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% Task 3: Kuwahara Filter
clc; clear; close all;

% Read the image
img = imread('image.jpg');
gray_img = rgb2gray(img); % Convert to grayscale
gray_img = double(gray_img);

% Kuwahara filter implementation
function output = kuwahara_filter(image, kernel_size)
    [h, w] = size(image);
    half_size = floor(kernel_size / 2);
    output = zeros(h, w);

    for y = half_size + 1:h - half_size
        for x = half_size + 1:w - half_size
            % Extract region for the kernel
            region = image(y-half_size:y+half_size, x-half_size:x+half_size);

            % Define the four sub-regions
            regions = {region(1:half_size+1, 1:half_size+1), ... % Top-left
                       region(1:half_size+1, half_size+1:end), ... % Top-
right
                       region(half_size+1:end, 1:half_size+1), ... % Bottom-
left
                       region(half_size+1:end, half_size+1:end)}; % Bottom-
right

            % Calculate means and variances for each region
            means = zeros(1, 4);
            variances = zeros(1, 4);
            for k = 1:4
                means(k) = mean(regions{k}(:));
                variances(k) = var(regions{k}(:));
            end

            % Find the region with the minimum variance
            [~, min_index] = min(variances);
            output(y, x) = means(min_index); % Assign mean to output
        end
    end

    output = uint8(output); % Convert output to uint8 for display
end

% Apply Kuwahara filter
kuwahara_result = kuwahara_filter(gray_img, 5);

% Display result
figure;
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imshow(kuwahara_result);
title('Kuwahara Filter Result');
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