DEMO of Multi-color superpixel method.

This web is to demonstrate the multi-color superpixel method published in our paper

(Note that the program cannot run before you re-generate the DLUT in your own computer, since the DLUT is too large and cannot be uploaded to github.)

1. Define target Field

the target fields here are plane waves in different colors.

```
% Define the field.
N=100; %number of superpixels.
Utar=zeros(N,N,3);
[X,Y]=meshgrid(1:N,1:N); % grid

Utar(:,:,1)=8*exp(1i*2*pi/10*X).*(abs(X-N/2)<N/4);
Utar(:,:,2)=8*exp(1i*2*pi/25*X).*(abs(Y-N/2)<N/4);
Utar(:,:,3)=8*(abs(Y-N/2)<N/4).*(abs(X-N/2)<N/4);

figure
for i=1:3
    subplot(2,3,i)
    imagesc(abs(Utar(:,:,i)).^2) %Intensity
    subplot(2,3,3+i)
    imagesc(angle(Utar(:,:,i))) %Phase
end
```

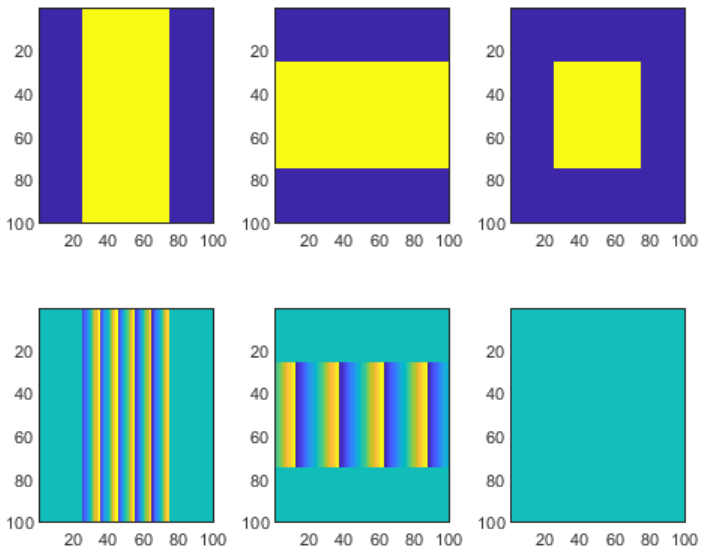

Fig.1. Intensity and phase of three colors.

2. Generate DMD pattern

Load the DLUT and then use "DMDgeneration_SP" function.

The DLUT is already generated. If you want to generate DLUT with different parameters (e.g. wavelength), you may refer to the 4th part.

```
%load DLUT
mfLUT=matfile("DLUT/LUT-3.mat");
mfKDT=matfile("DLUT/KDTmodel-3.mat");
%
[DMD_SP,Error]=DMDgeneration_SP(Utar,mfLUT.wavelength,mfLUT.wavelength0,mfLUT.Npx,mfKDT.model,mfLUT.spList);

figure
imshow(DMD_SP)
```

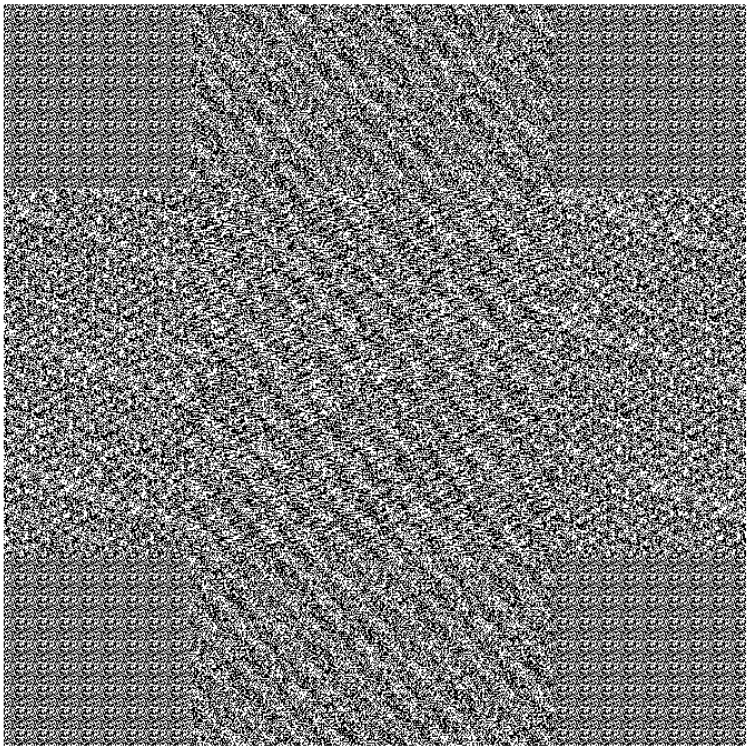

Fig.2. DMD Pattern

This pattern is not with the same size of DMD in general, you may padding "0" or "1" to adjust the size. But in simulation, that is not important.

3. Simulation

```
%simulate the output image
um=1e-6;
mm=1e-3;
px_size=7.56*um;
wavelength=um.*mfLUT.wavelength;
wavelength0=mfLUT.wavelength0*um;
Npx=mfLUT.Npx;
focal_len=250*mm;
a=wavelength0*focal_len/(Npx^2*px_size);
R=a*0.6;
npad=30*Npx; %padding to avoid reflection of borders in Fresnel diffraction
simulation.
DMD_SP=Padding(DMD_SP,npad);
Uout_SP=DMDforvard(DMD_SP,px_size,wavelength,Npx,a,R,focal_len);
Uout_SP=InvPadding(Uout_SP,npad);
DMD_SP=InvPadding(DMD_SP,npad);

figure
for i=1:3
    subplot(2,3,i)
    imagesc(abs(Uout_SP(:,:,i)).^2) %Intensity
    subplot(2,3,3+i)
    imagesc(angle(Uout_SP(:,:,i))) %Phase
end
```

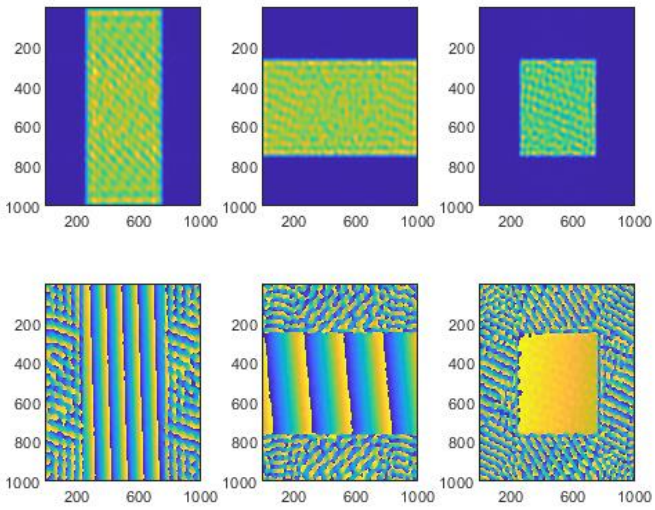

Fig.3. Output Image

4. DLUT generation

You can find two codes in folder "DLUT".

"LUTgenerate.m" generate the DLUT, you may modify the parameters and run the program. Then use "save("DLUT-x")" to save data to "DLUT-x.mat". Note that the generation of DLUT may take long time, depending on your parameters. You may want to choose small Ba and Bp as test (Ba~1,Bp~2).

"KDTgenerate.m" generate the KDTree based on the input DLUT filename. You also need save it as "KDTmodel-x.mat".

After generating the new DLUT and KDTmodel files, you can load them as in part 2.