CS 216 Homework 3

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Problem 1
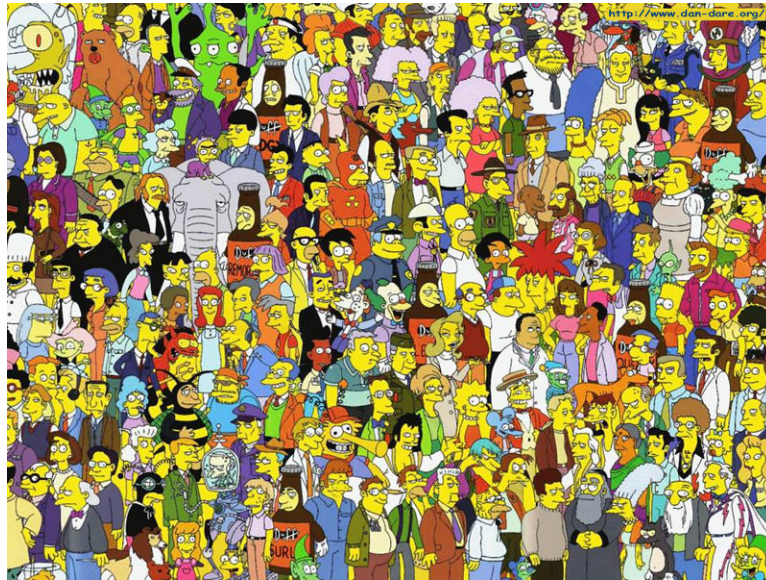
k-Means Clustering results

Figure 1: Original Image

Figure 2: The k-Means Image when $k = 2$

Figure 3: The k-Means Image when $k = 5$

Figure 4: The k-Means Image when $k = 10$

Result when skewing the Red Channel

If we multiply the red channel by 100, then the mean will tend more toward the red channel than the other channels. The result will be a red tint on the final result image. That is exactly what happened with the following images which are the same k-means images as above but the red channel was multiplied by 100 before k-Means was done.

Figure 5: The k-Means Image when $k = 2$ and a skewed red channel

Figure 6: The k-Means Image when $k = 5$ and a skewed red channel

Figure 7: The k-Means Image when $k = 10$ and a skewed red channel

Problem 2

Here is my original image:

Figure 8: The image of the zebra

8 filter images

Figure 9: The Horizontal Derivative image when $\sigma = 1$

Figure 10: The Horizontal Derivative image when $\sigma = 2$

Figure 11: The Horizontal Derivative image when $\sigma = 4$

Figure 12: The Vertical Derivative image when $\sigma = 1$

Figure 13: The Vertical Derivative image when $\sigma = 2$

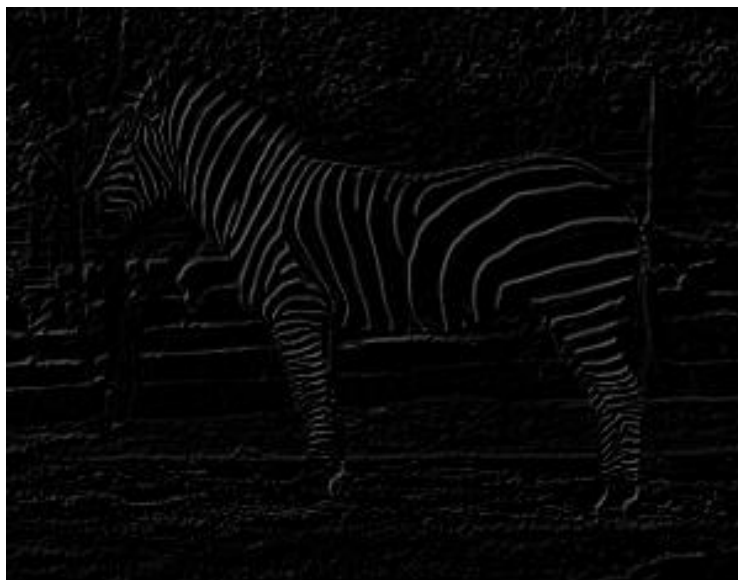Figure 14: The Vertical Derivative image when $\sigma = 4$

Figure 15: The Gaussian Difference when $\sigma_2 = 2$ and $\sigma_1 = 1$

Figure 16: The Gaussian Difference when $\sigma_2 = 4$ and $\sigma_1 = 2$

Matlab code

Here is the parent script that calls the function:

```
imname = 'zebra_small.jpg';
imageData = im2double(rgb2gray(imread(imname)));
get8FilterImages(imageData,imname);
```

Here is the main function that gets the information:

```
function [ horizDeriv_Sigma1_imageData,vertDeriv_Sigma1_imageData,...
    horizDeriv_Sigma2_imageData,vertDeriv_Sigma2_imageData,...
    horizDeriv_Sigma4_imageData,vertDeriv_Sigma4_imageData,...
    gaussDiff_4_2_imageData,gaussDiff_2_1_imageData] = get8FilterImages( imageData,
%GET8FILTERIMAGES Summary of this function goes here
%   Detailed explanation goes here

[horizDeriv_Sigma1_imageData,vertDeriv_Sigma1_imageData] =...
    computeDerivImages(imageData,1,imname);
[horizDeriv_Sigma2_imageData,vertDeriv_Sigma2_imageData] =...
```

```
    computeDerivImages(imageData,2,imname);
[horizDeriv_Sigma4_imageData,vertDeriv_Sigma4_imageData] =...
    computeDerivImages(imageData,4,imname);
gaussDiff_4_2_imageData = computeGaussDiff(imageData,1,2,imname);
gaussDiff_2_1_imageData = computeGaussDiff(imageData,2,4,imname);
end
```

This is the helper function that gets the gaussian derivatives:

```
function [horizDerivImage,vertDerivImage] = computeDerivImages( imageData,sigma,imn
%COMPUTEDERIVIMAGES Summary of this function goes here
%   Detailed explanation goes here

gaussFilt = fspecial('gaussian',sigma);
filteredImageData = conv2(imageData,gaussFilt,'same');
horizDerivFilter = [1 -1];
horizDerivImage = conv2(filteredImageData,horizDerivFilter,'same');
vertDerivFilter = transpose(horizDerivFilter);
vertDerivImage = conv2(filteredImageData,vertDerivFilter,'same');
horizDerivImageName = strcat('sigma_',num2str(sigma),'_horizDeriv_',imname);
vertDerivImageName = strcat('sigma_',num2str(sigma),'_vertDeriv_',imname);
imwrite(horizDerivImage,horizDerivImageName,'JPEG');
imwrite(vertDerivImage,vertDerivImageName,'JPEG');

end
```

This is the helper function that computes the gaussian differences

```
function [filterDiffImageData] = computeGaussDiff( imageData,sigma1,sigma2,imname )
%COMPUTEDERIVIMAGES Summary of this function goes here
%   Detailed explanation goes here

gaussFilt1 = fspecial('gaussian',sigma1);
gaussFilt2 = fspecial('gaussian',sigma2);
filteredImageData1 = conv2(imageData,gaussFilt1,'same');
filteredImageData2 = conv2(imageData,gaussFilt2,'same');
filterDiffImageData = filteredImageData2-filteredImageData1;
filterDiffImageName = strcat('sigma2_',num2str(sigma2),'_sigma1_',...
    num2str(sigma1),'_gaussDiff_',imname);
```

```
imwrite(filterDiffImageData,filterDiffImageName,'JPEG');

end
```