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Digital Imaging Processing

Homework 2, Question 5:

Take an image and quantize it to 32 grayscale levels using only the imresize function in MATLAB, and write the steps you followed in the process

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My Aproach:

The most straight forward way to use imresize to quantize the image down to 32 values would be to create a mapping from the original 256 intensity levels to 32 levels using the imresize function. Then, I could apply this mapping to the original image to obtain the quantized image.

First I will load and display the image as a starting point.

```
clear; close all; clc;

originalImage = imread('cameraman.tif');
figure;
imshow(originalImage);
title('Original Image');
```

Before performing any operations to the image I will normalize it between 0 and 1.

```
normalizedImage = double(originalImage) / 255;
```

Now I will create a vector to store the original intenstiy values

```
intensityLevels = (0:255)';
```

Next I will resize the intensity levels vector to have 32 levels using the imresize function with 'nearest' interpolation. By resizing the vector of intensity levels from 256 to 32, we can effectively use imresize to create a mapping that reduces the number of intensity levels.

```
quantizedLevels = imresize(intensityLevels, [32, 1], 'nearest');
```

Now that I have 32 unique intensity levels, I can upscale the one row vector back to the original number of columns using 'nearest' interpolation. This expanded mapping vector now has 256 elements, where each element corresponds to an original intensity level and maps it to one of the 32 quantized levels.

```
mapping = imresize(quantizedLevels, [256, 1], 'nearest');
```

The last step is to apply this "quantization mapping" to the original image which will cause each pixel in the original image to be replaced with its corresponding quantized intensity level using the mapping vector.

```
quantizedImage = mapping(double(originalImage) + 1);
quantizedImage = uint8(quantizedImage);

imshowpair(originalImage, quantizedImage, 'montage');
title('Original Image vs. Quantized Image with 32 Levels');
```

Original Image vs. Quantized Image with 32 Levels

To verify the quantization was successful, I will print how many unique values are in the quantized image.

```
uniqueLevels = unique(quantizedImage);
numLevels = numel(uniqueLevels);

fprintf('The quantized image has %d unique intensity levels.', numLevels);
```

```
The quantized image has 32 unique intensity levels.
```