Kuwahara filter

The Kuwahara filter is a sort of non-linear filter which a popular part in image processing where the aim is to reducing the level of noise in an image without loose away edges present in the image. How it operates is that an image is sectioned into sub-regions of an area usually a 2 by 2 square box then the mean and variance of the pixel intensity are computed. The filter will pick the region with the lowest variance, meaning it has the least noise and the mean is then used to replace the central pixel. This approach proved a very good method to reduce the annoying noise while keeping the most important properties of the image such as the edges; therefore, it may very helpful for any application like medical imaging, photography, etc.

```
clear all
imagePath = '/MATLAB Drive/IMG_3411.JPG';

image = imread(imagePath);

grayImage = rgb2gray(image);

[rows, cols] = size(grayImage);

k = 5;

% Pad the image symmetrically to handle borders during filtering
PaddedImage = padarray(grayImage, [k k], 'symmetric');
KuwaharaImage = zeros(rows, cols);

for i = 1:rows
    for j = 1:cols

         % Define the regions
        r1 = PaddedImage(i:i+k-1, j:j+k-1);  % Top-left region
        r2 = PaddedImage(i:i+k-1, j+k:j+2*k-1); % Top-right region
        r3 = PaddedImage(i+k:i+2*k-1, j:j+k-1); % Bottom-left region
        r4 = PaddedImage(i+k:i+2*k-1, j+k:j+2*k-1); % Bottom-right region

        % Calculate the means of each region
        means = [mean(r1(:)),mean(r2(:)),mean(r3(:)),mean(r4(:))];
        % Calculate the variances of each region
        variances =
[var(double(r1(:))),var(double(r2(:))),var(double(r3(:))),var(double(r4(:)))]
;

        [~, minIdx] = min(variances);

        KuwaharaImage(i, j) = means(minIdx);
    end
end

figure;
```

```
subplot(1, 2, 1);
imshow(uint8(grayImage));
title('Original Image');

subplot(1, 2, 2);
imshow(uint8(KuwaharaImage));
title('Kuwahara Filtered Image');
```