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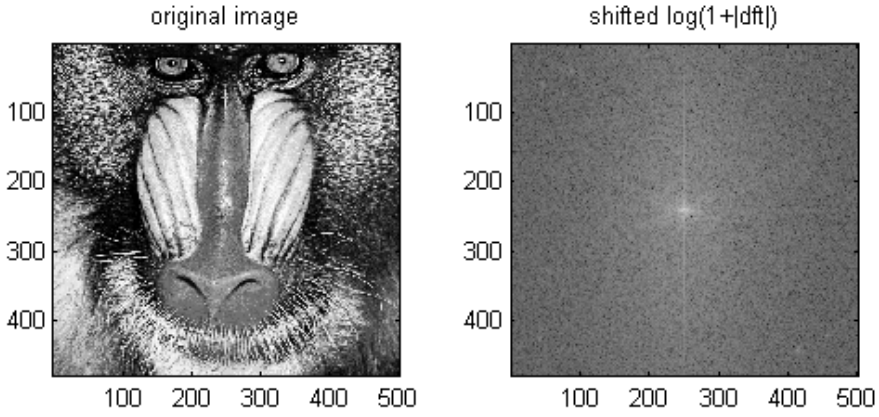
energyhist.m

2D energy histograms compute and display distribution of energy by radial frequency

```
%  S. Allen Broughton - 1 Oct 10
```

get and display image and shifted DFT

```
 load mandrill
% load earth
% load earth; X = X-mean(X(:)); % eliminate the DC coefficient
%  X = zeros(128,128); X(61:80,41:80)=1; % rectangle
fX = fft2(X);
sfX = fftshift(fX);

figure(1)
subplot(1,2,1)
imagesc(X), colormap(gray), axis equal, axis tight
title('original image');
subplot(1,2,2)
imagesc(log(1+abs(sfX))), colormap(gray), axis equal, axis tight
title('shifted log(1+|dft|)');
```



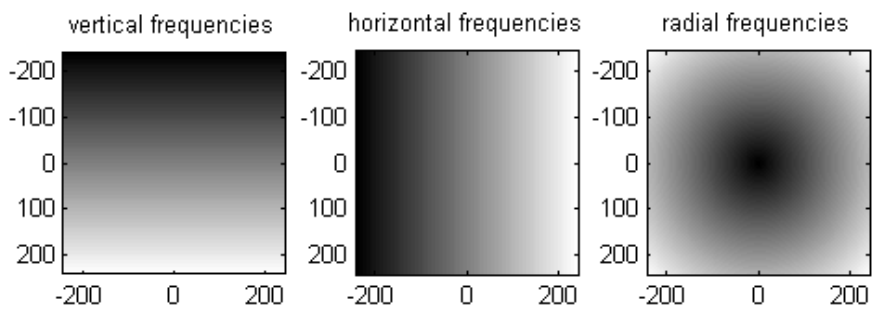
get image data and set up shifted frequency matrices

```
[m,n] = size(X);
N = m*n;
hm = round(m/2);
```

```
hn = round(n/2);
maxfreq = sqrt(hm^2+hn^2);

V = ((0:(m-1))-hm)'*ones(1,n);    % vertical frequencies
H = ones(m,1)*((0:(n-1))-hn);     % horizontal frequencies
R = sqrt(V.^2+H.^2);              % radial frequencies
```

display frequency maps

```
figure(2)
subplot(1,3,1)
imagesc([-hm,hm],[-hm,hm],V), colormap(gray), axis equal, axis tight
title('vertical frequencies');
subplot(1,3,2)
imagesc([-hm,hm],[-hm,hm],H), colormap(gray), axis equal, axis tight
title('horizontal frequencies')
subplot(1,3,3)
imagesc([-hm,hm],[-hm,hm],R), colormap(gray), axis equal, axis tight
title('radial frequencies')
```



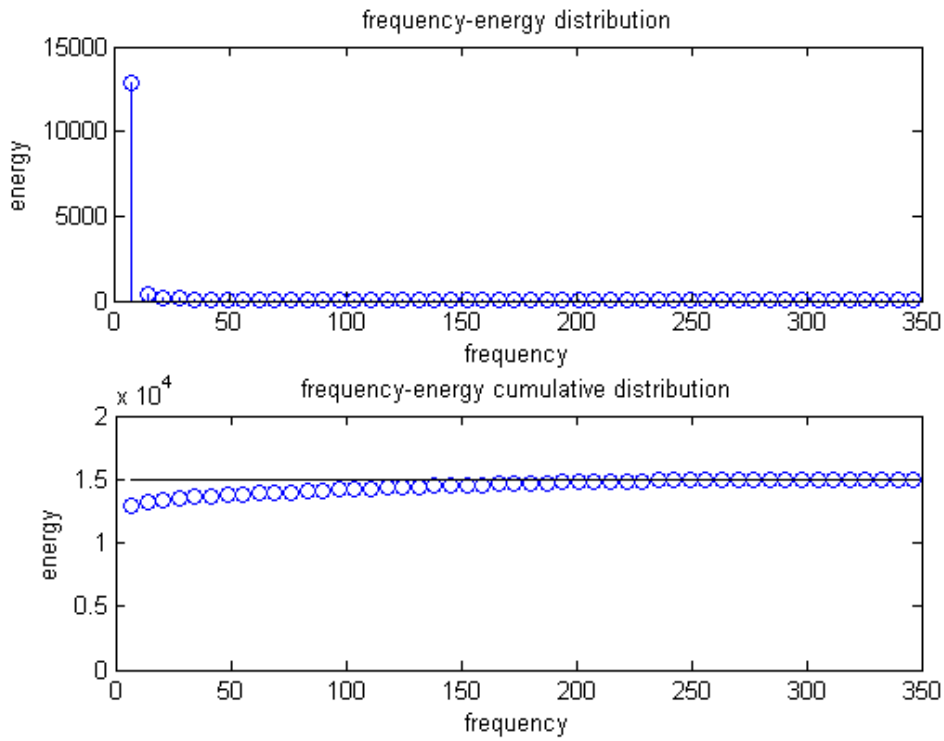
set up freqency data and calculate energy histogram

```
nbins = 50;
cEhist = [ ];
df = maxfreq/nbins;
E = energy(X) % display this to indicate calulation is proceeding

for j = 1: nbins,
    J = find (R <= j*df);
    Y = zeros(size(sfX));
    Y(J) = sfX(J);
    cEhist = [cEhist, energy(Y)/N];
end
Ehist = cEhist -[0,cEhist(1:nbins-1)]; % show energies


E =
```

```
1.5006e+004
```

display results

```
figure(3)
freqs = (1: nbins)*df;
subplot(2,1,1)
stem(freqs,Ehist),
xlabel('frequency')
ylabel('energy')
title('frequency-energy distribution')
subplot(2,1,2)
plot(freqs,cEhist,'o',freqs,E*ones(size(freqs)),'k-',freqs,0,'k-') % put in zero to include axis
xlabel('frequency')
ylabel('energy')
title('frequency-energy cumulative distribution')
```



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