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2)
clc;
clear all;close all;
I=imread('lena_gray.bmp');
inimg=I;
wname='haar';
QS=[1,4,16,32];
NZ=zeros(2,4);
PSNR1=zeros(2,4);
for i=1:4
[NonZeroNum,PSNR,outimg,f1,f2]=WaveletQuant(inimg,wname,QS(1,i));
NZ(1,i)=NonZeroNum;
PSNR1(1,i)=PSNR;
% figure,imshow(outimg),title(['Image',num2str(i)]);
end
figure,
plot(PSNR1(1,:),NZ(1,:));
figure,subplot(2,2,1),imshow(inimg),title('Input image');
subplot(2,2,2),imshow(outimg),title('Output image after quant');
subplot(2,2,3),imshow(f1,[]),title('Coefficient');
subplot(2,2,4),imshow(f2,[]),title('quantized coeff');
%%
for i=1:4
[NonZeroNum,PSNR,outimg]=WaveletQuant(inimg,'db4',QS(1,i));
NZ(2,i)=NonZeroNum;
PSNR1(2,i)=PSNR;
end

function [NonZeroNum,PSNR,outimg,f2,ff2]=WaveletQuant(inimg,wname,QS)

[ca,ch,cv,cd]=dwt2(inimg,wname,'mode','sym');
[caa,cah,cav,cad]=dwt2(ca,wname,'mode','sym');

f1=[caa,cav;cah,cad];
f2=[f1,cv;ch,cd];

fun=@(x)(floor((x+QS/2)./(QS).*QS));
cah1=blkproc(cah,[128 128],fun);
cah1=blkproc(cah,[128 128],fun);
cav1=blkproc(cav,[128 128],fun);
cad1=blkproc(cad,[128 128],fun);
ch1=blkproc(ch,[256 256],fun);
cv1=blkproc(cv,[256 256],fun);
cd1=blkproc(cd,[256 256],fun);
mean=128;
fun1=@(x)(floor((x-mean+QS/2)./(QS)).*QS+mean);
caal=blkproc(caa,[128 128],fun1);
ff1=[caal,cav1;cah1,cad1];
ff2=[ff1,cv1;ch1,cd1];
NonZeroNum=nnz(ff1)+nnz(cv1)+nnz(ch1)+nnz(cd1);

cal=idwt2(caal,cah1,cav1,cad1,wname);
outimg=idwt2(cal,ch1,cv1,cd1,wname);
outimg=uint8(outimg);
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MSE = mean2((outimg- inimg).^2);
PSNR = 10*log10(255^2/MSE);

end

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