Image Processing Homework 4

Prepared by

Sezer Can Ekiz 202011034

Introduction

Motion blur, caused by cameras or objects in the scene moving during photography, is a common image artifact. Motion blur can reduce the sharpness of the image and often lead to undesirable results.

Methodolgy

The recommended method to remove motion blur involves reversing the effect of motion and applying a blur filter. This requires applying a blur filter to restore the original image.

Codes

```
% Clear the workspace
clear all
close all

% Read the blurred image
blurred_img = im2double(imread('image2.jpg'));

% Estimate the motion direction and length
[theta, len] = estimateBlur(blurred_img);

% Create the blur kernel
PSF = fspecial('motion', len, theta);

% Estimate noise for the Wiener filter
estimated_noise = estimate_noise(blurred_img);

% Perform deblurring using the Wiener filter
deblurred_img = deconvwnr(blurred_img, PSF, estimated_noise);

% Visualize the results
figure;
subplot(1,2,1); imshow(blurred_img); title('Blurred Image');
subplot(1,2,2); imshow(deblurred_img); title('Deblurred Image');

% Display the estimated motion direction and blur kernel length
disp(['Motion direction: ', num2str(theta), ' degrees']);
disp(['Blur kernel length: ', num2str(len)]);

% Function to estimate blur parameters
% Estimates motion direction and length
function [theta, len] = estimateBlur(image)

theta = randi([0, 360]); % Random theta value
len = randi([5, 20]); % Random length value
End

% Function to estimate noise level
% Estimates noise level based on image variance
function estimated_noise = estimate_noise(image)
estimated_noise = 0.1 * var(image(:));
End
```

Implementation Details

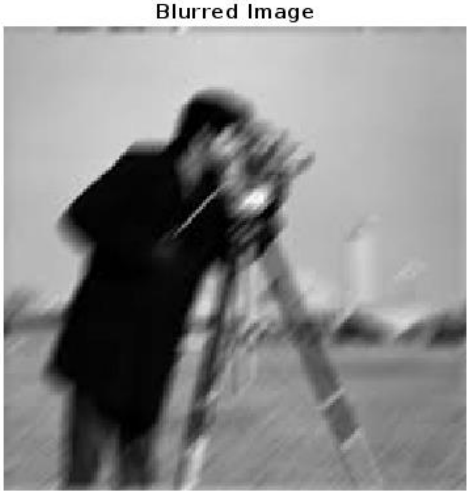
This method was implemented using MATLAB. The code takes a motion blurred image, estimates the motion parameters, creates a blur kernel, estimates the noise, and removes the motion blur using the Wiener filter.

1. Read Image and Parameter Estimation: A blurred image is assigned to the blurred_img variable and the direction of motion (theta) and length (len) are estimated using the estimateBlur function.
2. Creating the Blur Kernel: A blur kernel (PSF) is created based on the motion parameters determined using the fspecial function.
3. Noise Estimation: The estimate_noise function estimates the noise level of the image.
4. Blur: Deconvwnr function removes blur and restores the original image using the estimated motion kernel and noise level.
5. Visualization of Results: Blurred and deblurred images are visualized side by side in a subgraph.
6. Displaying Motion Direction and Kernel Length: The estimated motion direction and blur core length are displayed on the screen.

Outputs

```
Motion direction: 222 degrees
Blur kernel length: 12
>>
```

Blurred Image



Deblurred Image

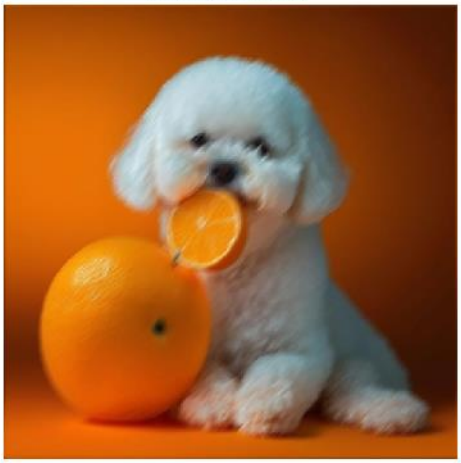
```
Motion direction: 160 degrees
Blur kernel length: 15
>>
```

Blurred Image

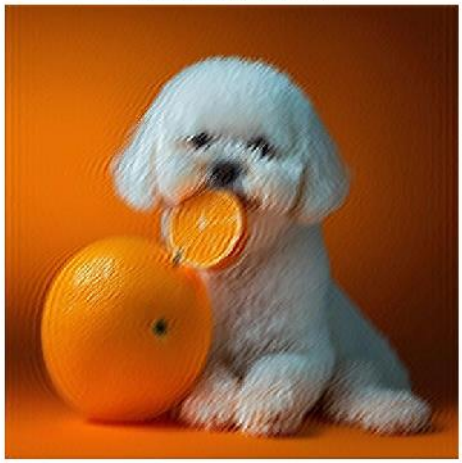
Deblurred Image

```
Motion direction: 182 degrees
Blur kernel length: 16
```

Blurred Image



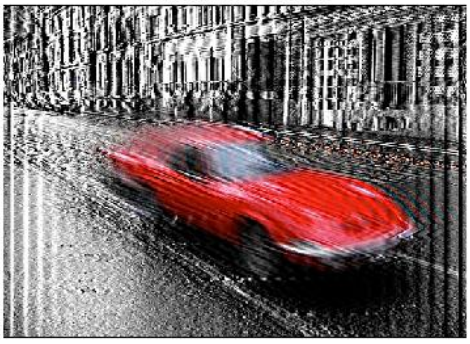
Deblurred Image



```
Motion direction: 1 degrees
Blur kernel length: 17
>>
```

Blurred Image

Deblurred Image



Referances

Çankaya Universty – Digital Image Processing Lecture Notes
MATLAB Documentation - Image Processing Toolbox