

LAMPIRAN

PROGRAM MATLAB yang digunakan pada M-File

%%%1. Simulasi dari noisy CFA image%%%%%%%%

```
clear all;
```

```
l=imread('kodak_fence','tif');
```

```
imshow(l);
```

```
l=double(l);
```

```
[n,m,ch]=size(l);
```

```
figure(1);clf;
```

```
imshow(l/255);
```

%%penambahan noise

```
noi=randn(n,m);
```

```
vr=12;%%noise level di red channel
```

```
vb=10;%%noise level di blue channel
```

```
vg=13;%%noise level di green channel
```

```
ln(:,3)=l(:,3)+vb*noi;
```

```
ln(:,1)=l(:,1)+vr*noi;
```

```
ln(:,2)=l(:,2)+vg*noi;
```

%% penghitungan CFA (Bayer pattern) citra

```
ml(1:n,1:m)=ln(:,2);
```

```
ml(1:2:n,2:2:m)=ln(1:2:n,2:2:m,1);
```

```
ml(2:2:n,1:2:m)=ln(2:2:n,1:2:m,3);%ml adalah di simulasiannya citra mosaic noisy CFA
```

%%2. Joint denoising and demosaicking%%%%%%%%

```
aku=imread('kodak_fence','tif');
```

```
ld1=aku;
```

```
ld1=ndmsc(ml,vr,vg,vb);
```

```
ld2=den_bayernoise(ld1,vr,vg,vb);
```

```
snrf=csnr(ld2,l,25,25) %PSNR yang telah di restorasi secara penuh
```

```
figure(2);clf;
```

```
imshow(ld2/255);
```

```
function out=ndmsc(A,vr,vg,vb)
```

```
%   vr,vg,vb -- the noise levels pada tiga channels
```

```
[N,M]=size(A);
```

```
%%filtering%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
```

```
f=[-1/4 1/2 1/2 -1/4];
```

```
Ah=conv2(A,f);
```

```
Ah=Ah(:,3:2+M);
```

```
Av=conv2(A,f');
```

```
Av=Av(3:2+N,:);
```

```
%%menghitung color differences%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
```

```
dh=zeros(N,M);
```

```
dv=dh;
```

```
for i=1:2:N
```

```
    dh(i,1:2:M)=A(i,1:2:M)-Ah(i,1:2:M);
```

```
    dh(i,2:2:M)=Ah(i,2:2:M)-A(i,2:2:M);
```

```
    dv(i,1:2:M)=A(i,1:2:M)-Av(i,1:2:M);
```

```
    dv(i,2:2:M)=Av(i,2:2:M)-A(i,2:2:M);
```

```
end
```

```
for i=2:2:N
```

```
    dh(i,2:2:M)=A(i,2:2:M)-Ah(i,2:2:M);
```

```
    dh(i,1:2:M)=Ah(i,1:2:M)-A(i,1:2:M);
```

```
    dv(i,2:2:M)=A(i,2:2:M)-Av(i,2:2:M);
```

```
    dv(i,1:2:M)=Av(i,1:2:M)-A(i,1:2:M);
```

```
end
```

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%menghitung fungsi autocorrelation%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
```

```
fr(9)=vr^2/16;      fr(1)=fr(9);
```

```

fr(8)=vr^2/8+vg^2/8;    fr(2)=fr(8);
fr(7)=vr^2/4+vg^2/4;    fr(3)=fr(7);
fr(6)=3*vr^2/8+3*vg^2/8;  fr(4)=fr(6);
fr(5)=3*vr^2/8+4*vg^2/8;

```

```

fb(9)=vb^2/16;          fb(1)=fb(9);
fb(8)=vb^2/8+vg^2/8;    fb(2)=fb(8);
fb(7)=vb^2/4+vg^2/4;    fb(3)=fb(7);
fb(6)=3*vb^2/8+3*vg^2/8;  fb(4)=fb(6);
fb(5)=3*vb^2/8+4*vg^2/8;

```

%%%%%%%%%%low-pass filtering

```

f=[4 9 15 23 26 23 15 9 4]/128;
adh=conv2(dh,f);
adh=adh(:,5:4+M);
adv=conv2(dv,f');
adv=adv(5:4+N,:);

```

%%%%%%%%%%DCN proses perhitungan%%%%%%%%%%

f=conv(f,f);%dianggap f adalah symmetrical, f(l)=f(-l).

```

fr=conv(fr,f);lfr=(length(fr)+1)/2;
fb=conv(fb,f);lfb=(length(fb)+1)/2;
pnr=fr(lfr);
pnb=fb(lfb);

```

%%%%%%%%%%

```
s=4;
```

%%%mendapatkan nilai G

```
rAg=A;
```

```
for i=5:2:N-4
```

```
    for j=6:2:M-4
```

```
        th=dh(i,j-s:j+s);
```

```
        tv=dv(i-s:i+s,j);
```

```
        ath=adh(i,j-s:j+s);
```

```
        atv=adv(i-s:i+s,j);
```

%%%%%%%%%%

```
        mh=mean(ath);%ath(s+1);
```

```

ph=cov(ath)-pnr;
ph=max(ph,0.01);
Rh=mean((ath-th).^2)+0.1;
h=mh+ph*(ph+pnr+Rh)^(-1)*(th(s+1)-mh);
H=ph-ph*(ph+pnr+Rh)^(-1)*ph+0.1;

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

mv=mean(atv);%atv(s+1);
pv=cov(atv)-pnr;
pv=max(pv,0.01);
Rv=mean((atv-tv).^2)+0.1;
v=mv+pv*(pv+pnr+Rv)^(-1)*(tv(s+1)-mv);
V=pv-pv*(pv+pnr+Rv)^(-1)*pv+0.1;
d=(V*h+H*v)/(H+V);
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
rAg(i,j)=A(i,j)+d;

end

end

for i=6:2:N-4
    for j=5:2:M-4
        th=dh(i,j-s:j+s);
        tv=dv(i-s:i+s,j);
        ath=adh(i,j-s:j+s);
        atv=adv(i-s:i+s,j);
        %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
        mh=mean(ath);%ath(s+1);
        ph=cov(ath)-pnb;
        ph=max(ph,0.01);
        Rh=mean((ath-th).^2)+0.1;
        h=mh+ph*(ph+pnb+Rh)^(-1)*(th(s+1)-mh);
        H=ph-ph*(ph+pnb+Rh)^(-1)*ph+0.1;
    end
end

```

```

mv=mean(atv);%atv(s+1);
pv=cov(atv)-pnb;
pv=max(pv,0.01);
Rv=mean((atv-tv).^2)+0.1;
v=mv+pv*(pv+pnb+Rv)^(-1)*(tv(s+1)-mv);
V=pv-pv*(pv+pnb+Rv)^(-1)*pv+0.1;
d=(V*h+H*v)/(H+V);
%%%%%%
rAg(i,j)=A(i,j)+d;

end

end

rAg = round(rAg);
ind = find(rAg>2^8-1);
rAg(ind) = 2^8-1;
ind = find(rAg<0);
rAg(ind) = 0;

%%%%%%%%%%%%Get R,B
rAr=A;rAb=A;
for i=6:2:N-5
    for j=6:2:M-5
        rAr(i,j+1)=rAg(i,j+1)-(rAg(i-1,j)-rAr(i-1,j)+rAg(i-1,j+2)-rAr(i-1,j+2)+rAg(i+1,j)-rAr(i+1,j)+rAg(i+1,j+2)-
rAr(i+1,j+2))/4;
        rAb(i+1,j)=rAg(i+1,j)-(rAg(i,j-1)-rAb(i,j-1)+rAg(i,j+1)-rAb(i,j+1)+rAg(i+2,j-1)-rAb(i+2,j-1)+rAg(i+2,j+1)-
rAb(i+2,j+1))/4;
    end
end

%%%%%%%%%%%%
for i=6:2:N-5
    for j=6:2:M-5
        rAr(i,j)=rAg(i,j)-(rAg(i-1,j)-rAr(i-1,j)+rAg(i,j-1)-rAr(i,j-1)+rAg(i,j+1)-rAr(i,j+1)+rAg(i+1,j)-rAr(i+1,j))/4;
        rAb(i,j)=rAg(i,j)-(rAg(i-1,j)-rAb(i-1,j)+rAg(i,j-1)-rAb(i,j-1)+rAg(i,j+1)-rAb(i,j+1)+rAg(i+1,j)-rAb(i+1,j))/4;
    end
end

```

```

        rAr(i+1,j+1)=rAg(i+1,j+1)-(rAg(i,j+1)-rAr(i,j+1)+rAg(i+1,j)-rAr(i+1,j))+rAg(i+1,j+2)-
        rAr(i+1,j+2)+rAg(i+2,j+1)-rAr(i+2,j+1))/4;
        rAb(i+1,j+1)=rAg(i+1,j+1)-(rAg(i,j+1)-rAb(i,j+1)+rAg(i+1,j)-rAb(i+1,j))+rAg(i+1,j+2)-
        rAb(i+1,j+2)+rAg(i+2,j+1)-rAb(i+2,j+1))/4;
    end
end

```

```

rAr = round(rAr);
ind = find(rAr>2^8-1);
rAr(ind) = 2^8-1;
ind = find(rAr<0);
rAr(ind) = 0;
rAb = round(rAb);
ind = find(rAb>2^8-1);
rAb(ind) = 2^8-1;
ind = find(rAb<0);
rAb(ind) = 0;

```

```

out(:,1) = rAr;
out(:,2) = rAg;
out(:,3) = rAb;

```

```

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
return;

```

```

function l=den_bayernoise(ln,vr,vg,vb);

```

```

rln(:,:)=ln(:,1);
gln(:,:)=ln(:,2);
bln(:,:)=ln(:,3);

```

```

lr=den_bayer(rln,vr,vg,vb);
lg=den_bayer(gln,vr,vg,vb);
lb=den_bayer(bln,vr,vg,vb);

```

```
lr = round(lr);  
ind = find(lr>2^8-1);  
lr(ind) = 2^8-1;  
ind = find(lr<0);  
lr(ind) = 0;
```

```
lg = round(lg);  
ind = find(lg>2^8-1);  
lg(ind) = 2^8-1;  
ind = find(lg<0);  
lg(ind) = 0;
```

```
lb = round(lb);  
ind = find(lb>2^8-1);  
lb(ind) = 2^8-1;  
ind = find(lb<0);  
lb(ind) = 0;
```

```
l(:,1)=lr;  
l(:,2)=lg;  
l(:,3)=lb;
```

```
return;
```

```
function A=den_bayer(ln,vr,vg,vb)  
[ld,hd,lr,hr]=wfilters('db4');  
J=3;  
[S,HW,WH,WW] = denocwt2d(ld,hd,J,ln,vr,vg,vb);  
A=iocwt2d(S,HW,WH,WW,lr,hr);  
return;
```