

3. Kuwahara filter:

- The Kuwahara filter is a non linear smoothing filter. It preserves edges while reducing noise by analyzing the variance within overlapping square regions of a image
- It selects the region with the least variance to determine the output pixel value, effectively maintaining sharp features.

```
input_img=imread('image.jpeg');
gray_image=rgb2gray(input_img);
gray_image=double(gray_image);
window_size = 5;
% Pad the image to handle borders
pad = floor(window_size / 2);
gray_image = padarray(gray_image, [pad pad], 'symmetric');

% Preallocate the output image
img_output = zeros(size(gray_image));
[r, c] = size(gray_image);

for i = pad + 1:r - pad
    for j = pad + 1:c - pad
        % Get the local region
        region = gray_image(i-pad:i+pad, j-pad:j+pad);

        % Calculate the means and variances of the four quadrants
        m = zeros(4,1);
        v = zeros(4,1);
        k = 1; % Initialize counter for the quadrants

        for x_offset = [-1, 0]
            for y_offset = [-1, 0]
                sub_region = region(pad + x_offset + 1:pad + x_offset +
pad,pad + y_offset + 1:pad + y_offset + pad);
                m(k) = mean(sub_region(:));
                v(k) = var(sub_region(:));
                k = k + 1;
            end
        end

        % Choose the minimum variance
        [~, idx] = min(v);
        img_output(i, j) = m(idx);
    end
end

% Remove padding
img_output = img_output(pad + 1:end - pad, pad + 1:end - pad);
img_output = uint8(img_output); % Convert to uint8
```

```
%Display results  
imshow(img_output),title('Kuwahara filter image');
```

Kuwahara filter image

