 0.9952 | 0.9980 |
|  | Gcorr | 0.9954 | 0.9946 | 0.9941 | 0.9946 | 0.9947 | 0.9951 | 0.9950 | 0.9991 |
|  | Bcorr | 0.9942 | 0.9903 | 0.9897 | 0.9903 | 0.9902 | 0.9905 | 0.9902 | 0.9941 |
|  | meanRGBcor | 0.9954 | 0.9934 | 0.9929 | 0.9934 | 0.9934 | 0.9937 | 0.9935 | 0.9971 |

| | Offset Num. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|
| | cellwidth | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 |
| | cellheight | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 |
| 21 | reiteration | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 |
| | RMS_red | 5.6411 | 6.5893 | 6.8514 | 6.5893 | 6.5733 | 6.4156 | 6.5664 | 4.2729 |
| | RMS_green | 5.6411 | 6.5893 | 6.8514 | 6.5893 | 6.5733 | 6.4156 | 6.5664 | 4.2729 |
| | RMS_blue | 5.6411 | 6.5893 | 6.8514 | 6.5893 | 6.5733 | 6.4156 | 6.5664 | 4.2729 |
| | RMSE | 5.5121 | 6.2689 | 6.5538 | 6.2689 | 6.2372 | 6.0483 | 6.1317 | 3.3588 |
| | Rcorr | 0.9965 | 0.9952 | 0.9948 | 0.9952 | 0.9952 | 0.9954 | 0.9952 | 0.9980 |
| | Gcorr | 0.9954 | 0.9946 | 0.9940 | 0.9946 | 0.9947 | 0.9951 | 0.9950 | 0.9991 |
| | Bcorr | 0.9942 | 0.9903 | 0.9896 | 0.9903 | 0.9902 | 0.9905 | 0.9902 | 0.9941 |
| | meanRGBcor | 0.9954 | 0.9934 | 0.9928 | 0.9934 | 0.9934 | 0.9937 | 0.9935 | 0.9971 |
| 22 | reiteration | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 |
| | RMS_red | 5.6411 | 6.5893 | 6.8784 | 6.5893 | 6.5733 | 6.4156 | 6.5664 | 4.2729 |
| | RMS_green | 5.6411 | 6.5893 | 6.8784 | 6.5893 | 6.5733 | 6.4156 | 6.5664 | 4.2729 |
| | RMS_blue | 5.6411 | 6.5893 | 6.8784 | 6.5893 | 6.5733 | 6.4156 | 6.5664 | 4.2729 |
| | RMSE | 5.5121 | 6.2689 | 6.5821 | 6.2689 | 6.2372 | 6.0483 | 6.1317 | 3.3588 |
| | Rcorr | 0.9965 | 0.9952 | 0.9947 | 0.9952 | 0.9952 | 0.9954 | 0.9952 | 0.9980 |
| | Gcorr | 0.9954 | 0.9946 | 0.9940 | 0.9946 | 0.9947 | 0.9951 | 0.9950 | 0.9991 |
| | Bcorr | 0.9942 | 0.9903 | 0.9895 | 0.9903 | 0.9902 | 0.9905 | 0.9902 | 0.9941 |
| | meanRGBcor | 0.9954 | 0.9934 | 0.9927 | 0.9934 | 0.9934 | 0.9937 | 0.9935 | 0.9971 |
| 23 | reiteration | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 |
| | RMS_red | 5.6411 | 6.5893 | 6.8981 | 6.5893 | 6.5733 | 6.4156 | 6.5664 | 4.2729 |
| | RMS_green | 5.6411 | 6.5893 | 6.8981 | 6.5893 | 6.5733 | 6.4156 | 6.5664 | 4.2729 |
| | RMS_blue | 5.6411 | 6.5893 | 6.8981 | 6.5893 | 6.5733 | 6.4156 | 6.5664 | 4.2729 |
| | RMSE | 5.5121 | 6.2689 | 6.6029 | 6.2689 | 6.2372 | 6.0483 | 6.1317 | 3.3588 |
| | Rcorr | 0.9965 | 0.9952 | 0.9947 | 0.9952 | 0.9952 | 0.9954 | 0.9952 | 0.9980 |
| | Gcorr | 0.9954 | 0.9946 | 0.9939 | 0.9946 | 0.9947 | 0.9951 | 0.9950 | 0.9991 |
| | Bcorr | 0.9942 | 0.9903 | 0.9895 | 0.9903 | 0.9902 | 0.9905 | 0.9902 | 0.9941 |
| | meanRGBcor | 0.9954 | 0.9934 | 0.9927 | 0.9934 | 0.9934 | 0.9937 | 0.9935 | 0.9971 |
| 24 | reiteration | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 |
| | RMS_red | 5.6411 | 6.5893 | 6.9221 | 6.5893 | 6.5733 | 6.4156 | 6.5664 | 4.2729 |
| | RMS_green | 5.6411 | 6.5893 | 6.9221 | 6.5893 | 6.5733 | 6.4156 | 6.5664 | 4.2729 |
| | RMS_blue | 5.6411 | 6.5893 | 6.9221 | 6.5893 | 6.5733 | 6.4156 | 6.5664 | 4.2729 |
| | RMSE | 5.5121 | 6.2689 | 6.6281 | 6.2689 | 6.2372 | 6.0483 | 6.1317 | 3.3588 |
| | Rcorr | 0.9965 | 0.9952 | 0.9947 | 0.9952 | 0.9952 | 0.9954 | 0.9952 | 0.9980 |
| | Gcorr | 0.9954 | 0.9946 | 0.9939 | 0.9946 | 0.9947 | 0.9951 | 0.9950 | 0.9991 |
| | Bcorr | 0.9942 | 0.9903 | 0.9894 | 0.9903 | 0.9902 | 0.9905 | 0.9902 | 0.9941 |
| | meanRGBcor | 0.9954 | 0.9934 | 0.9927 | 0.9934 | 0.9934 | 0.9937 | 0.9935 | 0.9971 |

| | Offset Num. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|
| | cellwidth | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 |
| | cellheight | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 |
| | meanRGBcor | 0.9954 | 0.9934 | 0.9927 | 0.9934 | 0.9934 | 0.9937 | 0.9935 | 0.9971 |
| 25 | reiteration | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | RMS_red | 5.6411 | 6.5893 | 6.9453 | 6.5893 | 6.5733 | 6.4156 | 6.5664 | 4.2729 |
| | RMS_green | 5.6411 | 6.5893 | 6.9453 | 6.5893 | 6.5733 | 6.4156 | 6.5664 | 4.2729 |
| | RMS_blue | 5.6411 | 6.5893 | 6.9453 | 6.5893 | 6.5733 | 6.4156 | 6.5664 | 4.2729 |
| | RMSE | 5.5121 | 6.2689 | 6.6525 | 6.2689 | 6.2372 | 6.0483 | 6.1317 | 3.3588 |
| | Rcorr | 0.9965 | 0.9952 | 0.9946 | 0.9952 | 0.9952 | 0.9954 | 0.9952 | 0.9980 |
| | Gcorr | 0.9954 | 0.9946 | 0.9938 | 0.9946 | 0.9947 | 0.9951 | 0.9950 | 0.9991 |
| | Bcorr | 0.9942 | 0.9903 | 0.9894 | 0.9903 | 0.9902 | 0.9905 | 0.9902 | 0.9941 |
| | meanRGBcor | 0.9954 | 0.9934 | 0.9926 | 0.9934 | 0.9934 | 0.9937 | 0.9935 | 0.9971 |

Table C(2)-2. Raw data of RMSE on Salad data at QF. 50

| | Offset Num. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|
| | cellwidth | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 |
| | cellheight | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 |
| 1 | reiteration | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | RMS_red | 3.6052 | 3.7868 | 4.0331 | 3.9936 | 4.0409 | 3.8883 | 3.9331 | 2.3406 |
| | RMS_green | 3.6052 | 3.7868 | 4.0331 | 3.9936 | 4.0409 | 3.8883 | 3.9331 | 2.3406 |
| | RMS_blue | 3.6052 | 3.7868 | 4.0331 | 3.9936 | 4.0409 | 3.8883 | 3.9331 | 2.3406 |
| | RMSE | 3.4343 | 3.6004 | 3.7706 | 3.7769 | 3.7827 | 3.6574 | 3.6658 | 1.8658 |
| | Rcorr | 0.9986 | 0.9984 | 0.9982 | 0.9982 | 0.9982 | 0.9983 | 0.9983 | 0.9994 |
| | Gcorr | 0.9983 | 0.9982 | 0.9981 | 0.9980 | 0.9981 | 0.9982 | 0.9982 | 0.9997 |
| | Bcorr | 0.9975 | 0.9968 | 0.9966 | 0.9966 | 0.9966 | 0.9966 | 0.9965 | 0.9981 |
| | meanRGBcor | 0.9981 | 0.9978 | 0.9976 | 0.9976 | 0.9976 | 0.9977 | 0.9977 | 0.9991 |
| 2 | reiteration | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | RMS_red | 3.6355 | 3.7988 | 4.0446 | 4.0126 | 4.0686 | 3.9088 | 3.9847 | 2.3925 |
| | RMS_green | 3.6355 | 3.7988 | 4.0446 | 4.0126 | 4.0686 | 3.9088 | 3.9847 | 2.3925 |
| | RMS_blue | 3.6355 | 3.7988 | 4.0446 | 4.0126 | 4.0686 | 3.9088 | 3.9847 | 2.3925 |
| | RMSE | 3.4765 | 3.6301 | 3.7988 | 3.8052 | 3.8173 | 3.6860 | 3.7084 | 1.9166 |
| | Rcorr | 0.9985 | 0.9984 | 0.9982 | 0.9982 | 0.9982 | 0.9983 | 0.9982 | 0.9994 |
| | Gcorr | 0.9983 | 0.9982 | 0.9981 | 0.9980 | 0.9980 | 0.9982 | 0.9982 | 0.9997 |
| | Bcorr | 0.9973 | 0.9967 | 0.9964 | 0.9965 | 0.9964 | 0.9965 | 0.9964 | 0.9980 |
| | meanRGBcor | 0.9980 | 0.9978 | 0.9975 | 0.9976 | 0.9975 | 0.9977 | 0.9976 | 0.9990 |
| 3 | reiteration | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | RMS_red | 3.6340 | 3.8002 | 4.0465 | 4.0190 | 4.0660 | 3.9069 | 3.9824 | 2.4155 |
| | RMS_green | 3.6340 | 3.8002 | 4.0465 | 4.0190 | 4.0660 | 3.9069 | 3.9824 | 2.4155 |
| | RMS_blue | 3.6340 | 3.8002 | 4.0465 | 4.0190 | 4.0660 | 3.9069 | 3.9824 | 2.4155 |
| | RMSE | 3.4929 | 3.6386 | 3.8136 | 3.8211 | 3.8324 | 3.6972 | 3.7229 | 1.9413 |
| | Rcorr | 0.9985 | 0.9984 | 0.9982 | 0.9982 | 0.9982 | 0.9983 | 0.9982 | 0.9994 |
| | Gcorr | 0.9983 | 0.9982 | 0.9981 | 0.9980 | 0.9980 | 0.9982 | 0.9982 | 0.9997 |
| | Bcorr | 0.9972 | 0.9966 | 0.9963 | 0.9964 | 0.9963 | 0.9964 | 0.9963 | 0.9979 |
| | meanRGBcor | 0.9980 | 0.9977 | 0.9975 | 0.9975 | 0.9975 | 0.9976 | 0.9976 | 0.9990 |
| 4 | reiteration | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| | RMS_red | 3.6349 | 3.8033 | 4.0530 | 4.0230 | 4.0622 | 3.9059 | 3.9803 | 2.4303 |
| | RMS_green | 3.6349 | 3.8033 | 4.0530 | 4.0230 | 4.0622 | 3.9059 | 3.9803 | 2.4303 |
| | RMS_blue | 3.6349 | 3.8033 | 4.0530 | 4.0230 | 4.0622 | 3.9059 | 3.9803 | 2.4303 |
| | RMSE | 3.4987 | 3.6429 | 3.8223 | 3.8264 | 3.8372 | 3.7033 | 3.7297 | 1.9532 |
| | Rcorr | 0.9985 | 0.9984 | 0.9982 | 0.9982 | 0.9982 | 0.9983 | 0.9982 | 0.9993 |
| | Gcorr | 0.9983 | 0.9982 | 0.9980 | 0.9980 | 0.9980 | 0.9982 | 0.9982 | 0.9997 |
| | Bcorr | 0.9971 | 0.9966 | 0.9963 | 0.9964 | 0.9963 | 0.9964 | 0.9962 | 0.9979 |
| | meanRGBcor | 0.9980 | 0.9977 | 0.9975 | 0.9975 | 0.9975 | 0.9976 | 0.9975 | 0.9990 |

| | Offset Num. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|
| | cellwidth | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 |
| | cellheight | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 |
| 5 | reiteration | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| | RMS_red | 3.6354 | 3.8049 | 4.0565 | 4.0240 | 4.0624 | 3.9070 | 3.9830 | 2.4383 |
| | RMS_green | 3.6354 | 3.8049 | 4.0565 | 4.0240 | 4.0624 | 3.9070 | 3.9830 | 2.4383 |
| | RMS_blue | 3.6354 | 3.8049 | 4.0565 | 4.0240 | 4.0624 | 3.9070 | 3.9830 | 2.4383 |
| | RMSE | 3.5005 | 3.6450 | 3.8267 | 3.8285 | 3.8398 | 3.7048 | 3.7326 | 1.9615 |
| | Rcorr | 0.9985 | 0.9984 | 0.9982 | 0.9982 | 0.9982 | 0.9983 | 0.9982 | 0.9993 |
| | Gcorr | 0.9983 | 0.9982 | 0.9980 | 0.9980 | 0.9980 | 0.9982 | 0.9982 | 0.9997 |
| | Bcorr | 0.9971 | 0.9966 | 0.9963 | 0.9964 | 0.9962 | 0.9964 | 0.9962 | 0.9979 |
| | meanRGBcor | 0.9980 | 0.9977 | 0.9975 | 0.9975 | 0.9975 | 0.9976 | 0.9975 | 0.9990 |
| 6 | reiteration | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| | RMS_red | 3.6357 | 3.8050 | 4.0594 | 4.0252 | 4.0627 | 3.9078 | 3.9853 | 2.4540 |
| | RMS_green | 3.6357 | 3.8050 | 4.0594 | 4.0252 | 4.0627 | 3.9078 | 3.9853 | 2.4540 |
| | RMS_blue | 3.6357 | 3.8050 | 4.0594 | 4.0252 | 4.0627 | 3.9078 | 3.9853 | 2.4540 |
| | RMSE | 3.5017 | 3.6450 | 3.8301 | 3.8297 | 3.8401 | 3.7059 | 3.7342 | 1.9700 |
| | Rcorr | 0.9985 | 0.9984 | 0.9982 | 0.9982 | 0.9982 | 0.9983 | 0.9982 | 0.9993 |
| | Gcorr | 0.9983 | 0.9982 | 0.9980 | 0.9980 | 0.9980 | 0.9982 | 0.9982 | 0.9997 |
| | Bcorr | 0.9971 | 0.9966 | 0.9963 | 0.9964 | 0.9962 | 0.9964 | 0.9962 | 0.9979 |
| | meanRGBcor | 0.9980 | 0.9977 | 0.9975 | 0.9975 | 0.9975 | 0.9976 | 0.9975 | 0.9990 |
| 7 | reiteration | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| | RMS_red | 3.6356 | 3.8050 | 4.0629 | 4.0272 | 4.0628 | 3.9078 | 3.9875 | 2.4544 |
| | RMS_green | 3.6356 | 3.8050 | 4.0629 | 4.0272 | 4.0628 | 3.9078 | 3.9875 | 2.4544 |
| | RMS_blue | 3.6356 | 3.8050 | 4.0629 | 4.0272 | 4.0628 | 3.9078 | 3.9875 | 2.4544 |
| | RMSE | 3.5017 | 3.6450 | 3.8337 | 3.8317 | 3.8403 | 3.7059 | 3.7352 | 1.9705 |
| | Rcorr | 0.9985 | 0.9984 | 0.9982 | 0.9982 | 0.9982 | 0.9983 | 0.9982 | 0.9993 |
| | Gcorr | 0.9983 | 0.9982 | 0.9980 | 0.9980 | 0.9980 | 0.9982 | 0.9982 | 0.9997 |
| | Bcorr | 0.9971 | 0.9966 | 0.9962 | 0.9964 | 0.9962 | 0.9964 | 0.9962 | 0.9979 |
| | meanRGBcor | 0.9980 | 0.9977 | 0.9975 | 0.9975 | 0.9975 | 0.9976 | 0.9975 | 0.9990 |
| 8 | reiteration | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| | RMS_red | 3.6356 | 3.8050 | 4.0668 | 4.0289 | 4.0630 | 3.9078 | 3.9875 | 2.4544 |
| | RMS_green | 3.6356 | 3.8050 | 4.0668 | 4.0289 | 4.0630 | 3.9078 | 3.9875 | 2.4544 |
| | RMS_blue | 3.6356 | 3.8050 | 4.0668 | 4.0289 | 4.0630 | 3.9078 | 3.9875 | 2.4544 |
| | RMSE | 3.5016 | 3.6450 | 3.8378 | 3.8335 | 3.8405 | 3.7059 | 3.7352 | 1.9705 |
| | Rcorr | 0.9985 | 0.9984 | 0.9982 | 0.9982 | 0.9982 | 0.9983 | 0.9982 | 0.9993 |
| | Gcorr | 0.9983 | 0.9982 | 0.9980 | 0.9980 | 0.9980 | 0.9982 | 0.9982 | 0.9997 |
| | Bcorr | 0.9971 | 0.9966 | 0.9962 | 0.9964 | 0.9962 | 0.9964 | 0.9962 | 0.9979 |
| | meanRGBcor | 0.9980 | 0.9977 | 0.9975 | 0.9975 | 0.9975 | 0.9976 | 0.9975 | 0.9990 |

| | Offset Num. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|
| | cellwidth | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 |
| | cellheight | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 |
| 9 | reiteration | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 |
| | RMS_red | 3.6355 | 3.8050 | 4.0714 | 4.0304 | 4.0633 | 3.9078 | 3.9875 | 2.4544 |
| | RMS_green | 3.6355 | 3.8050 | 4.0714 | 4.0304 | 4.0633 | 3.9078 | 3.9875 | 2.4544 |
| | RMS_blue | 3.6355 | 3.8050 | 4.0714 | 4.0304 | 4.0633 | 3.9078 | 3.9875 | 2.4544 |
| | RMSE | 3.5016 | 3.6450 | 3.8427 | 3.8349 | 3.8408 | 3.7059 | 3.7352 | 1.9705 |
| | Rcorr | 0.9985 | 0.9984 | 0.9982 | 0.9982 | 0.9982 | 0.9983 | 0.9982 | 0.9993 |
| | Gcorr | 0.9983 | 0.9982 | 0.9980 | 0.9980 | 0.9980 | 0.9982 | 0.9982 | 0.9997 |
| | Bcorr | 0.9971 | 0.9966 | 0.9962 | 0.9964 | 0.9962 | 0.9964 | 0.9962 | 0.9979 |
| | meanRGBcor | 0.9980 | 0.9977 | 0.9975 | 0.9975 | 0.9975 | 0.9976 | 0.9975 | 0.9990 |
| 10 | reiteration | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| | RMS_red | 3.6355 | 3.8050 | 4.0764 | 4.0321 | 4.0636 | 3.9078 | 3.9875 | 2.4544 |
| | RMS_green | 3.6355 | 3.8050 | 4.0764 | 4.0321 | 4.0636 | 3.9078 | 3.9875 | 2.4544 |
| | RMS_blue | 3.6355 | 3.8050 | 4.0764 | 4.0321 | 4.0636 | 3.9078 | 3.9875 | 2.4544 |
| | RMSE | 3.5016 | 3.6450 | 3.8480 | 3.8367 | 3.8411 | 3.7059 | 3.7352 | 1.9705 |
| | Rcorr | 0.9985 | 0.9984 | 0.9982 | 0.9982 | 0.9982 | 0.9983 | 0.9982 | 0.9993 |
| | Gcorr | 0.9983 | 0.9982 | 0.9980 | 0.9980 | 0.9980 | 0.9982 | 0.9982 | 0.9997 |
| | Bcorr | 0.9971 | 0.9966 | 0.9962 | 0.9964 | 0.9962 | 0.9964 | 0.9962 | 0.9979 |
| | meanRGBcor | 0.9980 | 0.9977 | 0.9975 | 0.9975 | 0.9975 | 0.9976 | 0.9975 | 0.9990 |
| 11 | reiteration | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 |
| | RMS_red | 3.6355 | 3.8050 | 4.0819 | 4.0343 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMS_green | 3.6355 | 3.8050 | 4.0819 | 4.0343 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMS_blue | 3.6355 | 3.8050 | 4.0819 | 4.0343 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMSE | 3.5016 | 3.6450 | 3.8538 | 3.8390 | 3.8415 | 3.7059 | 3.7352 | 1.9705 |
| | Rcorr | 0.9985 | 0.9984 | 0.9981 | 0.9982 | 0.9982 | 0.9983 | 0.9982 | 0.9993 |
| | Gcorr | 0.9983 | 0.9982 | 0.9980 | 0.9980 | 0.9980 | 0.9982 | 0.9982 | 0.9997 |
| | Bcorr | 0.9971 | 0.9966 | 0.9962 | 0.9964 | 0.9962 | 0.9964 | 0.9962 | 0.9979 |
| | meanRGBcor | 0.9980 | 0.9977 | 0.9975 | 0.9975 | 0.9975 | 0.9976 | 0.9975 | 0.9990 |
| 12 | reiteration | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| | RMS_red | 3.6355 | 3.8050 | 4.0880 | 4.0365 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMS_green | 3.6355 | 3.8050 | 4.0880 | 4.0365 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMS_blue | 3.6355 | 3.8050 | 4.0880 | 4.0365 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMSE | 3.5016 | 3.6450 | 3.8603 | 3.8412 | 3.8415 | 3.7059 | 3.7352 | 1.9705 |
| | Rcorr | 0.9985 | 0.9984 | 0.9981 | 0.9982 | 0.9982 | 0.9983 | 0.9982 | 0.9993 |
| | Gcorr | 0.9983 | 0.9982 | 0.9980 | 0.9980 | 0.9980 | 0.9982 | 0.9982 | 0.9997 |
| | Bcorr | 0.9971 | 0.9966 | 0.9962 | 0.9964 | 0.9962 | 0.9964 | 0.9962 | 0.9979 |
| | meanRGBcor | 0.9980 | 0.9977 | 0.9975 | 0.9975 | 0.9975 | 0.9976 | 0.9975 | 0.9990 |

| | Offset Num. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|
| | cellwidth | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 |
| | cellheight | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 |
| 13 | reiteration | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 |
| | RMS_red | 3.6355 | 3.8050 | 4.0945 | 4.0385 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMS_green | 3.6355 | 3.8050 | 4.0945 | 4.0385 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMS_blue | 3.6355 | 3.8050 | 4.0945 | 4.0385 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMSE | 3.5015 | 3.6450 | 3.8672 | 3.8435 | 3.8415 | 3.7059 | 3.7352 | 1.9705 |
| | Rcorr | 0.9985 | 0.9984 | 0.9981 | 0.9982 | 0.9982 | 0.9983 | 0.9982 | 0.9993 |
| | Gcorr | 0.9983 | 0.9982 | 0.9980 | 0.9980 | 0.9980 | 0.9982 | 0.9982 | 0.9997 |
| | Bcorr | 0.9971 | 0.9966 | 0.9962 | 0.9964 | 0.9962 | 0.9964 | 0.9962 | 0.9979 |
| | meanRGBcor | 0.9980 | 0.9977 | 0.9974 | 0.9975 | 0.9975 | 0.9976 | 0.9975 | 0.9990 |
| 14 | reiteration | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 |
| | RMS_red | 3.6355 | 3.8050 | 4.1018 | 4.0407 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMS_green | 3.6355 | 3.8050 | 4.1018 | 4.0407 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMS_blue | 3.6355 | 3.8050 | 4.1018 | 4.0407 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMSE | 3.5015 | 3.6450 | 3.8749 | 3.8458 | 3.8415 | 3.7059 | 3.7352 | 1.9705 |
| | Rcorr | 0.9985 | 0.9984 | 0.9981 | 0.9982 | 0.9982 | 0.9983 | 0.9982 | 0.9993 |
| | Gcorr | 0.9983 | 0.9982 | 0.9980 | 0.9980 | 0.9980 | 0.9982 | 0.9982 | 0.9997 |
| | Bcorr | 0.9971 | 0.9966 | 0.9962 | 0.9964 | 0.9962 | 0.9964 | 0.9962 | 0.9979 |
| | meanRGBcor | 0.9980 | 0.9977 | 0.9974 | 0.9975 | 0.9975 | 0.9976 | 0.9975 | 0.9990 |
| 15 | reiteration | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| | RMS_red | 3.6355 | 3.8050 | 4.1091 | 4.0437 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMS_green | 3.6355 | 3.8050 | 4.1091 | 4.0437 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMS_blue | 3.6355 | 3.8050 | 4.1091 | 4.0437 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMSE | 3.5015 | 3.6450 | 3.8827 | 3.8489 | 3.8415 | 3.7059 | 3.7352 | 1.9705 |
| | Rcorr | 0.9985 | 0.9984 | 0.9981 | 0.9982 | 0.9982 | 0.9983 | 0.9982 | 0.9993 |
| | Gcorr | 0.9983 | 0.9982 | 0.9980 | 0.9980 | 0.9980 | 0.9982 | 0.9982 | 0.9997 |
| | Bcorr | 0.9971 | 0.9966 | 0.9962 | 0.9964 | 0.9962 | 0.9964 | 0.9962 | 0.9979 |
| | meanRGBcor | 0.9980 | 0.9977 | 0.9974 | 0.9975 | 0.9975 | 0.9976 | 0.9975 | 0.9990 |
| 16 | reiteration | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 |
| | RMS_red | 3.6355 | 3.8050 | 4.1170 | 4.0461 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMS_green | 3.6355 | 3.8050 | 4.1170 | 4.0461 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMS_blue | 3.6355 | 3.8050 | 4.1170 | 4.0461 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMSE | 3.5015 | 3.6450 | 3.8910 | 3.8514 | 3.8415 | 3.7059 | 3.7352 | 1.9705 |
| | Rcorr | 0.9985 | 0.9984 | 0.9981 | 0.9982 | 0.9982 | 0.9983 | 0.9982 | 0.9993 |
| | Gcorr | 0.9983 | 0.9982 | 0.9980 | 0.9980 | 0.9980 | 0.9982 | 0.9982 | 0.9997 |
| | Bcorr | 0.9971 | 0.9966 | 0.9962 | 0.9964 | 0.9962 | 0.9964 | 0.9962 | 0.9979 |
| | meanRGBcor | 0.9980 | 0.9977 | 0.9974 | 0.9975 | 0.9975 | 0.9976 | 0.9975 | 0.9990 |

| | Offset Num. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|
| | cellwidth | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 |
| | cellheight | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 |
| 17 | reiteration | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 17 |
| | RMS_red | 3.6355 | 3.8050 | 4.1255 | 4.0488 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMS_green | 3.6355 | 3.8050 | 4.1255 | 4.0488 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMS_blue | 3.6355 | 3.8050 | 4.1255 | 4.0488 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMSE | 3.5015 | 3.6450 | 3.8999 | 3.8543 | 3.8415 | 3.7059 | 3.7352 | 1.9705 |
| | Rcorr | 0.9985 | 0.9984 | 0.9981 | 0.9982 | 0.9982 | 0.9983 | 0.9982 | 0.9993 |
| | Gcorr | 0.9983 | 0.9982 | 0.9980 | 0.9980 | 0.9980 | 0.9982 | 0.9982 | 0.9997 |
| | Bcorr | 0.9971 | 0.9966 | 0.9962 | 0.9963 | 0.9962 | 0.9964 | 0.9962 | 0.9979 |
| | meanRGBcor | 0.9980 | 0.9977 | 0.9974 | 0.9975 | 0.9975 | 0.9976 | 0.9975 | 0.9990 |
| 18 | reiteration | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 |
| | RMS_red | 3.6355 | 3.8050 | 4.1336 | 4.0523 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMS_green | 3.6355 | 3.8050 | 4.1336 | 4.0523 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMS_blue | 3.6355 | 3.8050 | 4.1336 | 4.0523 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMSE | 3.5015 | 3.6450 | 3.9084 | 3.8581 | 3.8415 | 3.7059 | 3.7352 | 1.9705 |
| | Rcorr | 0.9985 | 0.9984 | 0.9981 | 0.9982 | 0.9982 | 0.9983 | 0.9982 | 0.9993 |
| | Gcorr | 0.9983 | 0.9982 | 0.9979 | 0.9980 | 0.9980 | 0.9982 | 0.9982 | 0.9997 |
| | Bcorr | 0.9971 | 0.9966 | 0.9962 | 0.9963 | 0.9962 | 0.9964 | 0.9962 | 0.9979 |
| | meanRGBcor | 0.9980 | 0.9977 | 0.9974 | 0.9975 | 0.9975 | 0.9976 | 0.9975 | 0.9990 |
| 19 | reiteration | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 |
| | RMS_red | 3.6355 | 3.8050 | 4.1424 | 4.0558 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMS_green | 3.6355 | 3.8050 | 4.1424 | 4.0558 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMS_blue | 3.6355 | 3.8050 | 4.1424 | 4.0558 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMSE | 3.5015 | 3.6450 | 3.9178 | 3.8617 | 3.8415 | 3.7059 | 3.7352 | 1.9705 |
| | Rcorr | 0.9985 | 0.9984 | 0.9981 | 0.9982 | 0.9982 | 0.9983 | 0.9982 | 0.9993 |
| | Gcorr | 0.9983 | 0.9982 | 0.9979 | 0.9980 | 0.9980 | 0.9982 | 0.9982 | 0.9997 |
| | Bcorr | 0.9971 | 0.9966 | 0.9961 | 0.9963 | 0.9962 | 0.9964 | 0.9962 | 0.9979 |
| | meanRGBcor | 0.9980 | 0.9977 | 0.9974 | 0.9975 | 0.9975 | 0.9976 | 0.9975 | 0.9990 |
| 20 | reiteration | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| | RMS_red | 3.6355 | 3.8050 | 4.1513 | 4.0594 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMS_green | 3.6355 | 3.8050 | 4.1513 | 4.0594 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMS_blue | 3.6355 | 3.8050 | 4.1513 | 4.0594 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMSE | 3.5015 | 3.6450 | 3.9272 | 3.8655 | 3.8415 | 3.7059 | 3.7352 | 1.9705 |
| | Rcorr | 0.9985 | 0.9984 | 0.9981 | 0.9982 | 0.9982 | 0.9983 | 0.9982 | 0.9993 |
| | Gcorr | 0.9983 | 0.9982 | 0.9979 | 0.9980 | 0.9980 | 0.9982 | 0.9982 | 0.9997 |
| | Bcorr | 0.9971 | 0.9966 | 0.9961 | 0.9963 | 0.9962 | 0.9964 | 0.9962 | 0.9979 |
| | meanRGBcor | 0.9980 | 0.9977 | 0.9974 | 0.9975 | 0.9975 | 0.9976 | 0.9975 | 0.9990 |

| | Offset Num. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|
| | cellwidth | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 |
| | cellheight | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 |
| 21 | reiteration | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 |
| | RMS_red | 3.6355 | 3.8050 | 4.1603 | 4.0636 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMS_green | 3.6355 | 3.8050 | 4.1603 | 4.0636 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMS_blue | 3.6355 | 3.8050 | 4.1603 | 4.0636 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMSE | 3.5015 | 3.6450 | 3.9367 | 3.8699 | 3.8415 | 3.7059 | 3.7352 | 1.9705 |
| | Rcorr | 0.9985 | 0.9984 | 0.9981 | 0.9982 | 0.9982 | 0.9983 | 0.9982 | 0.9993 |
| | Gcorr | 0.9983 | 0.9982 | 0.9979 | 0.9980 | 0.9980 | 0.9982 | 0.9982 | 0.9997 |
| | Bcorr | 0.9971 | 0.9966 | 0.9961 | 0.9963 | 0.9962 | 0.9964 | 0.9962 | 0.9979 |
| | meanRGBcor | 0.9980 | 0.9977 | 0.9974 | 0.9975 | 0.9975 | 0.9976 | 0.9975 | 0.9990 |
| 22 | reiteration | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 |
| | RMS_red | 3.6355 | 3.8050 | 4.1698 | 4.0681 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMS_green | 3.6355 | 3.8050 | 4.1698 | 4.0681 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMS_blue | 3.6355 | 3.8050 | 4.1698 | 4.0681 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMSE | 3.5015 | 3.6450 | 3.9467 | 3.8747 | 3.8415 | 3.7059 | 3.7352 | 1.9705 |
| | Rcorr | 0.9985 | 0.9984 | 0.9981 | 0.9982 | 0.9982 | 0.9983 | 0.9982 | 0.9993 |
| | Gcorr | 0.9983 | 0.9982 | 0.9979 | 0.9979 | 0.9980 | 0.9982 | 0.9982 | 0.9997 |
| | Bcorr | 0.9971 | 0.9966 | 0.9961 | 0.9963 | 0.9962 | 0.9964 | 0.9962 | 0.9979 |
| | meanRGBcor | 0.9980 | 0.9977 | 0.9974 | 0.9975 | 0.9975 | 0.9976 | 0.9975 | 0.9990 |
| 23 | reiteration | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 |
| | RMS_red | 3.6355 | 3.8050 | 4.1800 | 4.0722 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMS_green | 3.6355 | 3.8050 | 4.1800 | 4.0722 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMS_blue | 3.6355 | 3.8050 | 4.1800 | 4.0722 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMSE | 3.5015 | 3.6450 | 3.9577 | 3.8790 | 3.8415 | 3.7059 | 3.7352 | 1.9705 |
| | Rcorr | 0.9985 | 0.9984 | 0.9981 | 0.9982 | 0.9982 | 0.9983 | 0.9982 | 0.9993 |
| | Gcorr | 0.9983 | 0.9982 | 0.9979 | 0.9979 | 0.9980 | 0.9982 | 0.9982 | 0.9997 |
| | Bcorr | 0.9971 | 0.9966 | 0.9961 | 0.9963 | 0.9962 | 0.9964 | 0.9962 | 0.9979 |
| | meanRGBcor | 0.9980 | 0.9977 | 0.9973 | 0.9975 | 0.9975 | 0.9976 | 0.9975 | 0.9990 |
| 24 | reiteration | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 |
| | RMS_red | 3.6355 | 3.8050 | 4.1896 | 4.0764 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMS_green | 3.6355 | 3.8050 | 4.1896 | 4.0764 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMS_blue | 3.6355 | 3.8050 | 4.1896 | 4.0764 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMSE | 3.5015 | 3.6450 | 3.9678 | 3.8836 | 3.8415 | 3.7059 | 3.7352 | 1.9705 |
| | Rcorr | 0.9985 | 0.9984 | 0.9980 | 0.9982 | 0.9982 | 0.9983 | 0.9982 | 0.9993 |
| | Gcorr | 0.9983 | 0.9982 | 0.9979 | 0.9979 | 0.9980 | 0.9982 | 0.9982 | 0.9997 |
| | Bcorr | 0.9971 | 0.9966 | 0.9961 | 0.9963 | 0.9962 | 0.9964 | 0.9962 | 0.9979 |
| | meanRGBcor | 0.9980 | 0.9977 | 0.9973 | 0.9975 | 0.9975 | 0.9976 | 0.9975 | 0.9990 |

| | Offset Num. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|
| | cellwidth | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 |
| | cellheight | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 |
| 25 | reiteration | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | RMS_red | 3.6355 | 3.8050 | 4.1987 | 4.0795 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMS_green | 3.6355 | 3.8050 | 4.1987 | 4.0795 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMS_blue | 3.6355 | 3.8050 | 4.1987 | 4.0795 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMSE | 3.5015 | 3.6450 | 3.9774 | 3.8869 | 3.8415 | 3.7059 | 3.7352 | 1.9705 |
| | Rcorr | 0.9985 | 0.9984 | 0.9980 | 0.9982 | 0.9982 | 0.9983 | 0.9982 | 0.9993 |
| | Gcorr | 0.9983 | 0.9982 | 0.9979 | 0.9979 | 0.9980 | 0.9982 | 0.9982 | 0.9997 |
| | Bcorr | 0.9971 | 0.9966 | 0.9961 | 0.9963 | 0.9962 | 0.9964 | 0.9962 | 0.9979 |
| | meanRGBcor | 0.9980 | 0.9977 | 0.9973 | 0.9975 | 0.9975 | 0.9976 | 0.9975 | 0.9990 |

Table C(2)-3. Raw data of RMSE on Salad data at QF. 75

| | Offset Num. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|
| | cellwidth | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 |
| | cellheight | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 |
| 1 | reiteration | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | RMS_red | 3.6052 | 3.7868 | 4.0331 | 3.9936 | 4.0409 | 3.8883 | 3.9331 | 2.3406 |
| | RMS_green | 3.6052 | 3.7868 | 4.0331 | 3.9936 | 4.0409 | 3.8883 | 3.9331 | 2.3406 |
| | RMS_blue | 3.6052 | 3.7868 | 4.0331 | 3.9936 | 4.0409 | 3.8883 | 3.9331 | 2.3406 |
| | RMSE | 3.4343 | 3.6004 | 3.7706 | 3.7769 | 3.7827 | 3.6574 | 3.6658 | 1.8658 |
| | Rcorr | 0.9986 | 0.9984 | 0.9982 | 0.9982 | 0.9982 | 0.9983 | 0.9983 | 0.9994 |
| | Gcorr | 0.9983 | 0.9982 | 0.9981 | 0.9980 | 0.9981 | 0.9982 | 0.9982 | 0.9997 |
| | Bcorr | 0.9975 | 0.9968 | 0.9966 | 0.9966 | 0.9966 | 0.9966 | 0.9965 | 0.9981 |
| | meanRGBcor | 0.9981 | 0.9978 | 0.9976 | 0.9976 | 0.9976 | 0.9977 | 0.9977 | 0.9991 |
| 2 | reiteration | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | RMS_red | 3.6355 | 3.7988 | 4.0446 | 4.0126 | 4.0686 | 3.9088 | 3.9847 | 2.3925 |
| | RMS_green | 3.6355 | 3.7988 | 4.0446 | 4.0126 | 4.0686 | 3.9088 | 3.9847 | 2.3925 |
| | RMS_blue | 3.6355 | 3.7988 | 4.0446 | 4.0126 | 4.0686 | 3.9088 | 3.9847 | 2.3925 |
| | RMSE | 3.4765 | 3.6301 | 3.7988 | 3.8052 | 3.8173 | 3.6860 | 3.7084 | 1.9166 |
| | Rcorr | 0.9985 | 0.9984 | 0.9982 | 0.9982 | 0.9982 | 0.9983 | 0.9982 | 0.9994 |
| | Gcorr | 0.9983 | 0.9982 | 0.9981 | 0.9980 | 0.9980 | 0.9982 | 0.9982 | 0.9997 |
| | Bcorr | 0.9973 | 0.9967 | 0.9964 | 0.9965 | 0.9964 | 0.9965 | 0.9964 | 0.9980 |
| | meanRGBcor | 0.9980 | 0.9978 | 0.9975 | 0.9976 | 0.9975 | 0.9977 | 0.9976 | 0.9990 |
| 3 | reiteration | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | RMS_red | 3.6340 | 3.8002 | 4.0465 | 4.0190 | 4.0660 | 3.9069 | 3.9824 | 2.4155 |
| | RMS_green | 3.6340 | 3.8002 | 4.0465 | 4.0190 | 4.0660 | 3.9069 | 3.9824 | 2.4155 |
| | RMS_blue | 3.6340 | 3.8002 | 4.0465 | 4.0190 | 4.0660 | 3.9069 | 3.9824 | 2.4155 |
| | RMSE | 3.4929 | 3.6386 | 3.8136 | 3.8211 | 3.8324 | 3.6972 | 3.7229 | 1.9413 |
| | Rcorr | 0.9985 | 0.9984 | 0.9982 | 0.9982 | 0.9982 | 0.9983 | 0.9982 | 0.9994 |
| | Gcorr | 0.9983 | 0.9982 | 0.9981 | 0.9980 | 0.9980 | 0.9982 | 0.9982 | 0.9997 |
| | Bcorr | 0.9972 | 0.9966 | 0.9963 | 0.9964 | 0.9963 | 0.9964 | 0.9963 | 0.9979 |
| | meanRGBcor | 0.9980 | 0.9977 | 0.9975 | 0.9975 | 0.9975 | 0.9976 | 0.9976 | 0.9990 |
| 4 | reiteration | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| | RMS_red | 3.6349 | 3.8033 | 4.0530 | 4.0230 | 4.0622 | 3.9059 | 3.9803 | 2.4303 |
| | RMS_green | 3.6349 | 3.8033 | 4.0530 | 4.0230 | 4.0622 | 3.9059 | 3.9803 | 2.4303 |
| | RMS_blue | 3.6349 | 3.8033 | 4.0530 | 4.0230 | 4.0622 | 3.9059 | 3.9803 | 2.4303 |
| | RMSE | 3.4987 | 3.6429 | 3.8223 | 3.8264 | 3.8372 | 3.7033 | 3.7297 | 1.9532 |
| | Rcorr | 0.9985 | 0.9984 | 0.9982 | 0.9982 | 0.9982 | 0.9983 | 0.9982 | 0.9993 |
| | Gcorr | 0.9983 | 0.9982 | 0.9980 | 0.9980 | 0.9980 | 0.9982 | 0.9982 | 0.9997 |
| | Bcorr | 0.9971 | 0.9966 | 0.9963 | 0.9964 | 0.9963 | 0.9964 | 0.9962 | 0.9979 |
| | meanRGBcor | 0.9980 | 0.9977 | 0.9975 | 0.9975 | 0.9975 | 0.9976 | 0.9975 | 0.9990 |

| | Offset Num. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|
| | cellwidth | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 |
| | cellheight | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 |
| 5 | reiteration | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| | RMS_red | 3.6354 | 3.8049 | 4.0565 | 4.0240 | 4.0624 | 3.9070 | 3.9830 | 2.4383 |
| | RMS_green | 3.6354 | 3.8049 | 4.0565 | 4.0240 | 4.0624 | 3.9070 | 3.9830 | 2.4383 |
| | RMS_blue | 3.6354 | 3.8049 | 4.0565 | 4.0240 | 4.0624 | 3.9070 | 3.9830 | 2.4383 |
| | RMSE | 3.5005 | 3.6450 | 3.8267 | 3.8285 | 3.8398 | 3.7048 | 3.7326 | 1.9615 |
| | Rcorr | 0.9985 | 0.9984 | 0.9982 | 0.9982 | 0.9982 | 0.9983 | 0.9982 | 0.9993 |
| | Gcorr | 0.9983 | 0.9982 | 0.9980 | 0.9980 | 0.9980 | 0.9982 | 0.9982 | 0.9997 |
| | Bcorr | 0.9971 | 0.9966 | 0.9963 | 0.9964 | 0.9962 | 0.9964 | 0.9962 | 0.9979 |
| | meanRGBcor | 0.9980 | 0.9977 | 0.9975 | 0.9975 | 0.9975 | 0.9976 | 0.9975 | 0.9990 |
| 6 | reiteration | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| | RMS_red | 3.6357 | 3.8050 | 4.0594 | 4.0252 | 4.0627 | 3.9078 | 3.9853 | 2.4540 |
| | RMS_green | 3.6357 | 3.8050 | 4.0594 | 4.0252 | 4.0627 | 3.9078 | 3.9853 | 2.4540 |
| | RMS_blue | 3.6357 | 3.8050 | 4.0594 | 4.0252 | 4.0627 | 3.9078 | 3.9853 | 2.4540 |
| | RMSE | 3.5017 | 3.6450 | 3.8301 | 3.8297 | 3.8401 | 3.7059 | 3.7342 | 1.9700 |
| | Rcorr | 0.9985 | 0.9984 | 0.9982 | 0.9982 | 0.9982 | 0.9983 | 0.9982 | 0.9993 |
| | Gcorr | 0.9983 | 0.9982 | 0.9980 | 0.9980 | 0.9980 | 0.9982 | 0.9982 | 0.9997 |
| | Bcorr | 0.9971 | 0.9966 | 0.9963 | 0.9964 | 0.9962 | 0.9964 | 0.9962 | 0.9979 |
| | meanRGBcor | 0.9980 | 0.9977 | 0.9975 | 0.9975 | 0.9975 | 0.9976 | 0.9975 | 0.9990 |
| 7 | reiteration | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| | RMS_red | 3.6356 | 3.8050 | 4.0629 | 4.0272 | 4.0628 | 3.9078 | 3.9875 | 2.4544 |
| | RMS_green | 3.6356 | 3.8050 | 4.0629 | 4.0272 | 4.0628 | 3.9078 | 3.9875 | 2.4544 |
| | RMS_blue | 3.6356 | 3.8050 | 4.0629 | 4.0272 | 4.0628 | 3.9078 | 3.9875 | 2.4544 |
| | RMSE | 3.5017 | 3.6450 | 3.8337 | 3.8317 | 3.8403 | 3.7059 | 3.7352 | 1.9705 |
| | Rcorr | 0.9985 | 0.9984 | 0.9982 | 0.9982 | 0.9982 | 0.9983 | 0.9982 | 0.9993 |
| | Gcorr | 0.9983 | 0.9982 | 0.9980 | 0.9980 | 0.9980 | 0.9982 | 0.9982 | 0.9997 |
| | Bcorr | 0.9971 | 0.9966 | 0.9962 | 0.9964 | 0.9962 | 0.9964 | 0.9962 | 0.9979 |
| | meanRGBcor | 0.9980 | 0.9977 | 0.9975 | 0.9975 | 0.9975 | 0.9976 | 0.9975 | 0.9990 |
| 8 | reiteration | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| | RMS_red | 3.6356 | 3.8050 | 4.0668 | 4.0289 | 4.0630 | 3.9078 | 3.9875 | 2.4544 |
| | RMS_green | 3.6356 | 3.8050 | 4.0668 | 4.0289 | 4.0630 | 3.9078 | 3.9875 | 2.4544 |
| | RMS_blue | 3.6356 | 3.8050 | 4.0668 | 4.0289 | 4.0630 | 3.9078 | 3.9875 | 2.4544 |
| | RMSE | 3.5016 | 3.6450 | 3.8378 | 3.8335 | 3.8405 | 3.7059 | 3.7352 | 1.9705 |
| | Rcorr | 0.9985 | 0.9984 | 0.9982 | 0.9982 | 0.9982 | 0.9983 | 0.9982 | 0.9993 |
| | Gcorr | 0.9983 | 0.9982 | 0.9980 | 0.9980 | 0.9980 | 0.9982 | 0.9982 | 0.9997 |
| | Bcorr | 0.9971 | 0.9966 | 0.9962 | 0.9964 | 0.9962 | 0.9964 | 0.9962 | 0.9979 |
| | meanRGBcor | 0.9980 | 0.9977 | 0.9975 | 0.9975 | 0.9975 | 0.9976 | 0.9975 | 0.9990 |

| | Offset Num. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|
| | cellwidth | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 |
| | cellheight | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 |
| 9 | reiteration | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 |
| | RMS_red | 3.6355 | 3.8050 | 4.0714 | 4.0304 | 4.0633 | 3.9078 | 3.9875 | 2.4544 |
| | RMS_green | 3.6355 | 3.8050 | 4.0714 | 4.0304 | 4.0633 | 3.9078 | 3.9875 | 2.4544 |
| | RMS_blue | 3.6355 | 3.8050 | 4.0714 | 4.0304 | 4.0633 | 3.9078 | 3.9875 | 2.4544 |
| | RMSE | 3.5016 | 3.6450 | 3.8427 | 3.8349 | 3.8408 | 3.7059 | 3.7352 | 1.9705 |
| | Rcorr | 0.9985 | 0.9984 | 0.9982 | 0.9982 | 0.9982 | 0.9983 | 0.9982 | 0.9993 |
| | Gcorr | 0.9983 | 0.9982 | 0.9980 | 0.9980 | 0.9980 | 0.9982 | 0.9982 | 0.9997 |
| | Bcorr | 0.9971 | 0.9966 | 0.9962 | 0.9964 | 0.9962 | 0.9964 | 0.9962 | 0.9979 |
| | meanRGBcor | 0.9980 | 0.9977 | 0.9975 | 0.9975 | 0.9975 | 0.9976 | 0.9975 | 0.9990 |
| 10 | reiteration | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| | RMS_red | 3.6355 | 3.8050 | 4.0764 | 4.0321 | 4.0636 | 3.9078 | 3.9875 | 2.4544 |
| | RMS_green | 3.6355 | 3.8050 | 4.0764 | 4.0321 | 4.0636 | 3.9078 | 3.9875 | 2.4544 |
| | RMS_blue | 3.6355 | 3.8050 | 4.0764 | 4.0321 | 4.0636 | 3.9078 | 3.9875 | 2.4544 |
| | RMSE | 3.5016 | 3.6450 | 3.8480 | 3.8367 | 3.8411 | 3.7059 | 3.7352 | 1.9705 |
| | Rcorr | 0.9985 | 0.9984 | 0.9982 | 0.9982 | 0.9982 | 0.9983 | 0.9982 | 0.9993 |
| | Gcorr | 0.9983 | 0.9982 | 0.9980 | 0.9980 | 0.9980 | 0.9982 | 0.9982 | 0.9997 |
| | Bcorr | 0.9971 | 0.9966 | 0.9962 | 0.9964 | 0.9962 | 0.9964 | 0.9962 | 0.9979 |
| | meanRGBcor | 0.9980 | 0.9977 | 0.9975 | 0.9975 | 0.9975 | 0.9976 | 0.9975 | 0.9990 |
| 11 | reiteration | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 |
| | RMS_red | 3.6355 | 3.8050 | 4.0819 | 4.0343 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMS_green | 3.6355 | 3.8050 | 4.0819 | 4.0343 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMS_blue | 3.6355 | 3.8050 | 4.0819 | 4.0343 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMSE | 3.5016 | 3.6450 | 3.8538 | 3.8390 | 3.8415 | 3.7059 | 3.7352 | 1.9705 |
| | Rcorr | 0.9985 | 0.9984 | 0.9981 | 0.9982 | 0.9982 | 0.9983 | 0.9982 | 0.9993 |
| | Gcorr | 0.9983 | 0.9982 | 0.9980 | 0.9980 | 0.9980 | 0.9982 | 0.9982 | 0.9997 |
| | Bcorr | 0.9971 | 0.9966 | 0.9962 | 0.9964 | 0.9962 | 0.9964 | 0.9962 | 0.9979 |
| | meanRGBcor | 0.9980 | 0.9977 | 0.9975 | 0.9975 | 0.9975 | 0.9976 | 0.9975 | 0.9990 |
| 12 | reiteration | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| | RMS_red | 3.6355 | 3.8050 | 4.0880 | 4.0365 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMS_green | 3.6355 | 3.8050 | 4.0880 | 4.0365 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMS_blue | 3.6355 | 3.8050 | 4.0880 | 4.0365 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMSE | 3.5016 | 3.6450 | 3.8603 | 3.8412 | 3.8415 | 3.7059 | 3.7352 | 1.9705 |
| | Rcorr | 0.9985 | 0.9984 | 0.9981 | 0.9982 | 0.9982 | 0.9983 | 0.9982 | 0.9993 |
| | Gcorr | 0.9983 | 0.9982 | 0.9980 | 0.9980 | 0.9980 | 0.9982 | 0.9982 | 0.9997 |
| | Bcorr | 0.9971 | 0.9966 | 0.9962 | 0.9964 | 0.9962 | 0.9964 | 0.9962 | 0.9979 |
| | meanRGBcor | 0.9980 | 0.9977 | 0.9975 | 0.9975 | 0.9975 | 0.9976 | 0.9975 | 0.9990 |

| | Offset Num. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|
| | cellwidth | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 |
| | cellheight | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 |
| 13 | reiteration | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 |
| | RMS_red | 3.6355 | 3.8050 | 4.0945 | 4.0385 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMS_green | 3.6355 | 3.8050 | 4.0945 | 4.0385 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMS_blue | 3.6355 | 3.8050 | 4.0945 | 4.0385 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMSE | 3.5015 | 3.6450 | 3.8672 | 3.8435 | 3.8415 | 3.7059 | 3.7352 | 1.9705 |
| | Rcorr | 0.9985 | 0.9984 | 0.9981 | 0.9982 | 0.9982 | 0.9983 | 0.9982 | 0.9993 |
| | Gcorr | 0.9983 | 0.9982 | 0.9980 | 0.9980 | 0.9980 | 0.9982 | 0.9982 | 0.9997 |
| | Bcorr | 0.9971 | 0.9966 | 0.9962 | 0.9964 | 0.9962 | 0.9964 | 0.9962 | 0.9979 |
| | meanRGBcor | 0.9980 | 0.9977 | 0.9974 | 0.9975 | 0.9975 | 0.9976 | 0.9975 | 0.9990 |
| 14 | reiteration | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 |
| | RMS_red | 3.6355 | 3.8050 | 4.1018 | 4.0407 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMS_green | 3.6355 | 3.8050 | 4.1018 | 4.0407 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMS_blue | 3.6355 | 3.8050 | 4.1018 | 4.0407 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMSE | 3.5015 | 3.6450 | 3.8749 | 3.8458 | 3.8415 | 3.7059 | 3.7352 | 1.9705 |
| | Rcorr | 0.9985 | 0.9984 | 0.9981 | 0.9982 | 0.9982 | 0.9983 | 0.9982 | 0.9993 |
| | Gcorr | 0.9983 | 0.9982 | 0.9980 | 0.9980 | 0.9980 | 0.9982 | 0.9982 | 0.9997 |
| | Bcorr | 0.9971 | 0.9966 | 0.9962 | 0.9964 | 0.9962 | 0.9964 | 0.9962 | 0.9979 |
| | meanRGBcor | 0.9980 | 0.9977 | 0.9974 | 0.9975 | 0.9975 | 0.9976 | 0.9975 | 0.9990 |
| 15 | reiteration | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| | RMS_red | 3.6355 | 3.8050 | 4.1091 | 4.0437 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMS_green | 3.6355 | 3.8050 | 4.1091 | 4.0437 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMS_blue | 3.6355 | 3.8050 | 4.1091 | 4.0437 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMSE | 3.5015 | 3.6450 | 3.8827 | 3.8489 | 3.8415 | 3.7059 | 3.7352 | 1.9705 |
| | Rcorr | 0.9985 | 0.9984 | 0.9981 | 0.9982 | 0.9982 | 0.9983 | 0.9982 | 0.9993 |
| | Gcorr | 0.9983 | 0.9982 | 0.9980 | 0.9980 | 0.9980 | 0.9982 | 0.9982 | 0.9997 |
| | Bcorr | 0.9971 | 0.9966 | 0.9962 | 0.9964 | 0.9962 | 0.9964 | 0.9962 | 0.9979 |
| | meanRGBcor | 0.9980 | 0.9977 | 0.9974 | 0.9975 | 0.9975 | 0.9976 | 0.9975 | 0.9990 |
| 16 | reiteration | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 |
| | RMS_red | 3.6355 | 3.8050 | 4.1170 | 4.0461 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMS_green | 3.6355 | 3.8050 | 4.1170 | 4.0461 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMS_blue | 3.6355 | 3.8050 | 4.1170 | 4.0461 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMSE | 3.5015 | 3.6450 | 3.8910 | 3.8514 | 3.8415 | 3.7059 | 3.7352 | 1.9705 |
| | Rcorr | 0.9985 | 0.9984 | 0.9981 | 0.9982 | 0.9982 | 0.9983 | 0.9982 | 0.9993 |
| | Gcorr | 0.9983 | 0.9982 | 0.9980 | 0.9980 | 0.9980 | 0.9982 | 0.9982 | 0.9997 |
| | Bcorr | 0.9971 | 0.9966 | 0.9962 | 0.9964 | 0.9962 | 0.9964 | 0.9962 | 0.9979 |
| | meanRGBcor | 0.9980 | 0.9977 | 0.9974 | 0.9975 | 0.9975 | 0.9976 | 0.9975 | 0.9990 |

| | Offset Num. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|
| | cellwidth | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 |
| | cellheight | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 |
| 17 | reiteration | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 17 |
| | RMS_red | 3.6355 | 3.8050 | 4.1255 | 4.0488 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMS_green | 3.6355 | 3.8050 | 4.1255 | 4.0488 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMS_blue | 3.6355 | 3.8050 | 4.1255 | 4.0488 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMSE | 3.5015 | 3.6450 | 3.8999 | 3.8543 | 3.8415 | 3.7059 | 3.7352 | 1.9705 |
| | Rcorr | 0.9985 | 0.9984 | 0.9981 | 0.9982 | 0.9982 | 0.9983 | 0.9982 | 0.9993 |
| | Gcorr | 0.9983 | 0.9982 | 0.9980 | 0.9980 | 0.9980 | 0.9982 | 0.9982 | 0.9997 |
| | Bcorr | 0.9971 | 0.9966 | 0.9962 | 0.9963 | 0.9962 | 0.9964 | 0.9962 | 0.9979 |
| | meanRGBcor | 0.9980 | 0.9977 | 0.9974 | 0.9975 | 0.9975 | 0.9976 | 0.9975 | 0.9990 |
| 18 | reiteration | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 |
| | RMS_red | 3.6355 | 3.8050 | 4.1336 | 4.0523 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMS_green | 3.6355 | 3.8050 | 4.1336 | 4.0523 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMS_blue | 3.6355 | 3.8050 | 4.1336 | 4.0523 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMSE | 3.5015 | 3.6450 | 3.9084 | 3.8581 | 3.8415 | 3.7059 | 3.7352 | 1.9705 |
| | Rcorr | 0.9985 | 0.9984 | 0.9981 | 0.9982 | 0.9982 | 0.9983 | 0.9982 | 0.9993 |
| | Gcorr | 0.9983 | 0.9982 | 0.9979 | 0.9980 | 0.9980 | 0.9982 | 0.9982 | 0.9997 |
| | Bcorr | 0.9971 | 0.9966 | 0.9962 | 0.9963 | 0.9962 | 0.9964 | 0.9962 | 0.9979 |
| | meanRGBcor | 0.9980 | 0.9977 | 0.9974 | 0.9975 | 0.9975 | 0.9976 | 0.9975 | 0.9990 |
| 19 | reiteration | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 |
| | RMS_red | 3.6355 | 3.8050 | 4.1424 | 4.0558 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMS_green | 3.6355 | 3.8050 | 4.1424 | 4.0558 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMS_blue | 3.6355 | 3.8050 | 4.1424 | 4.0558 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMSE | 3.5015 | 3.6450 | 3.9178 | 3.8617 | 3.8415 | 3.7059 | 3.7352 | 1.9705 |
| | Rcorr | 0.9985 | 0.9984 | 0.9981 | 0.9982 | 0.9982 | 0.9983 | 0.9982 | 0.9993 |
| | Gcorr | 0.9983 | 0.9982 | 0.9979 | 0.9980 | 0.9980 | 0.9982 | 0.9982 | 0.9997 |
| | Bcorr | 0.9971 | 0.9966 | 0.9961 | 0.9963 | 0.9962 | 0.9964 | 0.9962 | 0.9979 |
| | meanRGBcor | 0.9980 | 0.9977 | 0.9974 | 0.9975 | 0.9975 | 0.9976 | 0.9975 | 0.9990 |
| 20 | reiteration | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| | RMS_red | 3.6355 | 3.8050 | 4.1513 | 4.0594 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMS_green | 3.6355 | 3.8050 | 4.1513 | 4.0594 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMS_blue | 3.6355 | 3.8050 | 4.1513 | 4.0594 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMSE | 3.5015 | 3.6450 | 3.9272 | 3.8655 | 3.8415 | 3.7059 | 3.7352 | 1.9705 |
| | Rcorr | 0.9985 | 0.9984 | 0.9981 | 0.9982 | 0.9982 | 0.9983 | 0.9982 | 0.9993 |
| | Gcorr | 0.9983 | 0.9982 | 0.9979 | 0.9980 | 0.9980 | 0.9982 | 0.9982 | 0.9997 |
| | Bcorr | 0.9971 | 0.9966 | 0.9961 | 0.9963 | 0.9962 | 0.9964 | 0.9962 | 0.9979 |
| | meanRGBcor | 0.9980 | 0.9977 | 0.9974 | 0.9975 | 0.9975 | 0.9976 | 0.9975 | 0.9990 |

| | Offset Num. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|
| | cellwidth | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 |
| | cellheight | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 |
| 25 | reiteration | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | RMS_red | 3.6355 | 3.8050 | 4.1987 | 4.0795 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMS_green | 3.6355 | 3.8050 | 4.1987 | 4.0795 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMS_blue | 3.6355 | 3.8050 | 4.1987 | 4.0795 | 4.0640 | 3.9078 | 3.9875 | 2.4544 |
| | RMSE | 3.5015 | 3.6450 | 3.9774 | 3.8869 | 3.8415 | 3.7059 | 3.7352 | 1.9705 |
| | Rcorr | 0.9985 | 0.9984 | 0.9980 | 0.9982 | 0.9982 | 0.9983 | 0.9982 | 0.9993 |
| | Gcorr | 0.9983 | 0.9982 | 0.9979 | 0.9979 | 0.9980 | 0.9982 | 0.9982 | 0.9997 |
| | Bcorr | 0.9971 | 0.9966 | 0.9961 | 0.9963 | 0.9962 | 0.9964 | 0.9962 | 0.9979 |
| | meanRGBcor | 0.9980 | 0.9977 | 0.9973 | 0.9975 | 0.9975 | 0.9976 | 0.9975 | 0.9990 |

Table C(2)-4. Raw data of RMSE on Salad data at QF. 100

| | Offset Num. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|
| | cellwidth | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 |
| | cellheight | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 |
| 1 | reiteration | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | RMS_red | 1.5629 | 1.2516 | 1.5542 | 1.2426 | 1.5591 | 1.2510 | 1.5543 | 1.2216 |
| | RMS_green | 1.5629 | 1.2516 | 1.5542 | 1.2426 | 1.5591 | 1.2510 | 1.5543 | 1.2216 |
| | RMS_blue | 1.5629 | 1.2516 | 1.5542 | 1.2426 | 1.5591 | 1.2510 | 1.5543 | 1.2216 |
| | RMSE | 1.2120 | 1.0093 | 1.2089 | 1.0006 | 1.2098 | 1.0088 | 1.2089 | 0.9726 |
| | Rcorr | 0.9997 | 0.9998 | 0.9997 | 0.9998 | 0.9997 | 0.9998 | 0.9997 | 0.9998 |
| | Gcorr | 0.9999 | 0.9999 | 0.9999 | 0.9999 | 0.9999 | 0.9999 | 0.9999 | 0.9999 |
| | Bcorr | 0.9994 | 0.9996 | 0.9994 | 0.9996 | 0.9994 | 0.9996 | 0.9994 | 0.9996 |
| | meanRGBcor | 0.9997 | 0.9998 | 0.9997 | 0.9998 | 0.9997 | 0.9998 | 0.9997 | 0.9998 |
| 2 | reiteration | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | RMS_red | 1.9732 | 1.7790 | 2.0130 | 1.7711 | 2.0189 | 1.7768 | 2.0062 | 1.7517 |
| | RMS_green | 1.9732 | 1.7790 | 2.0130 | 1.7711 | 2.0189 | 1.7768 | 2.0062 | 1.7517 |
| | RMS_blue | 1.9732 | 1.7790 | 2.0130 | 1.7711 | 2.0189 | 1.7768 | 2.0062 | 1.7517 |
| | RMSE | 1.5465 | 1.4168 | 1.5682 | 1.4079 | 1.5678 | 1.4155 | 1.5648 | 1.3839 |
| | Rcorr | 0.9996 | 0.9996 | 0.9996 | 0.9997 | 0.9995 | 0.9997 | 0.9996 | 0.9997 |
| | Gcorr | 0.9998 | 0.9998 | 0.9998 | 0.9998 | 0.9998 | 0.9998 | 0.9998 | 0.9998 |
| | Bcorr | 0.9988 | 0.9990 | 0.9988 | 0.9990 | 0.9988 | 0.9990 | 0.9988 | 0.9990 |
| | meanRGBcor | 0.9994 | 0.9995 | 0.9994 | 0.9995 | 0.9994 | 0.9995 | 0.9994 | 0.9995 |
| 3 | reiteration | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | RMS_red | 2.2685 | 2.1751 | 2.3414 | 2.1706 | 2.3407 | 2.1777 | 2.3343 | 2.1510 |
| | RMS_green | 2.2685 | 2.1751 | 2.3414 | 2.1706 | 2.3407 | 2.1777 | 2.3343 | 2.1510 |
| | RMS_blue | 2.2685 | 2.1751 | 2.3414 | 2.1706 | 2.3407 | 2.1777 | 2.3343 | 2.1510 |
| | RMSE | 1.7938 | 1.7212 | 1.8292 | 1.7128 | 1.8275 | 1.7213 | 1.8262 | 1.6906 |
| | Rcorr | 0.9994 | 0.9995 | 0.9994 | 0.9995 | 0.9994 | 0.9995 | 0.9994 | 0.9995 |
| | Gcorr | 0.9997 | 0.9998 | 0.9997 | 0.9998 | 0.9997 | 0.9998 | 0.9997 | 0.9998 |
| | Bcorr | 0.9983 | 0.9985 | 0.9983 | 0.9985 | 0.9983 | 0.9985 | 0.9983 | 0.9985 |
| | meanRGBcor | 0.9992 | 0.9992 | 0.9991 | 0.9992 | 0.9991 | 0.9992 | 0.9991 | 0.9993 |
| 4 | reiteration | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| | RMS_red | 2.5025 | 2.4759 | 2.6053 | 2.4766 | 2.6046 | 2.4835 | 2.5995 | 2.4630 |
| | RMS_green | 2.5025 | 2.4759 | 2.6053 | 2.4766 | 2.6046 | 2.4835 | 2.5995 | 2.4630 |
| | RMS_blue | 2.5025 | 2.4759 | 2.6053 | 2.4766 | 2.6046 | 2.4835 | 2.5995 | 2.4630 |
| | RMSE | 1.9853 | 1.9540 | 2.0385 | 1.9466 | 2.0351 | 1.9572 | 2.0363 | 1.9286 |
| | Rcorr | 0.9993 | 0.9993 | 0.9992 | 0.9993 | 0.9992 | 0.9993 | 0.9993 | 0.9993 |
| | Gcorr | 0.9997 | 0.9997 | 0.9997 | 0.9997 | 0.9997 | 0.9997 | 0.9997 | 0.9997 |
| | Bcorr | 0.9978 | 0.9979 | 0.9978 | 0.9980 | 0.9978 | 0.9980 | 0.9978 | 0.9980 |
| | meanRGBcor | 0.9989 | 0.9990 | 0.9989 | 0.9990 | 0.9989 | 0.9990 | 0.9989 | 0.9990 |

| | Offset Num. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|
| | cellwidth | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 |
| | cellheight | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 |
| 5 | reiteration | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| | RMS_red | 2.6996 | 2.7201 | 2.8236 | 2.7280 | 3.0155 | 2.7329 | 2.8199 | 2.7109 |
| | RMS_green | 2.6996 | 2.7201 | 2.8236 | 2.7280 | 3.0155 | 2.7329 | 2.8199 | 2.7109 |
| | RMS_blue | 2.6996 | 2.7201 | 2.8236 | 2.7280 | 3.0155 | 2.7329 | 2.8199 | 2.7109 |
| | RMSE | 2.1447 | 2.1420 | 2.2082 | 2.1375 | 2.3502 | 2.1475 | 2.2062 | 2.1161 |
| | Rcorr | 0.9992 | 0.9992 | 0.9991 | 0.9992 | 0.9990 | 0.9992 | 0.9991 | 0.9992 |
| | Gcorr | 0.9996 | 0.9996 | 0.9996 | 0.9996 | 0.9996 | 0.9996 | 0.9996 | 0.9997 |
| | Bcorr | 0.9974 | 0.9975 | 0.9974 | 0.9976 | 0.9970 | 0.9975 | 0.9974 | 0.9976 |
| | meanRGBcor | 0.9987 | 0.9988 | 0.9987 | 0.9988 | 0.9985 | 0.9988 | 0.9987 | 0.9988 |
| 6 | reiteration | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| | RMS_red | 2.8679 | 2.9185 | 3.0099 | 2.9357 | 3.1793 | 2.9347 | 3.0073 | 2.9151 |
| | RMS_green | 2.8679 | 2.9185 | 3.0099 | 2.9357 | 3.1793 | 2.9347 | 3.0073 | 2.9151 |
| | RMS_blue | 2.8679 | 2.9185 | 3.0099 | 2.9357 | 3.1793 | 2.9347 | 3.0073 | 2.9151 |
| | RMSE | 2.2779 | 2.2913 | 2.3515 | 2.2932 | 2.4730 | 2.3003 | 2.3499 | 2.2702 |
| | Rcorr | 0.9991 | 0.9991 | 0.9990 | 0.9990 | 0.9989 | 0.9990 | 0.9990 | 0.9991 |
| | Gcorr | 0.9996 | 0.9996 | 0.9996 | 0.9996 | 0.9995 | 0.9996 | 0.9996 | 0.9996 |
| | Bcorr | 0.9970 | 0.9971 | 0.9970 | 0.9972 | 0.9966 | 0.9971 | 0.9970 | 0.9972 |
| | meanRGBcor | 0.9986 | 0.9986 | 0.9985 | 0.9986 | 0.9984 | 0.9986 | 0.9985 | 0.9986 |
| 7 | reiteration | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| | RMS_red | 3.0038 | 3.0895 | 3.1706 | 3.1063 | 3.3135 | 3.1071 | 3.1638 | 3.0919 |
| | RMS_green | 3.0038 | 3.0895 | 3.1706 | 3.1063 | 3.3135 | 3.1071 | 3.1638 | 3.0919 |
| | RMS_blue | 3.0038 | 3.0895 | 3.1706 | 3.1063 | 3.3135 | 3.1071 | 3.1638 | 3.0919 |
| | RMSE | 2.3856 | 2.4177 | 2.4722 | 2.4212 | 2.5740 | 2.4277 | 2.4680 | 2.4013 |
| | Rcorr | 0.9990 | 0.9989 | 0.9989 | 0.9989 | 0.9988 | 0.9989 | 0.9989 | 0.9989 |
| | Gcorr | 0.9996 | 0.9996 | 0.9995 | 0.9996 | 0.9995 | 0.9996 | 0.9995 | 0.9996 |
| | Bcorr | 0.9967 | 0.9968 | 0.9967 | 0.9968 | 0.9963 | 0.9968 | 0.9967 | 0.9968 |
| | meanRGBcor | 0.9984 | 0.9984 | 0.9984 | 0.9984 | 0.9982 | 0.9984 | 0.9984 | 0.9984 |
| 8 | reiteration | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| | RMS_red | 3.1248 | 3.2310 | 3.3076 | 3.2574 | 3.4385 | 3.2589 | 3.3008 | 3.2405 |
| | RMS_green | 3.1248 | 3.2310 | 3.3076 | 3.2574 | 3.4385 | 3.2589 | 3.3008 | 3.2405 |
| | RMS_blue | 3.1248 | 3.2310 | 3.3076 | 3.2574 | 3.4385 | 3.2589 | 3.3008 | 3.2405 |
| | RMSE | 2.4784 | 2.5227 | 2.5723 | 2.5309 | 2.6649 | 2.5370 | 2.5695 | 2.5112 |
| | Rcorr | 0.9989 | 0.9988 | 0.9988 | 0.9988 | 0.9987 | 0.9988 | 0.9988 | 0.9988 |
| | Gcorr | 0.9995 | 0.9995 | 0.9995 | 0.9995 | 0.9995 | 0.9995 | 0.9995 | 0.9995 |
| | Bcorr | 0.9964 | 0.9965 | 0.9964 | 0.9965 | 0.9961 | 0.9965 | 0.9964 | 0.9965 |
| | meanRGBcor | 0.9983 | 0.9983 | 0.9982 | 0.9983 | 0.9981 | 0.9983 | 0.9982 | 0.9983 |

| | Offset Num. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|
| | cellwidth | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 |
| | cellheight | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 |
| 9 | reiteration | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 |
| | RMS_red | 3.2330 | 3.3478 | 3.4279 | 3.3846 | 3.5405 | 3.3858 | 3.4233 | 3.3656 |
| | RMS_green | 3.2330 | 3.3478 | 3.4279 | 3.3846 | 3.5405 | 3.3858 | 3.4233 | 3.3656 |
| | RMS_blue | 3.2330 | 3.3478 | 3.4279 | 3.3846 | 3.5405 | 3.3858 | 3.4233 | 3.3656 |
| | RMSE | 2.5580 | 2.6101 | 2.6617 | 2.6220 | 2.7384 | 2.6276 | 2.6591 | 2.6025 |
| | Rcorr | 0.9988 | 0.9988 | 0.9987 | 0.9987 | 0.9986 | 0.9987 | 0.9987 | 0.9987 |
| | Gcorr | 0.9995 | 0.9995 | 0.9995 | 0.9995 | 0.9995 | 0.9995 | 0.9995 | 0.9995 |
| | Bcorr | 0.9962 | 0.9962 | 0.9961 | 0.9962 | 0.9958 | 0.9962 | 0.9961 | 0.9963 |
| | meanRGBcor | 0.9982 | 0.9981 | 0.9981 | 0.9982 | 0.9980 | 0.9981 | 0.9981 | 0.9982 |
| 10 | reiteration | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| | RMS_red | 3.3232 | 3.4511 | 3.5309 | 3.4948 | 3.6354 | 3.4995 | 3.5295 | 3.4780 |
| | RMS_green | 3.3232 | 3.4511 | 3.5309 | 3.4948 | 3.6354 | 3.4995 | 3.5295 | 3.4780 |
| | RMS_blue | 3.3232 | 3.4511 | 3.5309 | 3.4948 | 3.6354 | 3.4995 | 3.5295 | 3.4780 |
| | RMSE | 2.6270 | 2.6863 | 2.7375 | 2.7017 | 2.8061 | 2.7105 | 2.7360 | 2.6832 |
| | Rcorr | 0.9988 | 0.9987 | 0.9986 | 0.9986 | 0.9985 | 0.9986 | 0.9986 | 0.9987 |
| | Gcorr | 0.9995 | 0.9995 | 0.9994 | 0.9995 | 0.9994 | 0.9995 | 0.9994 | 0.9995 |
| | Bcorr | 0.9959 | 0.9959 | 0.9959 | 0.9960 | 0.9956 | 0.9959 | 0.9959 | 0.9960 |
| | meanRGBcor | 0.9981 | 0.9980 | 0.9980 | 0.9980 | 0.9979 | 0.9980 | 0.9980 | 0.9981 |
| 11 | reiteration | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 |
| | RMS_red | 3.4004 | 3.5405 | 3.6206 | 3.5865 | 3.7177 | 3.5955 | 3.6210 | 3.5731 |
| | RMS_green | 3.4004 | 3.5405 | 3.6206 | 3.5865 | 3.7177 | 3.5955 | 3.6210 | 3.5731 |
| | RMS_blue | 3.4004 | 3.5405 | 3.6206 | 3.5865 | 3.7177 | 3.5955 | 3.6210 | 3.5731 |
| | RMSE | 2.6865 | 2.7524 | 2.8042 | 2.7686 | 2.8634 | 2.7794 | 2.8032 | 2.7531 |
| | Rcorr | 0.9987 | 0.9986 | 0.9986 | 0.9986 | 0.9985 | 0.9986 | 0.9986 | 0.9986 |
| | Gcorr | 0.9995 | 0.9994 | 0.9994 | 0.9994 | 0.9994 | 0.9994 | 0.9994 | 0.9994 |
| | Bcorr | 0.9957 | 0.9957 | 0.9957 | 0.9958 | 0.9955 | 0.9957 | 0.9956 | 0.9958 |
| | meanRGBcor | 0.9980 | 0.9979 | 0.9979 | 0.9979 | 0.9978 | 0.9979 | 0.9979 | 0.9979 |
| 12 | reiteration | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| | RMS_red | 3.4693 | 3.6147 | 3.7010 | 3.6693 | 3.7914 | 3.6775 | 3.7073 | 3.6580 |
| | RMS_green | 3.4693 | 3.6147 | 3.7010 | 3.6693 | 3.7914 | 3.6775 | 3.7073 | 3.6580 |
| | RMS_blue | 3.4693 | 3.6147 | 3.7010 | 3.6693 | 3.7914 | 3.6775 | 3.7073 | 3.6580 |
| | RMSE | 2.7375 | 2.8094 | 2.8611 | 2.8276 | 2.9168 | 2.8372 | 2.8637 | 2.8142 |
| | Rcorr | 0.9987 | 0.9986 | 0.9985 | 0.9985 | 0.9984 | 0.9985 | 0.9985 | 0.9985 |
| | Gcorr | 0.9994 | 0.9994 | 0.9994 | 0.9994 | 0.9994 | 0.9994 | 0.9994 | 0.9994 |
| | Bcorr | 0.9956 | 0.9955 | 0.9955 | 0.9956 | 0.9953 | 0.9955 | 0.9955 | 0.9956 |
| | meanRGBcor | 0.9979 | 0.9978 | 0.9978 | 0.9979 | 0.9977 | 0.9978 | 0.9978 | 0.9979 |

| | Offset Num. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|
| | cellwidth | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 |
| | cellheight | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 |
| 13 | reiteration | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 |
| | RMS_red | 3.5232 | 3.6743 | 3.7733 | 3.7424 | 3.8595 | 3.7524 | 3.7787 | 3.7327 |
| | RMS_green | 3.5232 | 3.6743 | 3.7733 | 3.7424 | 3.8595 | 3.7524 | 3.7787 | 3.7327 |
| | RMS_blue | 3.5232 | 3.6743 | 3.7733 | 3.7424 | 3.8595 | 3.7524 | 3.7787 | 3.7327 |
| | RMSE | 2.7778 | 2.8555 | 2.9128 | 2.8798 | 2.9638 | 2.8912 | 2.9145 | 2.8684 |
| | Rcorr | 0.9986 | 0.9985 | 0.9984 | 0.9985 | 0.9984 | 0.9984 | 0.9984 | 0.9985 |
| | Gcorr | 0.9994 | 0.9994 | 0.9994 | 0.9994 | 0.9994 | 0.9994 | 0.9994 | 0.9994 |
| | Bcorr | 0.9954 | 0.9954 | 0.9953 | 0.9955 | 0.9951 | 0.9954 | 0.9953 | 0.9955 |
| | meanRGBcor | 0.9978 | 0.9978 | 0.9977 | 0.9978 | 0.9976 | 0.9977 | 0.9977 | 0.9978 |
| 14 | reiteration | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 |
| | RMS_red | 3.5698 | 3.7342 | 3.8402 | 3.8067 | 3.8595 | 3.8169 | 3.8463 | 3.7982 |
| | RMS_green | 3.5698 | 3.7342 | 3.8402 | 3.8067 | 3.8595 | 3.8169 | 3.8463 | 3.7982 |
| | RMS_blue | 3.5698 | 3.7342 | 3.8402 | 3.8067 | 3.8595 | 3.8169 | 3.8463 | 3.7982 |
| | RMSE | 2.8146 | 2.8989 | 2.9596 | 2.9260 | 2.9638 | 2.9392 | 2.9623 | 2.9163 |
| | Rcorr | 0.9986 | 0.9985 | 0.9984 | 0.9984 | 0.9984 | 0.9984 | 0.9984 | 0.9984 |
| | Gcorr | 0.9994 | 0.9994 | 0.9994 | 0.9994 | 0.9994 | 0.9994 | 0.9994 | 0.9994 |
| | Bcorr | 0.9953 | 0.9952 | 0.9952 | 0.9953 | 0.9951 | 0.9952 | 0.9952 | 0.9953 |
| | meanRGBcor | 0.9978 | 0.9977 | 0.9976 | 0.9977 | 0.9976 | 0.9977 | 0.9976 | 0.9977 |
| 15 | reiteration | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| | RMS_red | 3.6136 | 3.7342 | 3.8976 | 3.8683 | 3.9162 | 3.8799 | 3.9054 | 3.8583 |
| | RMS_green | 3.6136 | 3.7342 | 3.8976 | 3.8683 | 3.9162 | 3.8799 | 3.9054 | 3.8583 |
| | RMS_blue | 3.6136 | 3.7342 | 3.8976 | 3.8683 | 3.9162 | 3.8799 | 3.9054 | 3.8583 |
| | RMSE | 2.8483 | 2.8989 | 3.0004 | 2.9692 | 3.0047 | 2.9840 | 3.0049 | 2.9590 |
| | Rcorr | 0.9986 | 0.9985 | 0.9983 | 0.9983 | 0.9983 | 0.9983 | 0.9983 | 0.9984 |
| | Gcorr | 0.9994 | 0.9994 | 0.9993 | 0.9994 | 0.9993 | 0.9994 | 0.9993 | 0.9994 |
| | Bcorr | 0.9952 | 0.9952 | 0.9951 | 0.9952 | 0.9950 | 0.9951 | 0.9950 | 0.9952 |
| | meanRGBcor | 0.9977 | 0.9977 | 0.9976 | 0.9976 | 0.9976 | 0.9976 | 0.9976 | 0.9976 |
| 16 | reiteration | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 |
| | RMS_red | 3.6523 | 3.8322 | 3.9493 | 3.9259 | 3.9162 | 3.9342 | 3.9561 | 3.9161 |
| | RMS_green | 3.6523 | 3.8322 | 3.9493 | 3.9259 | 3.9162 | 3.9342 | 3.9561 | 3.9161 |
| | RMS_blue | 3.6523 | 3.8322 | 3.9493 | 3.9259 | 3.9162 | 3.9342 | 3.9561 | 3.9161 |
| | RMSE | 2.8783 | 2.9719 | 3.0378 | 3.0091 | 3.0047 | 3.0235 | 3.0399 | 2.9995 |
| | Rcorr | 0.9985 | 0.9984 | 0.9983 | 0.9983 | 0.9983 | 0.9983 | 0.9983 | 0.9983 |
| | Gcorr | 0.9994 | 0.9994 | 0.9993 | 0.9993 | 0.9993 | 0.9993 | 0.9993 | 0.9994 |
| | Bcorr | 0.9951 | 0.9950 | 0.9949 | 0.9951 | 0.9950 | 0.9949 | 0.9949 | 0.9951 |
| | meanRGBcor | 0.9977 | 0.9976 | 0.9975 | 0.9976 | 0.9976 | 0.9975 | 0.9975 | 0.9976 |

| | Offset Num. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|
| | cellwidth | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 |
| | cellheight | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 |
| 17 | reiteration | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 17 |
| | RMS_red | 3.6854 | 3.8717 | 3.9987 | 3.9691 | 4.0137 | 3.9821 | 4.0046 | 3.9681 |
| | RMS_green | 3.6854 | 3.8717 | 3.9987 | 3.9691 | 4.0137 | 3.9821 | 4.0046 | 3.9681 |
| | RMS_blue | 3.6854 | 3.8717 | 3.9987 | 3.9691 | 4.0137 | 3.9821 | 4.0046 | 3.9681 |
| | RMSE | 2.9030 | 3.0019 | 3.0709 | 3.0410 | 3.0746 | 3.0577 | 3.0732 | 3.0366 |
| | Rcorr | 0.9985 | 0.9983 | 0.9982 | 0.9983 | 0.9982 | 0.9982 | 0.9982 | 0.9983 |
| | Gcorr | 0.9994 | 0.9993 | 0.9993 | 0.9993 | 0.9993 | 0.9993 | 0.9993 | 0.9993 |
| | Bcorr | 0.9950 | 0.9949 | 0.9948 | 0.9950 | 0.9948 | 0.9948 | 0.9948 | 0.9949 |
| | meanRGBcor | 0.9976 | 0.9975 | 0.9975 | 0.9975 | 0.9974 | 0.9975 | 0.9975 | 0.9975 |
| 18 | reiteration | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 |
| | RMS_red | 3.7196 | 3.9091 | 4.0400 | 4.0147 | 4.0587 | 4.0268 | 4.0475 | 4.0126 |
| | RMS_green | 3.7196 | 3.9091 | 4.0400 | 4.0147 | 4.0587 | 4.0268 | 4.0475 | 4.0126 |
| | RMS_blue | 3.7196 | 3.9091 | 4.0400 | 4.0147 | 4.0587 | 4.0268 | 4.0475 | 4.0126 |
| | RMSE | 2.9285 | 3.0290 | 3.1015 | 3.0725 | 3.1049 | 3.0916 | 3.1041 | 3.0690 |
| | Rcorr | 0.9985 | 0.9983 | 0.9982 | 0.9982 | 0.9982 | 0.9982 | 0.9982 | 0.9982 |
| | Gcorr | 0.9994 | 0.9993 | 0.9993 | 0.9993 | 0.9993 | 0.9993 | 0.9993 | 0.9993 |
| | Bcorr | 0.9949 | 0.9948 | 0.9947 | 0.9949 | 0.9947 | 0.9947 | 0.9947 | 0.9948 |
| | meanRGBcor | 0.9976 | 0.9975 | 0.9974 | 0.9975 | 0.9974 | 0.9974 | 0.9974 | 0.9975 |
| 19 | reiteration | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 |
| | RMS_red | 3.7491 | 3.9439 | 4.0801 | 4.0572 | 4.1009 | 4.0657 | 4.0866 | 4.0532 |
| | RMS_green | 3.7491 | 3.9439 | 4.0801 | 4.0572 | 4.1009 | 4.0657 | 4.0866 | 4.0532 |
| | RMS_blue | 3.7491 | 3.9439 | 4.0801 | 4.0572 | 4.1009 | 4.0657 | 4.0866 | 4.0532 |
| | RMSE | 2.9519 | 3.0560 | 3.1295 | 3.1019 | 3.1345 | 3.1201 | 3.1325 | 3.0974 |
| | Rcorr | 0.9984 | 0.9983 | 0.9982 | 0.9982 | 0.9981 | 0.9982 | 0.9982 | 0.9982 |
| | Gcorr | 0.9994 | 0.9993 | 0.9993 | 0.9993 | 0.9993 | 0.9993 | 0.9993 | 0.9993 |
| | Bcorr | 0.9948 | 0.9947 | 0.9946 | 0.9948 | 0.9946 | 0.9946 | 0.9946 | 0.9948 |
| | meanRGBcor | 0.9975 | 0.9974 | 0.9974 | 0.9974 | 0.9973 | 0.9974 | 0.9974 | 0.9974 |
| 20 | reiteration | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| | RMS_red | 3.7748 | 3.9728 | 4.1142 | 4.0945 | 4.1374 | 4.1047 | 4.1258 | 4.0947 |
| | RMS_green | 3.7748 | 3.9728 | 4.1142 | 4.0945 | 4.1374 | 4.1047 | 4.1258 | 4.0947 |
| | RMS_blue | 3.7748 | 3.9728 | 4.1142 | 4.0945 | 4.1374 | 4.1047 | 4.1258 | 4.0947 |
| | RMSE | 2.9708 | 3.0765 | 3.1538 | 3.1286 | 3.1594 | 3.1485 | 3.1601 | 3.1249 |
| | Rcorr | 0.9984 | 0.9983 | 0.9981 | 0.9981 | 0.9981 | 0.9981 | 0.9981 | 0.9981 |
| | Gcorr | 0.9994 | 0.9993 | 0.9993 | 0.9993 | 0.9993 | 0.9993 | 0.9993 | 0.9993 |
| | Bcorr | 0.9947 | 0.9946 | 0.9946 | 0.9947 | 0.9945 | 0.9945 | 0.9946 | 0.9947 |
| | meanRGBcor | 0.9975 | 0.9974 | 0.9973 | 0.9974 | 0.9973 | 0.9973 | 0.9973 | 0.9974 |

| | Offset Num. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|
| | cellwidth | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 |
| | cellheight | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 |
| 21 | reiteration | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 |
| | RMS_red | 3.8009 | 3.9973 | 4.1430 | 4.1271 | 4.1712 | 4.1369 | 4.1593 | 4.1298 |
| | RMS_green | 3.8009 | 3.9973 | 4.1430 | 4.1271 | 4.1712 | 4.1369 | 4.1593 | 4.1298 |
| | RMS_blue | 3.8009 | 3.9973 | 4.1430 | 4.1271 | 4.1712 | 4.1369 | 4.1593 | 4.1298 |
| | RMSE | 2.9906 | 3.0956 | 3.1748 | 3.1534 | 3.1829 | 3.1718 | 3.1844 | 3.1497 |
| | Rcorr | 0.9984 | 0.9982 | 0.9981 | 0.9981 | 0.9981 | 0.9981 | 0.9981 | 0.9981 |
| | Gcorr | 0.9993 | 0.9993 | 0.9993 | 0.9993 | 0.9993 | 0.9993 | 0.9993 | 0.9993 |
| | Bcorr | 0.9946 | 0.9945 | 0.9945 | 0.9946 | 0.9944 | 0.9945 | 0.9945 | 0.9946 |
| | meanRGBcor | 0.9975 | 0.9974 | 0.9973 | 0.9973 | 0.9973 | 0.9973 | 0.9973 | 0.9973 |
| 22 | reiteration | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 |
| | RMS_red | 3.8238 | 4.0198 | 4.1673 | 4.1608 | 4.2005 | 4.1701 | 4.1909 | 4.1661 |
| | RMS_green | 3.8238 | 4.0198 | 4.1673 | 4.1608 | 4.2005 | 4.1701 | 4.1909 | 4.1661 |
| | RMS_blue | 3.8238 | 4.0198 | 4.1673 | 4.1608 | 4.2005 | 4.1701 | 4.1909 | 4.1661 |
| | RMSE | 3.0085 | 3.1130 | 3.1930 | 3.1776 | 3.2030 | 3.1957 | 3.2066 | 3.1755 |
| | Rcorr | 0.9984 | 0.9982 | 0.9981 | 0.9981 | 0.9981 | 0.9981 | 0.9981 | 0.9981 |
| | Gcorr | 0.9993 | 0.9993 | 0.9993 | 0.9993 | 0.9993 | 0.9993 | 0.9993 | 0.9993 |
| | Bcorr | 0.9946 | 0.9945 | 0.9944 | 0.9945 | 0.9943 | 0.9944 | 0.9944 | 0.9945 |
| | meanRGBcor | 0.9974 | 0.9973 | 0.9973 | 0.9973 | 0.9972 | 0.9972 | 0.9972 | 0.9973 |
| 23 | reiteration | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 |
| | RMS_red | 3.8470 | 4.0453 | 4.1891 | 4.1971 | 4.2249 | 4.1951 | 4.2204 | 4.1976 |
| | RMS_green | 3.8470 | 4.0453 | 4.1891 | 4.1971 | 4.2249 | 4.1951 | 4.2204 | 4.1976 |
| | RMS_blue | 3.8470 | 4.0453 | 4.1891 | 4.1971 | 4.2249 | 4.1951 | 4.2204 | 4.1976 |
| | RMSE | 3.0250 | 3.1306 | 3.2098 | 3.2016 | 3.2212 | 3.2140 | 3.2266 | 3.1968 |
| | Rcorr | 0.9984 | 0.9982 | 0.9981 | 0.9981 | 0.9980 | 0.9981 | 0.9980 | 0.9981 |
| | Gcorr | 0.9993 | 0.9993 | 0.9993 | 0.9993 | 0.9993 | 0.9993 | 0.9992 | 0.9993 |
| | Bcorr | 0.9945 | 0.9944 | 0.9944 | 0.9945 | 0.9943 | 0.9943 | 0.9943 | 0.9945 |
| | meanRGBcor | 0.9974 | 0.9973 | 0.9972 | 0.9973 | 0.9972 | 0.9972 | 0.9972 | 0.9973 |
| 24 | reiteration | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 |
| | RMS_red | 3.8657 | 4.0644 | 4.2127 | 4.2255 | 4.2504 | 4.2189 | 4.2489 | 4.2256 |
| | RMS_green | 3.8657 | 4.0644 | 4.2127 | 4.2255 | 4.2504 | 4.2189 | 4.2489 | 4.2256 |
| | RMS_blue | 3.8657 | 4.0644 | 4.2127 | 4.2255 | 4.2504 | 4.2189 | 4.2489 | 4.2256 |
| | RMSE | 3.0394 | 3.1454 | 3.2260 | 3.2223 | 3.2379 | 3.2318 | 3.2475 | 3.2174 |
| | Rcorr | 0.9983 | 0.9982 | 0.9980 | 0.9980 | 0.9980 | 0.9980 | 0.9980 | 0.9980 |
| | Gcorr | 0.9993 | 0.9993 | 0.9992 | 0.9992 | 0.9993 | 0.9992 | 0.9992 | 0.9993 |
| | Bcorr | 0.9945 | 0.9943 | 0.9943 | 0.9944 | 0.9942 | 0.9943 | 0.9943 | 0.9944 |
| | meanRGBcor | 0.9974 | 0.9973 | 0.9972 | 0.9972 | 0.9972 | 0.9972 | 0.9972 | 0.9972 |

|  | Offset Num. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|
|  | cellwidth | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 |
|  | cellheight | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 |
| 25 | reiteration | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
|  | RMS_red | 3.8832 | 4.0836 | 4.2324 | 4.2529 | 4.2741 | 4.2393 | 4.2753 | 4.2541 |
|  | RMS_green | 3.8832 | 4.0836 | 4.2324 | 4.2529 | 4.2741 | 4.2393 | 4.2753 | 4.2541 |
|  | RMS_blue | 3.8832 | 4.0836 | 4.2324 | 4.2529 | 4.2741 | 4.2393 | 4.2753 | 4.2541 |
|  | RMSE | 3.0521 | 3.1591 | 3.2398 | 3.2410 | 3.2549 | 3.2469 | 3.2660 | 3.2373 |
|  | Rcorr | 0.9983 | 0.9982 | 0.9980 | 0.9980 | 0.9980 | 0.9980 | 0.9980 | 0.9980 |
|  | Gcorr | 0.9993 | 0.9993 | 0.9992 | 0.9992 | 0.9992 | 0.9992 | 0.9992 | 0.9992 |
|  | Bcorr | 0.9944 | 0.9943 | 0.9943 | 0.9944 | 0.9942 | 0.9942 | 0.9942 | 0.9943 |
|  | meanRGBcor | 0.9974 | 0.9972 | 0.9972 | 0.9972 | 0.9971 | 0.9972 | 0.9971 | 0.9972 |