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| **Github账号：**[**117503445**](https://github.com/117503445) |
| **实验摘要：** 使用MATLAB，利用频域完成图片的合成分解，音频重采样，图片盲水印。 |
| **实验题目** |

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| **实验内容**  **1.**  **Input**  **1-1-in1.png**    **1-1-in2.png**    **Output**  **1-1-out.png**    **Code**  **I1 = imread('1-1-in1.png');**  **g1 = rgb2gray(I1);**  **s = fftshift(fft2(g1));**  **[M, N] = size(s);**  **n1 = fix(M / 2);**  **n2 = fix(N / 2);**  **%理想低通滤波器取d0=10 （15,30）可变**  **d0 = 10;**  **for i = 1:M**  **for j = 1:N**  **d = sqrt((i - n1)^2 + (j - n2)^2);**  **if d < d0**  **h = 1;**  **else**  **h = 0;**  **end**  **s(i, j) = h \* s(i, j);**  **end**  **end**  **s = ifftshift(s);**  **s = uint8(real(ifft2(s)));**  **figure(1);**  **imshow(s);**  **I2 = imread('1-1-in2.png');**  **g2 = rgb2gray(I2);**  **s2 = fftshift(fft2(g2));**  **[M2, N2] = size(s2);**  **n12 = fix(M2 / 2);**  **n22 = fix(N2 / 2);**  **%理想高通滤波器取d02=5 （15,30）可变**  **d02 = 10;**  **for i = 1:M2**  **for j = 1:N2**  **d = sqrt((i - n12)^2 + (j - n22)^2);**  **if d < d02**  **h = 0;**  **else**  **h = 1;**  **end**  **s2(i, j) = h \* s2(i, j);**  **end**  **end**  **s2 = ifftshift(s2);**  **s2 = uint8(real(ifft2(s2)));**  **figure(2);**  **imshow(s2);**  **%图片合并**  **s3 = imadd(s, s2);**  **figure(3);**  **imshow(s3);**  **imwrite(s3, '1-1-out.png', 'PNG')**  **2.**  **Input**  **1-2-in.png**    **Output**  **1-2-out1.png**    **1-2-out2.png**    **Code**  **I1 = imread('1-2-in.png');**  **g1 = rgb2gray(I1);**  **s = fftshift(fft2(g1));**  **[M, N] = size(s);**  **n1 = fix(M / 2);**  **n2 = fix(N / 2);**  **%理想低通滤波器取d0=10 （15,30）可变**  **d0 = 10;**  **for i = 1:M**  **for j = 1:N**  **d = sqrt((i - n1)^2 + (j - n2)^2);**  **if d < d0**  **h = 1;**  **else**  **h = 0;**  **end**  **s(i, j) = h \* s(i, j);**  **end**  **end**  **s = ifftshift(s);**  **s = uint8(real(ifft2(s)));**  **figure(1);**  **imshow(s);**  **imwrite(s, '1-2-out1.png', 'PNG')**  **I2 = imread('1-2-in.png');**  **g2 = rgb2gray(I2);**  **s2 = fftshift(fft2(g2));**  **[M2, N2] = size(s2);**  **n12 = fix(M2 / 2);**  **n22 = fix(N2 / 2);**  **%理想高通滤波器取d02=5 （15,30）可变**  **d02 = 2;**  **for i = 1:M2**  **for j = 1:N2**  **d = sqrt((i - n12)^2 + (j - n22)^2);**  **if d < d02**  **h = 0;**  **else**  **h = 1;**  **end**  **s2(i, j) = h \* s2(i, j);**  **end**  **end**  **s2 = ifftshift(s2);**  **s2 = uint8(real(ifft2(s2)));**  **figure(2);**  **imshow(s2);**  **imwrite(s2, '1-2-out2.png', 'PNG')**  **2.**  **Input**  **2-in-hello-world.wav**  **齐浩天自己录制的音频，人声，“Hello World”。**  **Output**    **通过sonud播放声音，可以明显观察到随着采样率降低，声音失真，变得低沉。**  **Fs = 44100;**  **file = '2-in-hello-world.wav';**  **[x1,Fs] = audioread(file);%x1为所读取的音频数据,Fs为采样频率**  **sound(x1,Fs); %播放音乐**  **figure(1);**  **subplot(611);**  **plot(x1);%做原始语音信号的时域图形**  **title('原始语音信号')**  **xlabel('采样点 n');**  **ylabel('音量 n');**  **y1=fft(x1); %做length(x1)点的FFT**  **y1=fftshift(y1);%频率分量将会移到坐标中心**  **subplot(612);**  **plot(abs(y1));%画出原始语音信号的频谱图，这里保证了x轴的点数必须和y轴点数一致**  **title('原始采样频率44k的语音信号的频谱');**  **x=resample(x1,1,2);**  **sound(x,Fs/2);**  **y=fft(x);**  **y=fftshift(y);%频率分量将会移到坐标中心**  **subplot(613);**  **plot(abs(y));%画出原始语音信号的频谱图，这里保证了x轴的点数必须和y轴点数一致**  **title('采样频率22k的语音信号的频谱');**  **x=resample(x,1,2);**  **sound(x,Fs/4);**  **y=fft(x);**  **y=fftshift(y);%频率分量将会移到坐标中心**  **subplot(614);**  **plot(abs(y));%画出原始语音信号的频谱图，这里保证了x轴的点数必须和y轴点数一致**  **title('采样频率11k的语音信号的频谱');**  **x=resample(x,1,2);**  **sound(x,Fs/8);**  **y=fft(x);**  **y=fftshift(y);%频率分量将会移到坐标中心**  **subplot(615);**  **plot(abs(y));%画出原始语音信号的频谱图，这里保证了x轴的点数必须和y轴点数一致**  **title('采样频率5.5k的语音信号的频谱');**  **x=resample(x,1,2);**  **sound(x,Fs/16);**  **y=fft(x);**  **y=fftshift(y);%频率分量将会移到坐标中心**  **subplot(616);**  **plot(abs(y));%画出原始语音信号的频谱图，这里保证了x轴的点数必须和y轴点数一致**  **title('采样频率2.75k的语音信号的频谱');**  **3**  **Input**  **3-in-girl.png**    **3-in-mark.png**    **Output**  **3-output-watermarked.png**    **clc;**  **clear;**  **close all;**  **alpha = 1;**  **im = double(imread('3-in-girl.png')) / 255;**  **mark = double(imread('3-in-mark.png')) / 255;**  **imsize = size(im);**  **TH = zeros(imsize(1) \* 0.5, imsize(2), imsize(3));**  **TH1 = TH;**  **TH1(1:size(mark, 1), 1:size(mark, 2), :) = mark;**  **M = randperm(0.5 \* imsize(1));**  **N = randperm(imsize(2));**  **for i = 1:imsize(1) \* 0.5**  **for j = 1:imsize(2)**  **TH(i, j, :) = TH1(M(i), N(j), :);**  **end**  **end**  **imsize = size(im);**  **%random**  **TH = zeros(imsize(1) \* 0.5, imsize(2), imsize(3));**  **TH1 = TH;**  **TH1(1:size(mark, 1), 1:size(mark, 2), :) = mark;**  **M = randperm(0.5 \* imsize(1));**  **N = randperm(imsize(2));**  **for i = 1:imsize(1) \* 0.5**  **for j = 1:imsize(2)**  **TH(i, j, :) = TH1(M(i), N(j), :);**  **end**  **end**  **mark\_ = zeros(imsize(1), imsize(2), imsize(3));**  **mark\_(1:imsize(1) \* 0.5, 1:imsize(2), :) = TH;**  **for i = 1:imsize(1) \* 0.5**  **for j = 1:imsize(2)**  **mark\_(imsize(1) + 1 - i, imsize(2) + 1 - j, :) = TH(i, j, :);**  **end**  **end**  **FA = fft2(im);**  **FB = FA + alpha \* double(mark\_);**  **FAO = ifft2(FB);**  **figure, imshow(FAO);**  **title('watermarked image');**  **imwrite(abs(FAO), '3-output-watermarked.png');** |
| **实验总结**  **熟悉了基于MATLAB的频域手段处理图像音频等多媒体信号。** |
| **参考文献**  <https://zhuanlan.zhihu.com/p/31917473>  <https://ww2.mathworks.cn/help/matlab/ref/imread.html>  <https://ww2.mathworks.cn/help/matlab/ref/imwrite.html>  <https://ww2.mathworks.cn/help/matlab/ref/fftshift.html>  <https://ww2.mathworks.cn/help/matlab/ref/fft.html> |