

Vincenzo Macri

Digital Imaging Processing

Homework 2, Question 1:

Create a binary mask for the region of interest in the image, then apply low-pass filters (Gaussian and Average filters) and high-pass filters (Laplacian and Prewitt filters) in MATLAB.

First I will load and display the image.

```
clear; close all; clc;

originalImage = imread('cameraman.tif');

figure;
imshow(originalImage);
title('Original Image');
```

Original Image



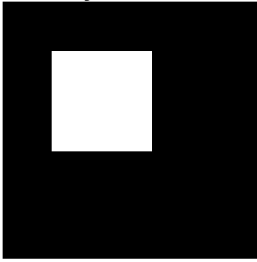
Next I will define a ROI and create a binary mask.

```
% [x, y, width, height]
rect = [50, 50, 100, 100];

% creating binary mask
mask = false(size(originalImage));
mask(rect(2):rect(2)+rect(4)-1, rect(1):rect(1)+rect(3)-1) = true;

figure;
imshow(mask);
title('Binary Mask of ROI');
```

Binary Mask of ROI



Now that I have created a binary mask for the ROI we can perform image manipulations. First I will demonstrate 2 different low pass filters.

Low Pass Filters

1: Gaussian Filter.

```
gaussianFilter = fspecial('gaussian', [5 5], 3); % 5x5 size with a std of 3

gaussianFilteredEntire = imfilter(originalImage, gaussianFilter, 'symmetric');
gaussianFiltered = originalImage;
gaussianFiltered(mask) = gaussianFilteredEntire(mask);

figure;
imshowpair(originalImage, gaussianFiltered, 'montage');
title('Original Image vs Gaussian Filtered ROI');
```

Original Image vs Gaussian Filtered ROI

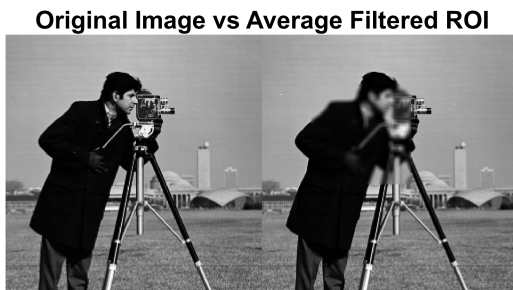


2: Averaging Filter.

```
averageFilter = fspecial('average', [5 5]); % 5x5 size

averageFilteredEntire = imfilter(originalImage, averageFilter, 'symmetric');
averageFiltered = originalImage;
averageFiltered(mask) = averageFilteredEntire(mask);
```

```
figure;
imshowpair(originalImage, averageFiltered, 'montage');
title('Original Image vs Average Filtered ROI');
```



Both the Gaussian and Averaging filters have similar "blurring" effects to the ROI in the image, as visualized in the figures. Next I will apply 2 different types of high pass filters to the ROI in the image.

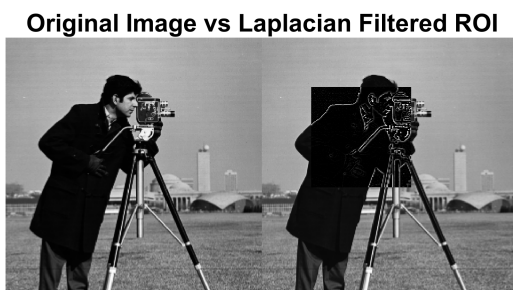
High Pass Filters

1: Laplacian Filter

```
laplacianFilter = fspecial('laplacian', 0.2); % alpha = 0.2

laplacianFilteredEntire = imfilter(originalImage, laplacianFilter, 'replicate');
laplacianFiltered = originalImage;
laplacianFiltered(mask) = laplacianFilteredEntire(mask);

figure;
imshowpair(originalImage, laplacianFiltered, 'montage');
title('Original Image vs Laplacian Filtered ROI');
```



2: Prewitt Filter

```
prewittH = fspecial('prewitt');
prewittV = prewittH';
```

```

prewittFilteredH = imfilter(originalImage, prewittH, 'replicate');
prewittFilteredV = imfilter(originalImage, prewittV, 'replicate');

% combine horizontal and vertical edges
prewittFilteredEntire = sqrt(double(prewittFilteredH).^2 +
double(prewittFilteredV).^2);
prewittFilteredEntire = uint8(mat2gray(prewittFilteredEntire) * 255);
prewittFiltered = originalImage;
prewittFiltered(mask) = prewittFilteredEntire(mask);

figure;
imshowpair(originalImage, prewittFiltered, 'montage');
title('Original Image vs Prewitt Filtered ROI');

```

Original Image vs Prewitt Filtered ROI



Both the Laplacian and Prewitt high pass filters have similar edge detection effects to the ROI in the image which is visualized in the figures.