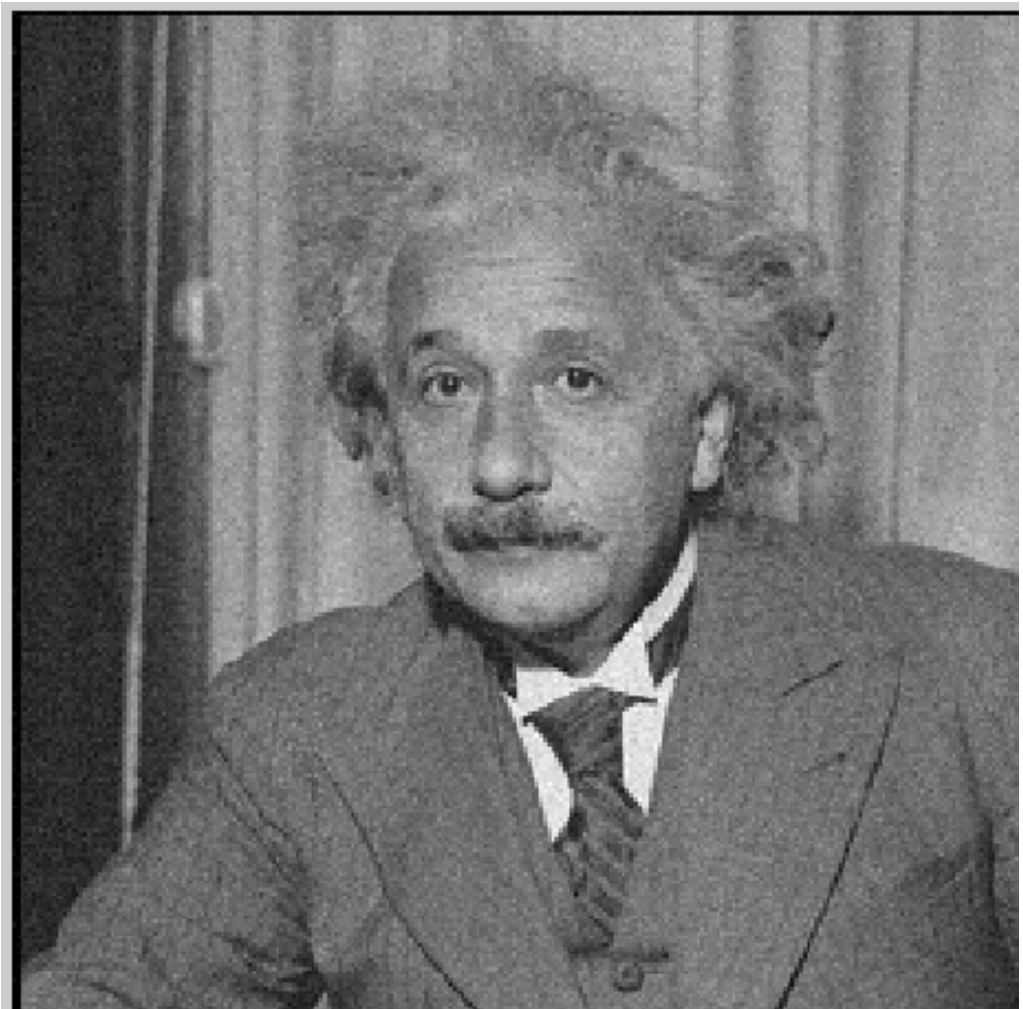
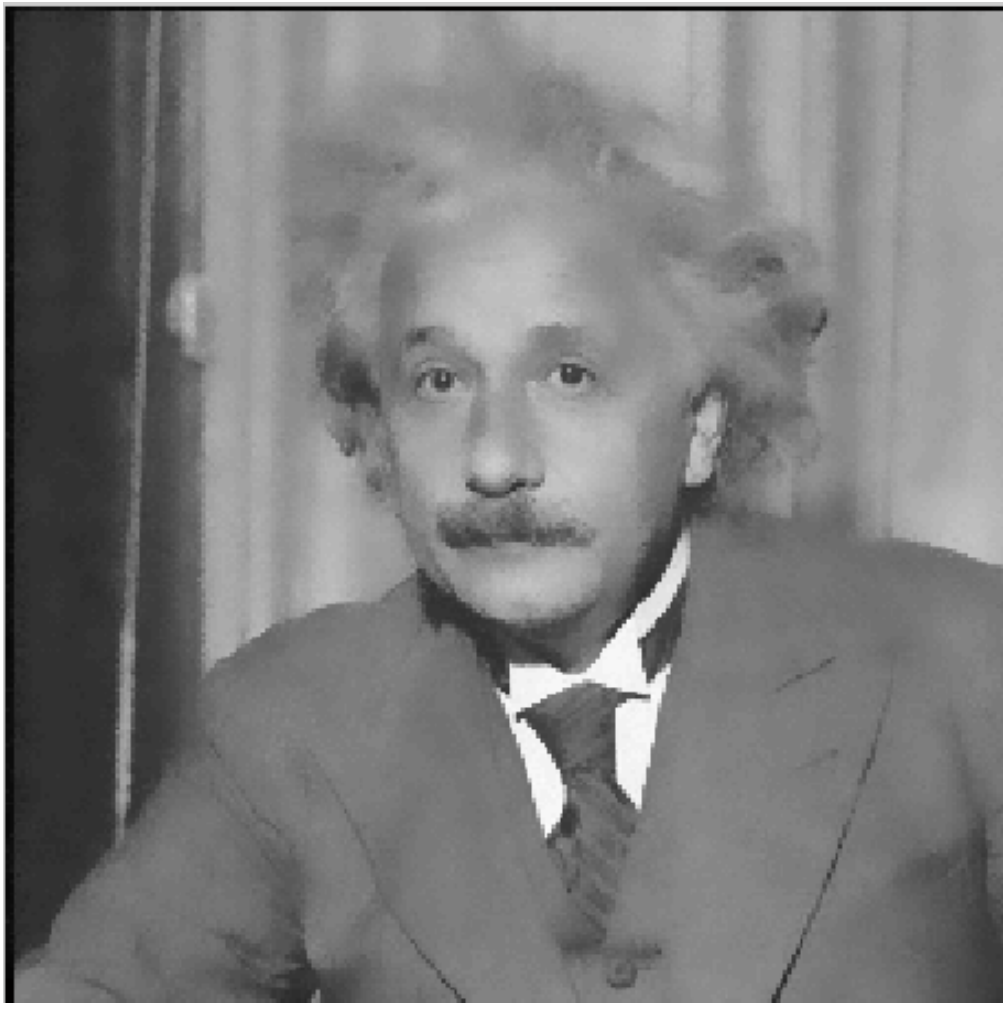
Detekcia hrán

Cvičenia z Počítačového Videnia I.

Bilaterálny filter

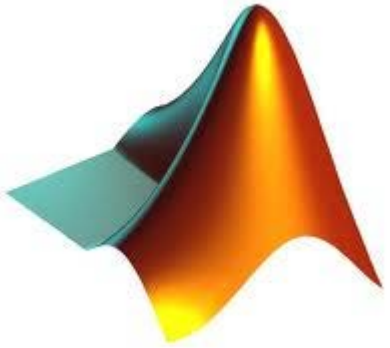
- Nelineárny vyhladzovací filter ktorý zachováva hrany v obraze





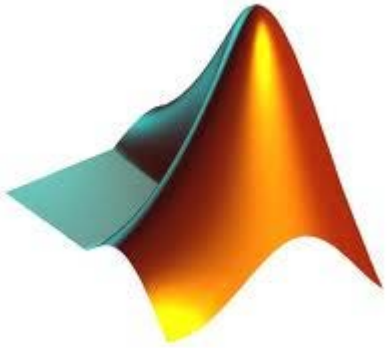
Bilaterálny filter (ukážka)

- Mathworks
- http://www.mathworks.com/matlabcentral/fileexchange/12191-bilateral-filtering



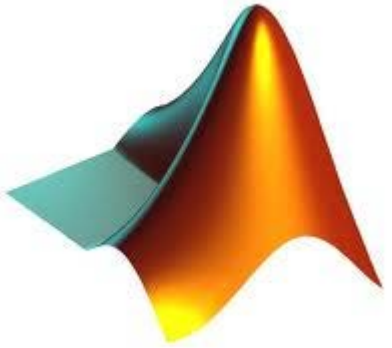
Bilaterálny filter

```
I=imread('cajka.jpg');
Gr = double(rgb2gray(I))/255;
J = imnoise(Gr, 'gaussian');
w = 5;
sigma = [3 0.2];
B = bfilter2(J,w,sigma);
```



Gaussovské vyhladenie (porovnanie)

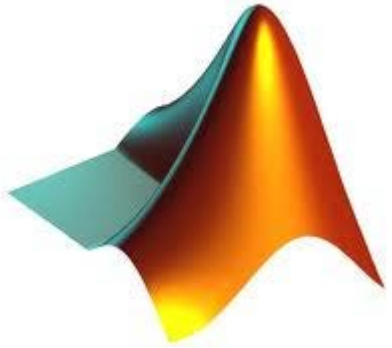
```
G = fspecial('gaussian',[5 5],2);
Ig = imfilter(J,G,'same');


figure, imshow(J);
figure, imagesc(B);
axis off; axis image; colormap gray;
figure, imshow(Ig);
```



Gradient

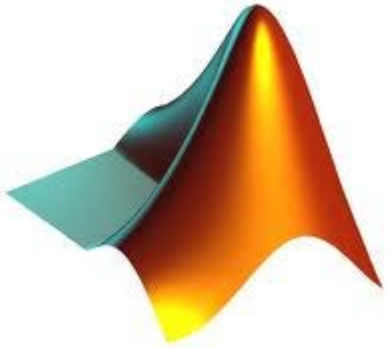
- Smer gradientu udáva najväčšiu zmenu intenzity

- **Sila (dôležitosť) hrany** = veľkosť gradientu
- **Smer hrany** = smer gradientu – 90˚



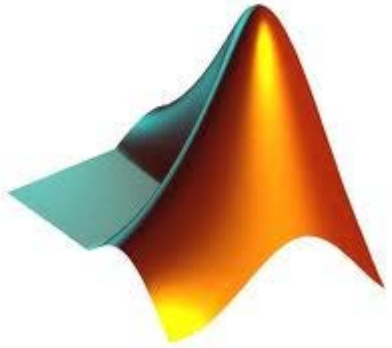
Gradient I.

```
I=imread('apple.jpg');
figure, imshow(I);
Z=double(rgb2gray(I));
[m n]=size(Z);
[X,Y] = meshgrid(1:n,1:m);
[DX,DY] = gradient(Z);
```



Gradient I.

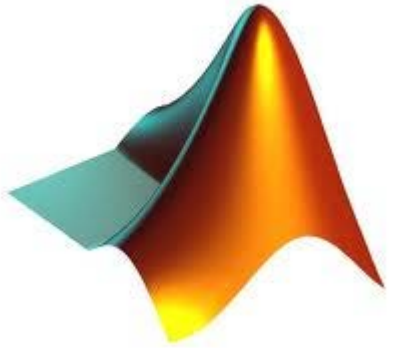
```
figure, contour(X,Y,Z,10);
hold on
quiver(X(1:10:end),Y(1:10:end),DX(1:1
  0:end),DY(1:10:end))
hold off
```



Dôležité

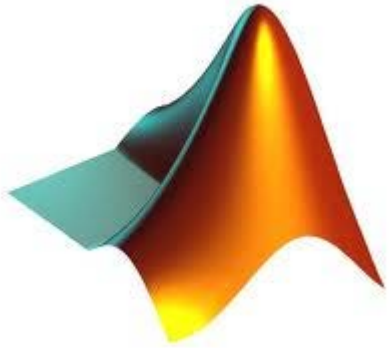
- osi
  - obrázok (imshow) má 0,0 vľavo hore
  - plot (contour, quiver, ...) vľavo dole

```
figure, imagesc(flipud(Z));
colormap(gray);
```



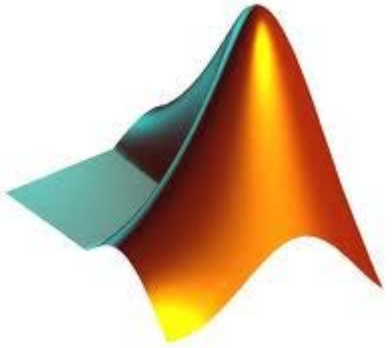
Gradient I.

- meshgrid
- contour
  - kde je veľa kontúr blízko seba, tam je veľký gradient
- quiver
  - (1:10:end) - každý 10. prvok poľa



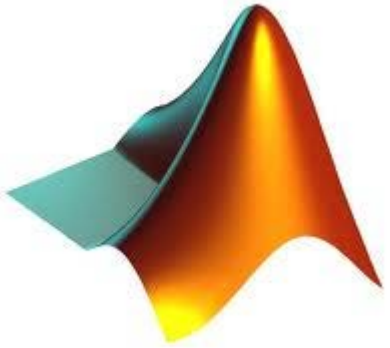
Gradient II.

```
h = fspecial('sobel');
SX=conv2(Z,h',’same');
SY=conv2(Z,h,'same');
SX(1,:)=0;
SX(end,:)=0;
SY(:,1)=0;
SY(:,end)=0;
```



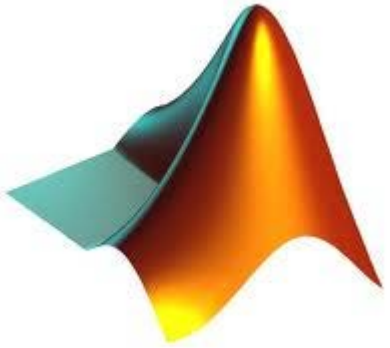
Gradient II.

```
figure
contour(X,Y,Z,10)
hold on
quiver(X(1:10:end),Y(1:10:end),SX(1:1
  0:end),SY(1:10:end))
```



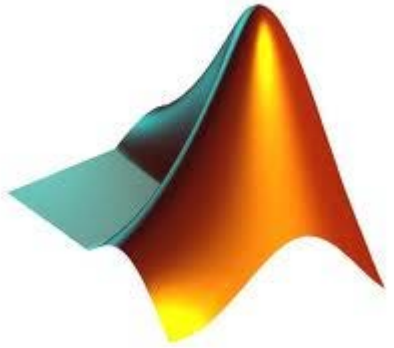
Šum a jeho odstránenie

- Šum
  - Gaussovský
  - Salt & Pepper
- Odstránenie šumu
  - Median
  - Mean
  - Gaussovský filter
  - Wiener



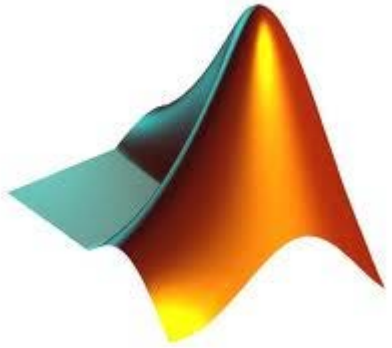
Šum a jeho odstránenie

```
I=imread('cajka.jpg');
Gr = double(rgb2gray(I))/255;
S1 = imnoise(Gr, 'gaussian');
S2 = imnoise(Gr, 'salt & pepper');
```



Ktorý filter je najlepší, prečo?

```
h = fspecial('average',5);
I11 = imfilter(S1,h);

I12 = medfilt2(S1,[5,5],'symmetric');

G = fspecial('gaussian',[5 5],2);
I13 = imfilter(S1,G,'same');

I14 = wiener2(S1,[5 5]);
```



Ktorý filter je najlepší, prečo?

```
h = fspecial('average',5);
I21 = imfilter(S2,h);

I22 = medfilt2(S2,[5,5],'symmetric');

G = fspecial('gaussian',[5 5],2);
I23 = imfilter(S2,G,'same');

I24 = wiener2(S1,[5 5]);
```