

作业一

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一、叠加灰度图像&叠加彩色图像

代码:

```
clc,clear;
close all;
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%输入图像
f=imread('sky.jpg');
f_gray=rgb2gray(f);%灰度转换
[M1,N1]=size(f_gray);
g=imread('airplane.jpg');
g_gray=rgb2gray(g);
[M2,N2]=size(g_gray);
figure,imshow(f),title('原始图像');
figure,imshow(g),title('素材图像');
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%处理第一幅图像
x1=f(1:M1,1:N1,1);
x2=f(1:M1,1:N1,2);
x3=f(1:M1,1:N1,3);
f1=cat(3,x1,x2,x3);
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%处理第二幅图像
y1=g(1:M2,1:N2,1);
y2=g(1:M2,1:N2,2);
y3=g(1:M2,1:N2,3);
g1=cat(3,y1,y2,y3);
%寻找图像一的中心位置
height_min=floor((M1-M2)/2+1);
height_max=floor((M1+M2)/2+1);
width_min=floor((N1-N2)/2+1);
width_max=floor((N1+N2)/2+1);
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%叠加灰度图像
t_gray=f_gray(height_min:height_max-1,width_min:width_max-1)...
    +g_gray;%将两幅等大图像合成
f_gray_last=f_gray;
f_gray_last(height_min:height_max-1,width_min:width_max-1)=t_gray;
figure,imshow(f_gray_last),title('叠加灰度图像');
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%叠加彩色图像
t=f(height_min:height_max-1,width_min:width_max-1,1:3)...
    +g;%将两幅等大图像合成
f_last=f;
f_last(height_min:height_max-1,width_min:width_max-1,1:3)=t;%最终图像
```

```
figure,imshow(f_last),title('叠加彩色图像');
```

实验结果



图 1 原始照片



图 2 原始照片

叠加灰度图像



图 3 叠加灰度照片

叠加彩色图像



图 4 叠加彩色照片

二、书本课后作业题

1、利用线性灰度变换，试写出把灰度范围[0, 30]拉伸为[0, 50]，把灰度范围[30, 60]移动到[50, 80]，把灰度范围[60, 90]压缩为[80, 90]的变换方程。

解：

$$g(x,y) = \begin{cases} 50 & f(x,y) > 30 \\ \frac{5}{3}f(x,y) & 0 \leq f(x,y) \leq 30 \\ 0 & f(x,y) < 0 \end{cases}$$

$$g(x,y) = \begin{cases} 80 & f(x,y) > 60 \\ f(x,y) + 20 & 30 \leq f(x,y) \leq 60 \\ 50 & f(x,y) < 30 \end{cases}$$

$$g(x,y) = \begin{cases} 90 & f(x,y) > 60 \\ \frac{1}{3}f(x,y) + 60 & 60 \leq f(x,y) \leq 90 \\ 80 & f(x,y) < 60 \end{cases}$$

2、给定以下图像数据：

$$f(x,y) = \begin{bmatrix} 2 & 7 & 6 & 1 & 3 & 6 & 9 & 5 \\ 4 & 2 & 3 & 4 & 2 & 7 & 6 & 8 \\ 8 & 9 & 6 & 5 & 3 & 7 & 3 & 2 \\ 6 & 4 & 5 & 3 & 2 & 9 & 4 & 3 \\ 5 & 4 & 6 & 9 & 4 & 3 & 7 & 4 \\ 3 & 2 & 4 & 7 & 5 & 6 & 3 & 1 \\ 4 & 5 & 6 & 4 & 3 & 5 & 7 & 7 \\ 1 & 3 & 5 & 2 & 4 & 6 & 8 & 9 \end{bmatrix}$$

1)、试求出用均值滤波器对该图进行平滑后的结果, 要求以填充 0 方式处理边界问题。

2)、试求出用如下均值加权滤波器 M 对该图进行平滑后的结果, 要求以重复像素方式处理边界问题。

$$M = \frac{1}{16} \begin{bmatrix} 1 & 2 & 1 \\ 2 & 4 & 2 \\ 1 & 2 & 1 \end{bmatrix}$$

解：

1) & 2) (增加对比度显示)

代码：

```
clc,clear;
close all;
```

```

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
f0=[2 7 6 1 3 6 9 5;
    4 2 3 4 2 7 6 8;
    8 9 6 5 3 7 3 2;
    6 4 5 3 2 9 4 3;
    5 4 6 9 4 3 7 4;
    3 2 4 7 5 6 3 1;
    4 5 6 4 3 5 7 7;
    1 3 5 2 4 6 8 9];
[height,width]=size(f0);
H1=(1/9).*[1 1 1;
    1 1 1;
    1 1 1];
M=1/16.*[
    1 2 1;
    2 4 2;
    1 2 1];
N1=3;%H1 为 N1*N1 矩阵
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%补 0 操作
%补 0 操作
t1=zeros(height,1);
t2=zeros(1,width+2);
f_1=[t2;t1 f0 t1;t2];
f_2=mat2gray(f_1);
f=uint8(255*f_2);
f_3=f(2:1+height,2:1+width);%显示原图像（扩展了对比度）
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%重复
%重复
g0=f0;
x1=[f(1,:);f;f(height,:)];
x2=[x1(:,1),x1,x1(:,1)];
g_1=mat2gray(x2);
g=uint8(255*g_1);
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
f1=double(f);
f_t=f1;
for i=1:(height-N1+1)%去掉边界
    for j=1:(width-N1+1)
        chip1=f1(i:i+N1-1,j:j+N1-1).*H1;
        s1=sum(sum(chip1));
        f_t(i+(N1-1)/2,j+(N1-1)/2)=s1;
    end
end
f4=uint8(f_t);

```

```

f_last=f4(2:1+height,2:1+width);
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
g1=double(g);
g_t=g1;
for i=1:(height-N1+1)%去掉边界
    for j=1:(width-N1+1)
        chip2=f1(i:i+N1-1,j:j+N1-1).*M;
        s2=sum(sum(chip2));
        g_t(i+(N1-1)/2,j+(N1-1)/2)=s2;
    end
end
g4=uint8(g_t);
g_last=g4(2:1+height,2:1+width);
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
figure,subplot(1,2,1),imshow(f_3),title('原图像')
subplot(1,2,2),imshow(f_last),title('均值滤波图像')
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
figure,subplot(1,2,1),imshow(f_3),title('原图像')
subplot(1,2,2),imshow(g_last),title('加权滤波图像')

```

处理结果:

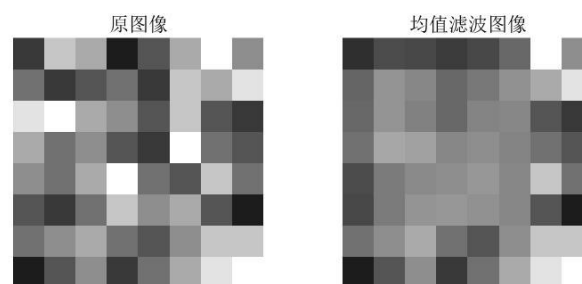


图 5 均值滤波图像

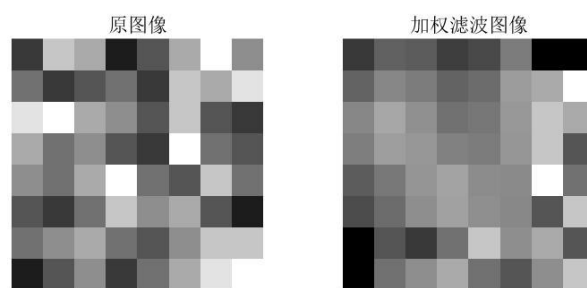


图 6 加权滤波图像