DAYANANDA SAGAR COLLEGE OF ENGINEERING
(An Autonomous Institute Affiliated to VTU, Belagavi)
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Department of Electronics and Communication Engineering

Perform frequency Analysis of an image signal

AAT

FOR

DIGITAL SIGNAL PROCESSING

(19EC5DCDSP)

SUBMITTED BY

Batch No-15

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INTRODUCTION

AIM:-TO PERFORM A FREQUENCY ANALYSIS OF AN IMAGE SIGNAL USING MATLAB

THEORY:- Frequency in image is the rate of change of intencity values.thus, a high-frequency image is the one where the intencity values change quickly from one pixel to the next. On the other hand, a low frequency image may be one that is relatively uniform in brightness or where intencity changes very slowly.most image contain both high-frequency and low-frequency components.

Based on the frequency,we can classify the filters as

1)Low pass filters

2)High pass filters

IDEAL HIGH PASS FILTER IN IMAGE PROCESS:-

Ideal Highpass Filter (IHPF) is used for image sharpening in the frequency domain. Image Sharpening is a technique to enhance the fine details and highlight the edges in a digital image. It removes low-frequency components from an image and preserves high-frequency components.
This ideal highpass filter is the reverse operation of the ideal lowpass filter. It can be determined using the following relation.

$$H_{HP}(u,v)=1-H_{LP}(u,v)$$

Where,, $H_{HP}(u,v)$ is the transfer function of the HPF and

$H_{LP}(u,v)$ IS The transfer function of the corresponding LPF

The transfer function of the IHPF can be specified by the function-

$$H(u,v)=\begin{cases} 0 & D(u,v)<D0 \\ 1 & D(u,v)>D0 \end{cases}$$

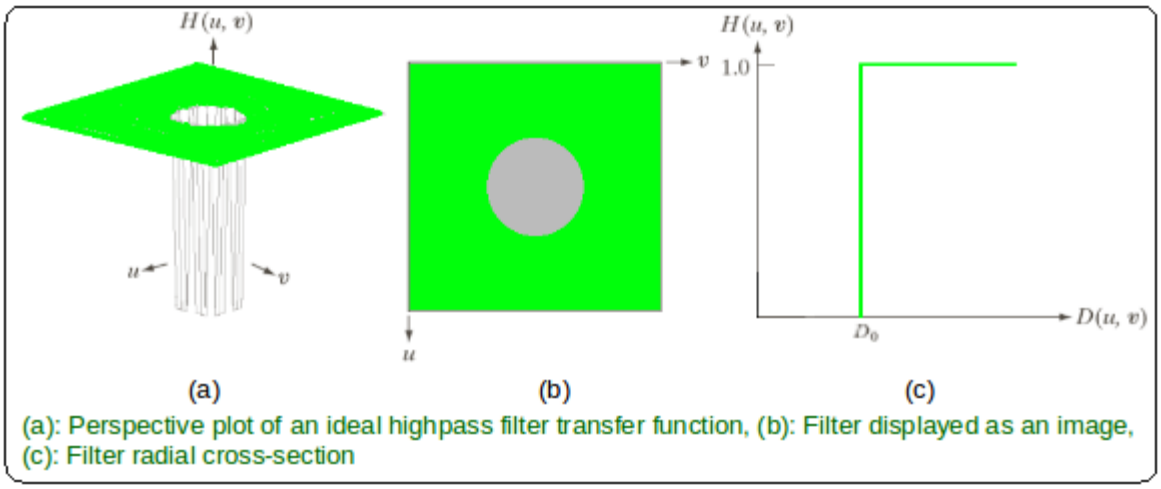
Where,

D0 Is positive constant.IHPF passes all the frequencies outside of a circle of radius D0 from origin without attenuation and cuts off all the frequencies within the circle.

This D0 is the transition point between H(u,v)=1 and H(u,v)=0,so this is termed as cutoff frequency.

D(u,v) is the Euclidean distance from any point (u,v) to the origin of the frequency plane i,e,

[D(u,v)]^2=(u^2+v^2)



(a): Perspective plot of an ideal highpass filter transfer function, (b): Filter displayed as an image, (c): Filter radial cross-section

IDEAL LOW PASS FILTER IN IMAGE PROCESS:-ideal low pass filter is used for image smoothing in the frequency domain.it removes high frequency noise from a digital image and preserves low frequency components.

It can be specified by the function,

H(u,v)={1 D(u,v)<D0

0 D(u,v)>D0

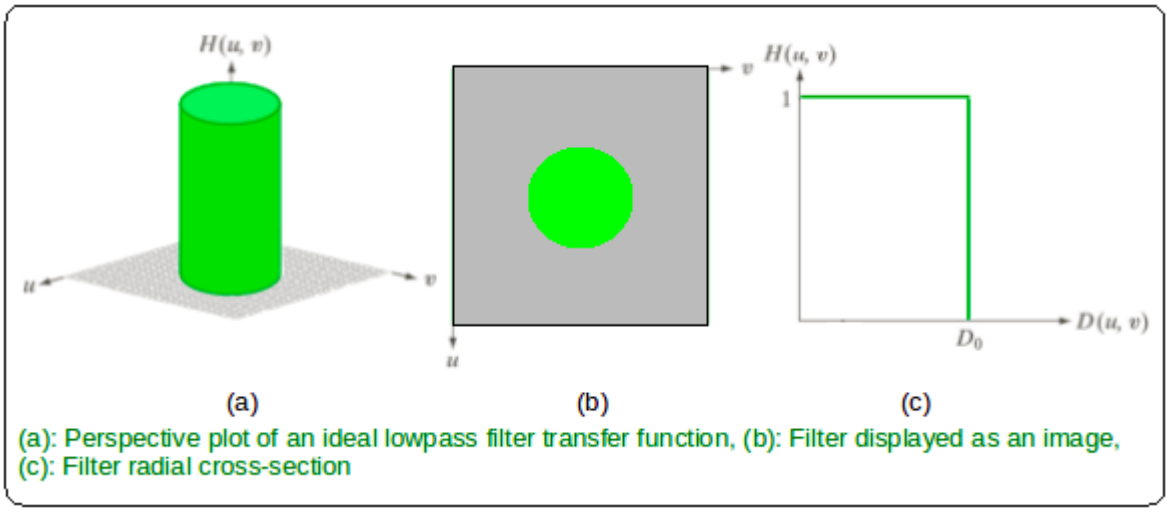
Where,

D0 Is a positive constant.ILPE passes all the frequencies within a circle of radius D0 from the origin without attenuation and cuts off all the frequencies outside the circle.

This D0 is the transition point between H(u,v)=1 and H(u,v)=0,so this is termed as cutoff frequency.

D(u,v) is the Euclidean distance from any point (u,v) to the origin point of the frequency plane,i.e

[D(u,v)]^2=(u^2+v^2)



(a): Perspective plot of an ideal lowpass filter transfer function, (b): Filter displayed as an image, (c): Filter radial cross-section

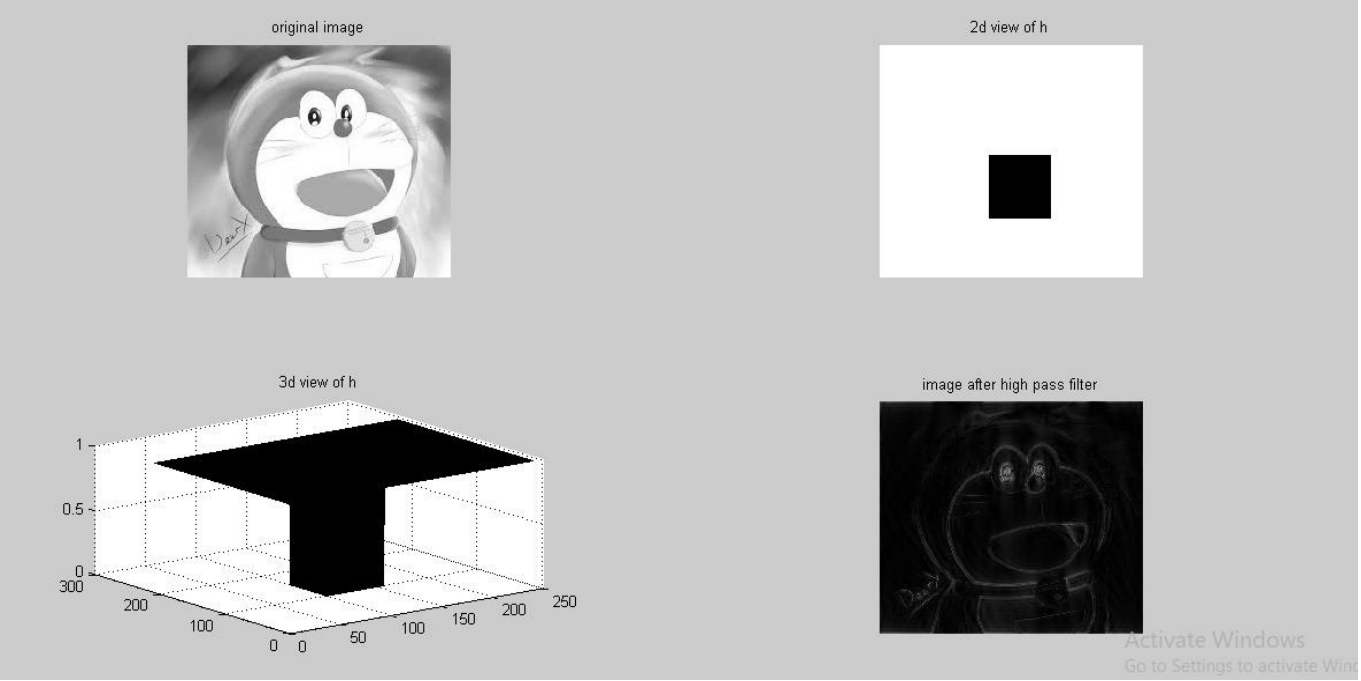
MATLAB PROGRAM

```
clc;clear all;close all;
A1=imread('C:\Users\Admin\Desktop\doremon.PNG');
figure(2)
imshow(A1);
A=rgb2gray(A1);
figure(1)
imshow(A);
[m,n]=size(A);
%design the filter kernal
h=zeros(m,n);
%h=ones(m,n);high pass filter
for i=100:200
   for j=100:200
```

```
        h(i,j)=1;
       % h(i,j)=0;high pass filter
    end
end
%shift the information to frequency domain
hf=fftshift(h);
af=fft2(A);
%apply the high passs filter
B=af.*hf;
c=abs(ifft2(B));
%display the input and output images
subplot(221);imshow(A);title('original image');
subplot(222);imshow(h);title('2d view of h');
subplot(223);surf(h);title('3d view of h');
subplot(224);imshow(uint8(c));title('image after low pass filter');
%subplot(224);imshow(uint8(c));title('image after high pass filter');
```

OUTPUT

HIGH PASS FILTER



OUTPUT

LOW PASS FILTER