Digital Image Processing HW1

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1. Problem Description

Use MATLAB program to produce a gray-scale image with identical color in the center square and varying colored background. The size of the squares is regulated to be 128×128 for outer ones, 40×40 for inner ones.

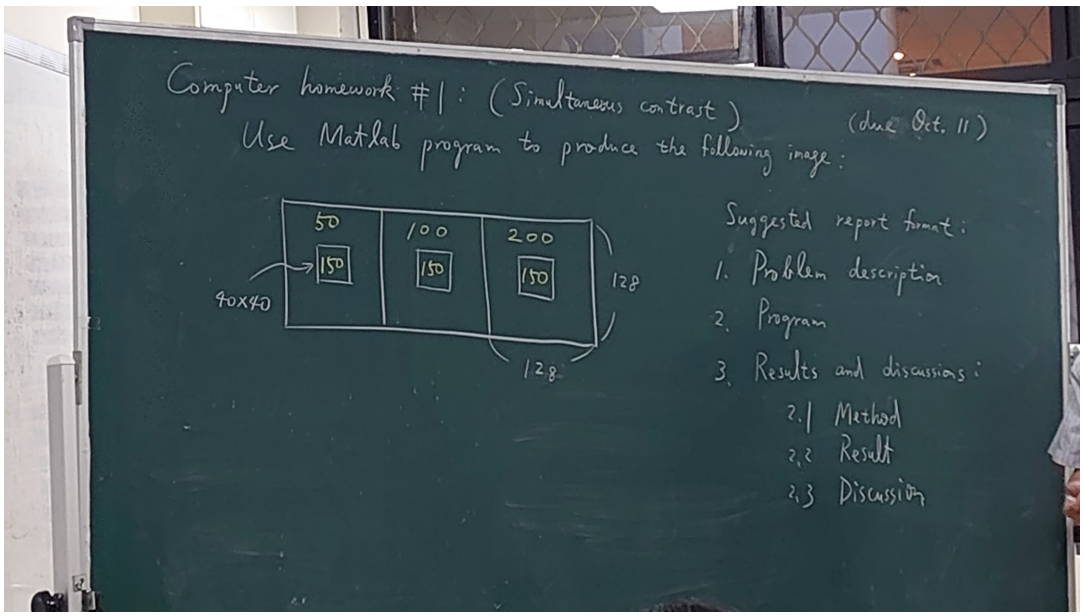

Figure 1: Picture of Question.

2. Program/Code

This is the function I coded for this question.

```
function draw3pic
  % ========================================
  % Since the picture is regulated by pixel size, it is unwise to just
  %  plot in XY plane.
  % ============Function=======
  function image = create_function(ol, il, ov, iv)
    % ol: outer length
    % il: inner length
    % ov: outer value
    % iv: inner value
    s = round(ol/2-il/2)+1;
    l = round(ol/2+il/2);
    array = ones(ol, ol)*ov;
    array(s:l,s:l) = array(s:l,s:l)/ov*iv;
    image = mat2gray(array, [0 255]);
  end
  % ============Array==========
  img{1} = create_function(128, 40, 50, 150);
  img{2} = create_function(128, 40, 100, 150);
  img{3} = create_function(128, 40, 200, 150);

  % ============Main===========
  space = mat2gray((ones(128, 5)*255), [0 255]);
  montage([img{1} space img{2} space img{3}], 'ThumbnailSize', [])
end
```

This is the code in MATLAB to execute this function.

```
>> draw3pic
```

3. Result and Discussion

3.1 Method

This function starts with the "Function" section for an internal array generating function. Whenever it is called, it returns an image array with a designated shape and value. In the "Array" section, three different arrays are generated and stored as a cell. In the "Main" section, an array is created to be used as spacing between the three squares, and at last, all of the image arrays are displayed with their exact pixel size.

3.2 Result

Figure 2: Result of the required squares.

3.3 Discussion - Mach Bands

This is the function I coded for creating Mach Bands.

```
function draw_mach_band(bc, x, y)
    % ========================================================
    % This function takes the number of bands as input and
    %     plot Mach bands.
    % bc: band count
    % x:  the width of each band
    % y:  the hight of bands
    % ========================DefaultValue=====================
    if nargin < 3
        bc = 5;
        x = 50;
        y = 200;
    end
    % ============================Main=========================
    max = 255;
    min = 0;
    diff = round((max - min) / bc);
    for i = 1:bc
        arr{i} = mat2gray(ones(y, x) * (min + diff * (i - 1)),[min max]);
```

```
    end
    montage(arr, 'ThumbnailSize', [], 'size', [1 length(arr)]);
end
```

This is the code in MATLAB to execute this function.

```
>> draw_mach_band() % Figure 2(b) / use default value to plot
>> draw_mach_band(8,20,80) % Figure 2(c)
>> draw_mach_band(20,30,160) % Figure 2(d)
```

(a) P2 5,50,200

(b) P2 8,20,80

(c) P2 20,30,160

Figure 3: Image results.