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%Pratap Luitel
%ENGS 111
%HW 2, Problem 2

%This script implements, calculates and plots min, max and difference
%order filter using the builtin matlab command ordfilt2.

filename='liftingbody.png';
imIn=imread(filename);
imIn=im2double(imIn);
kernel=[3,5,11,13];

for i =1:length(kernel)

    %min filter
    imOutMin=ordfilt2(imIn,1,ones(kernel(i)),'symmetric');
    %clip away values less than 0 to 0 and greater than 1 to 1.
    imOutMin=clip(imOutMin);%clip is a function i wrote,
    %max filter
    imOutMax=ordfilt2(imIn,kernel(i).^2,ones(kernel(i)),'symmetric');
    imOutMax=clip(imOutMax);
    %diff filter
    imOutDiff=imOutMax-imOutMin;
    imOutDiff=clip(imOutDiff);
    %clipping values outside the range[0-1]


    %plotting
    figure(i)
    kStr = num2str(kernel(i)); %kernel string
    subplot(221);imshow(imIn);title(['Original Image, Kernel: ' kStr 'x' kStr])
    subplot(222);imshow(imOutMin);title(['Min Filter, Kernel: ' kStr 'x' kStr])
    subplot(223);imshow(imOutMax);title(['Max Filter, Kernel: ' kStr 'x' kStr])
    subplot(224);imshow(imOutDiff);title(['Diff Filter, Kernel: ' kStr 'x' kStr])



end

%discussion

    fprintf('Each pixel is being replace by the minimum,maximum or\n');
    fprintf('the difference. When the kernel size is higher, \n');
    fprintf('we see bigger patches of brighter or darker pixels in the output.\n')
    fprintf('\n');
    fprintf('The min filter replaces each pixel by a darker pixel values. \n');
    fprintf('the max filter replaces each pixel by a brighter pixel values.\n');
    fprintf('The difference filter replaces each pixel by a difference\n');
    fprintf('between max value and min value. Thus the output\n ');
    fprintf('seems similar to that of a laplacian filter.\n')
    fprintf('\n');
```

```
fprintf('---------Boundaries---------------------\n');
fprintf('The boundaries contain a lot of zero pixels because ordfilt2\n');
fprintf('uses the default option of padding boundaries to 0.\n');
fprintf('This can be changed by adding the symmetric padding option as a\n');
fprintf('fourth parameter when calling the ordfilt2 command.\n');
```

Each pixel is being replace by the minimum,maximum or

the difference. When the kernel size is higher,
we see bigger patches of brighter or darker pixels in the output.

The min filter replaces each pixel by a darker pixel values.
the max filter replaces each pixel by a brighter pixel values.
The difference filter replaces each pixel by a difference
between max value and min value. Thus the output
seems similar to that of a laplacian filter.

---------Boundaries---------------------
The boundaries contain a lot of zero pixels because ordfilt2
uses the default option of padding boundaries to 0.
This can be changed by adding the symmetric padding option as a
fourth parameter when calling the ordfilt2 command.

Original Image, Kernel: 3x3

Min Filter, Kernel: 3x3

Max Filter, Kernel: 3x3

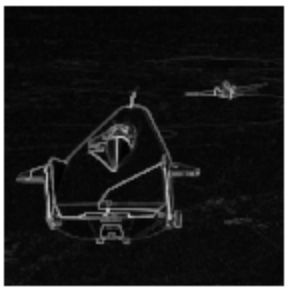
Diff Filter, Kernel: 3x3

Original Image, Kernel: 5x5

Min Filter, Kernel: 5x5

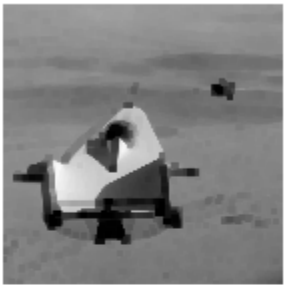
Max Filter, Kernel: 5x5

Diff Filter, Kernel: 5x5



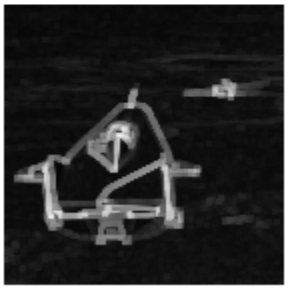
Original Image, Kernel: 11x11

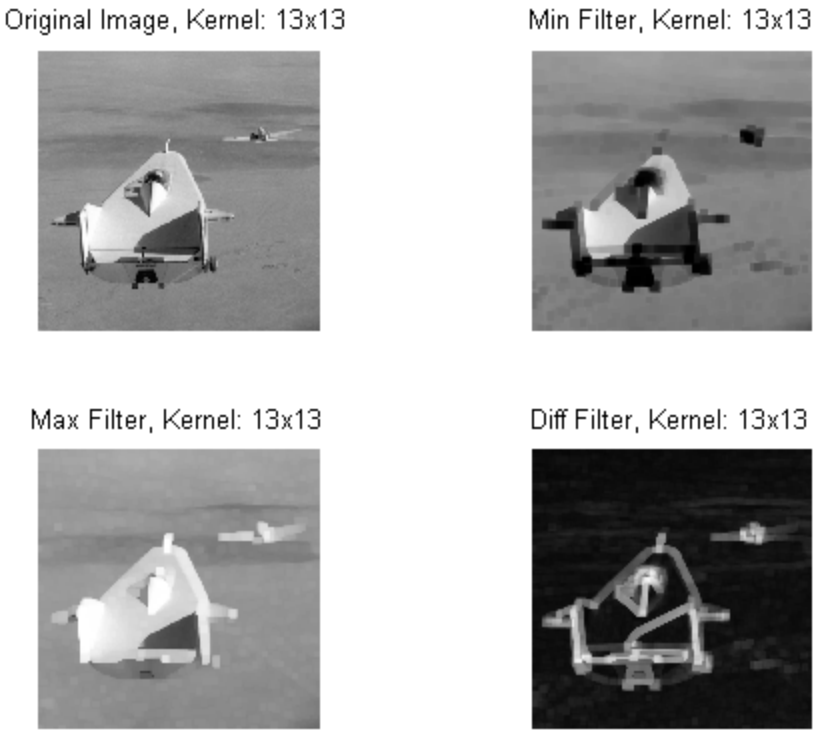
Min Filter, Kernel: 11x11



Max Filter, Kernel: 11x11

Diff Filter, Kernel: 11x11





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