Marmara University Electrical and-Electronics Engineering EE7025-Fundamentals of Digital Image Processing

PROJECT 1 REPORT

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Abstract

In this report is written for lecture project ongoing Marmara University lecture of Fundamentals of Digital Image Processing. Problem solutions and some sample codeblocks are described this report. MATLAB code and the referenced images are attached in delivered project folder also. More information and codeblocks can be found at my github page /mcagriaksoy. To solving the problems, MATLAB 2020b version is used with Windows 10 1909 Operation system is used.

1 Introduction

There is a theory which states that if ever anyone discovers exactly what the Universe is for and why it is here, it will instantly disappear and be replaced by something even more bizarre and inexplicable. There is another theory which states that this has already happened.

2 Answers

2.1 Question-1

Write a computer program capable of reducing the number of intensity levels in a image from 256 to 2, in integer powers of 2. The desired number of intensity levels needs to be a variable input to your program. Apply your program to Figure 2.21(a) and duplicate the results shown in Figure 2.21 of the book. Answer:

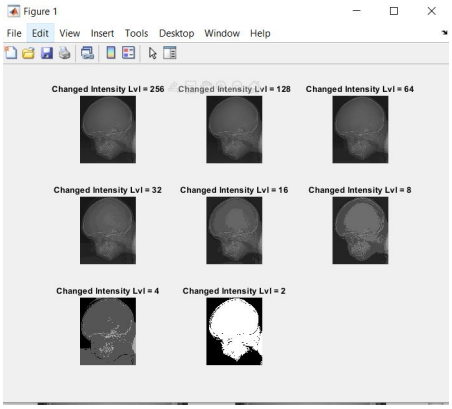

Figure 1: Decreasing intensity comparison

In this problem, I have investigated how to decrease intensity and found a solution with decreasing pixel intensity level with decreasing the info on the related pixels. The data has been divided to consts for 2 to the power of k value. I have changed k value 1 to 8 to obtain the results. Then via "subplot" function I have displayed on screen.

2.2 Question-2

Write a computer program capable of zooming and shrinking an image by pixel replication. Assume that the desired zoom/shrink factors are integers. Apply your program to Figure 2.21(a) to shrink the image by a factor of 10. Use your program to zoom the image in back to the resolution of the original. Explain the reasons for their differences. Answer: In this problem, via the imresize function

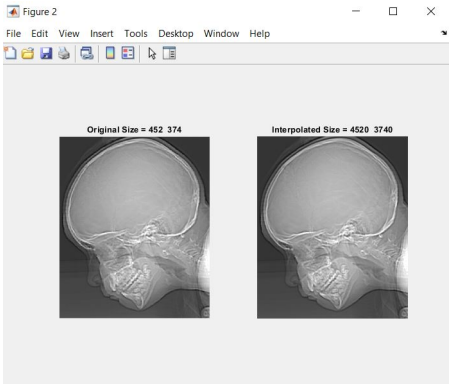

Figure 2: Interpolation and original image comparison

image is resized and shrinked. When image is zoom then shrinked back, some data has been lost. Because some blanks occurs when image is zoomed by 10factor. The program fills these pixels then when we shrinked back, these data differences can be observable.

2.3 Question-3

Repeat 2 by using bilinear and bicubic interpolations. Answer: In this problem,

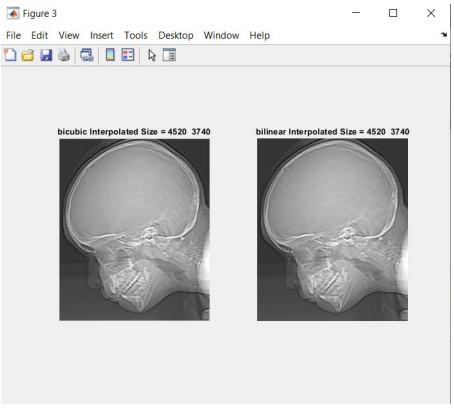

Figure 3: Bilinear-bicubic interpolation results

to zoom and shrinked back to image with bilinear and bicubic has been done with "imresize" function again with specific commands of bicubic and bilinear. As expected bicubic created better results when we compare bilinear.

```
img3=imread('Fig0221(a)(ctskull-256).tif');
img3_bicubic = imresize(img3,10,'bicubic');
img3_bilinear = imresize(img3,10,'bilinear');
```

2.4 Question-4

Write a computer program to implement affine transformation via inverse mapping. Apply your program to Figure 2.36(a) for the following affine transforms and show the output images in each case (Hint: the first matrix rotates the image by 30 degrees, the second matrix shrinks the image by a factor of 2, and the last matrix shifts the image 15 pixels and 20 pixels in the horizontal and vertical directions, respectively). Answer: In this problem, affine transformation via

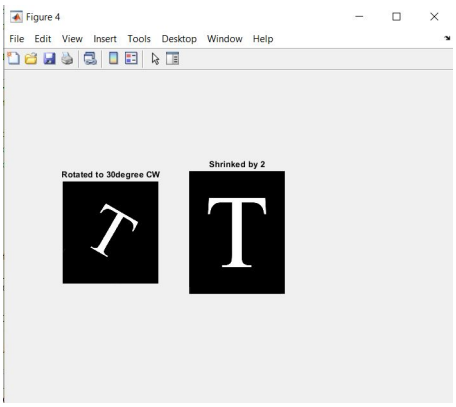

Figure 4: Rotating and shrinked Image

inverse mapping is used. To do that given matrix values are used on "affine2d" this function. When we get the transformation function via "imwarp" function we put it to on the image and results are displayed.

```
img4=imread('Fig0236(a)(letter_T).tif');
a = [0.866 0.5 0;-0.5 0.866 0; 0 0 1];
tform_a = affine2d(a);
b = [2 0 0; 0 2 0; 0 0 1];
tform_b = affine2d(b);
% c = [1 0 1; 0 1 0; 15 20 1];
% tform_c = affine2d(c);
img4_a = imwarp(img4,tform_a);
img4_b = imwarp(img4,tform_b);
% img3_c = imwarp(img3,tform_c);
```

3 Conclusion

In this project, the given project has been completed and I have learnt that how to decrease intensity on grayscale images, interpolation with different ways (like nearest neighbor, bicubic or bilinear), image registration, affine transformation and inverse mapping. MATLAB solution is attached and the codeblock is explained in this report.