Spracovanie obrazu

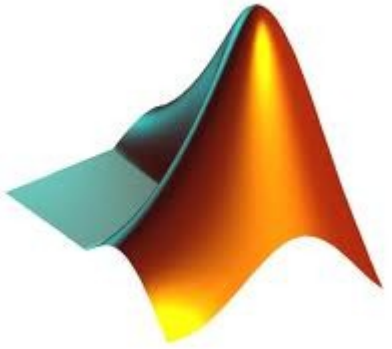
Cvičenia z Pokročilého spracovania obrazu.

Prístup k matlabu 15a

Linka na matlab je
https://iss.cvtisr.sk/

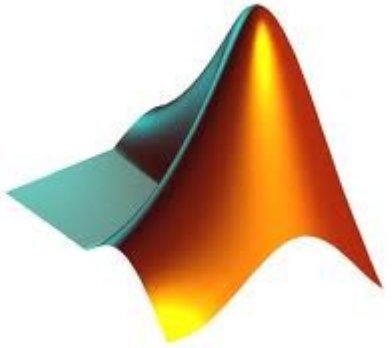
treba kliknúť na záložku matlab (alebo priamo sem)
https://iss.cvtisr.sk/web/guest/matlab

Inštitúcia UK , a email treba fakultný



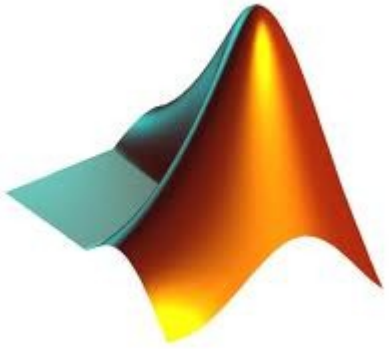
Stránka k matlabu

- http://www.mathworks.com/



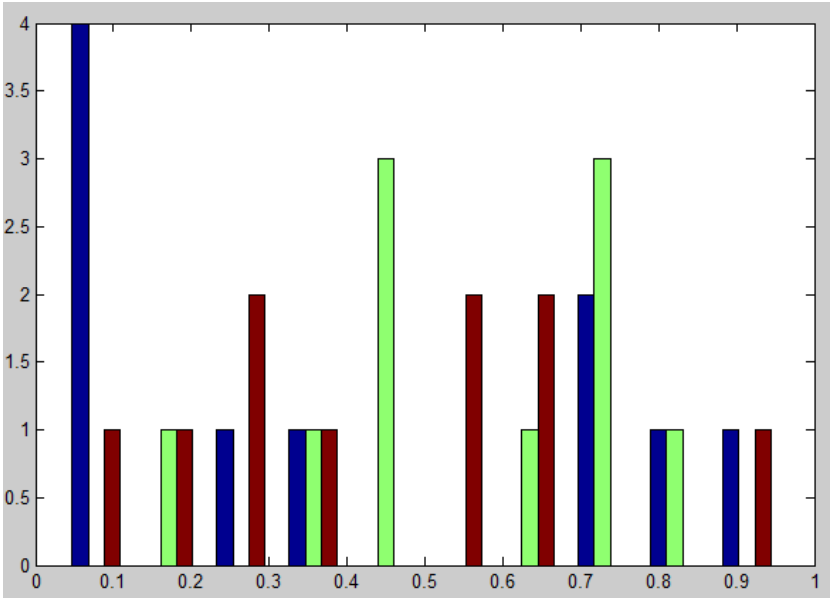
Spracovanie obrazu

- Histogram
- Vyhladzovanie
  - priemer, medián
- Prahovanie
- Detekcia hrán
  - Sobel, Roberts, …



Histogram

```
n = hist(Y)
n = hist(Y,x)
n = hist(Y,nbins)
[n,xout] = hist(...)
hist(...)
```



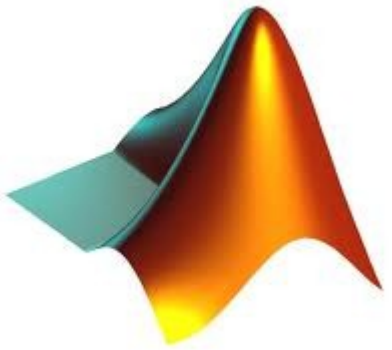
- nbins - počet tried histogramu
- pri N-D vráti histogram pre každý stĺpec spoločne v jednom grafe

Histogram

- I je obrázok, n počet tried histogramu

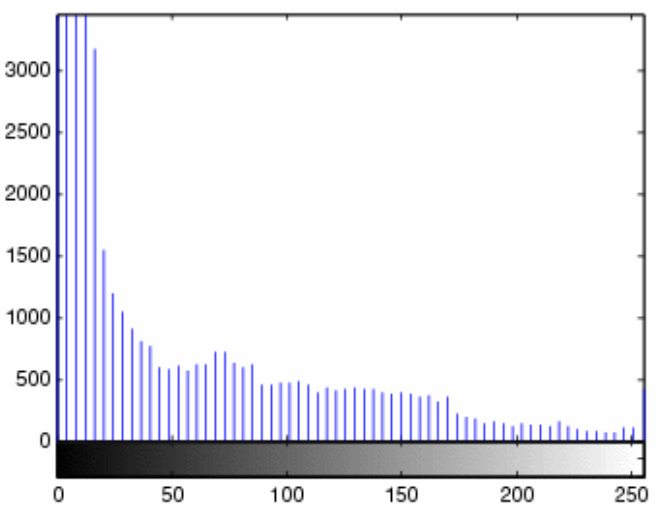
```
imhist(I);
```

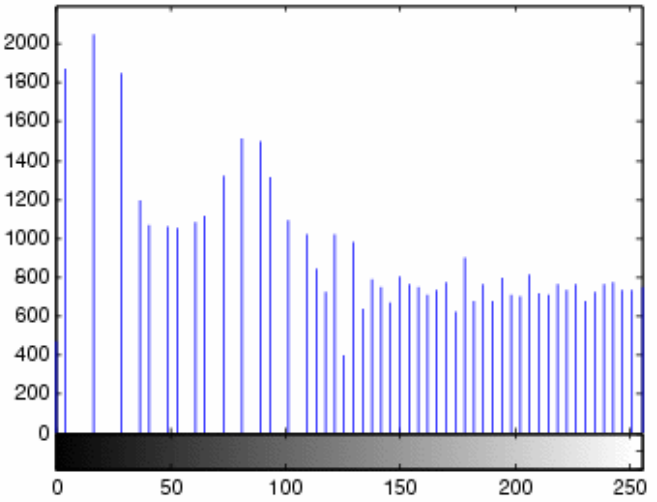
```
imhist(I, n);
```



Úprava histogramu

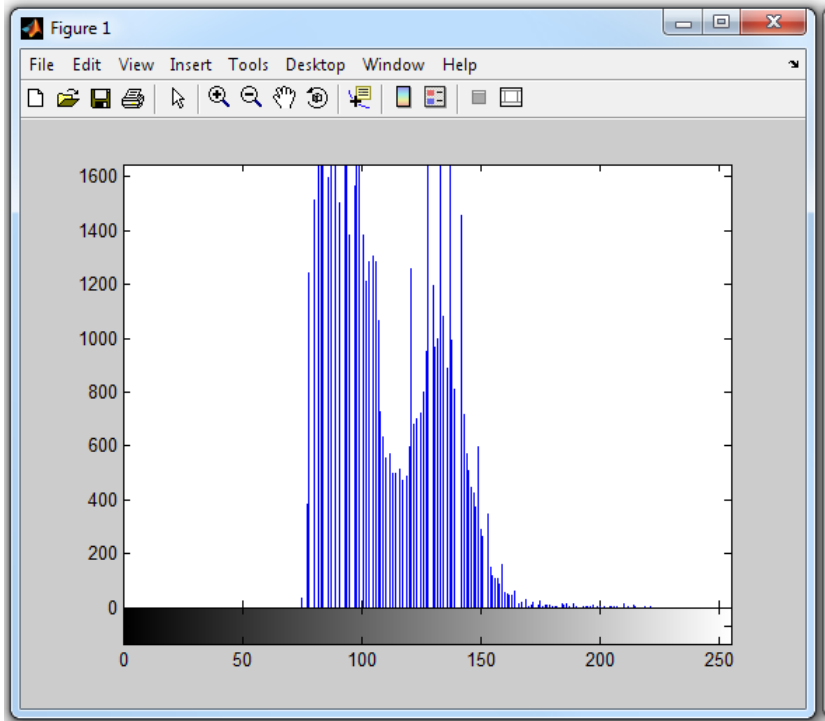
```
J = histeq(I, n)
```

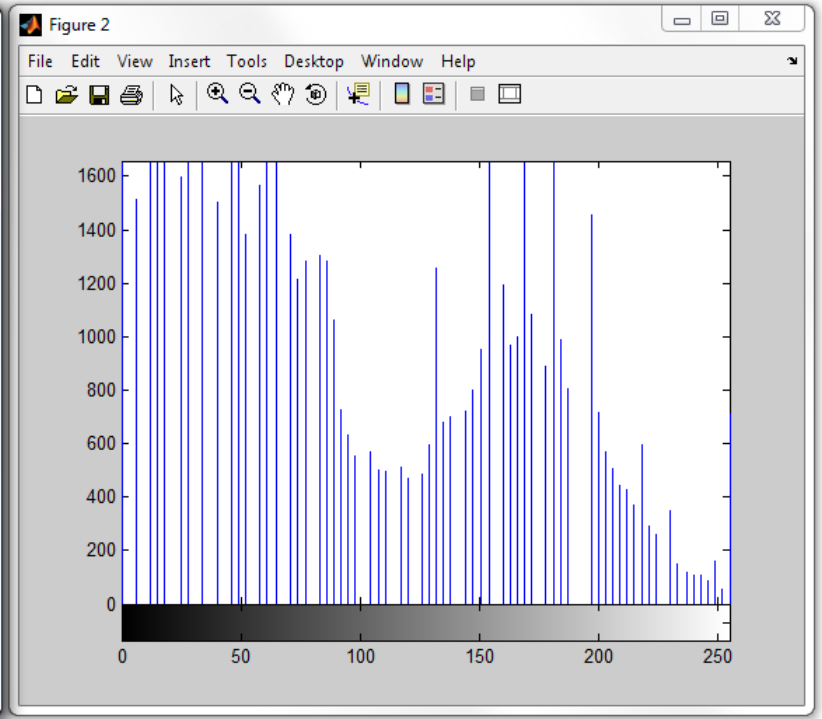


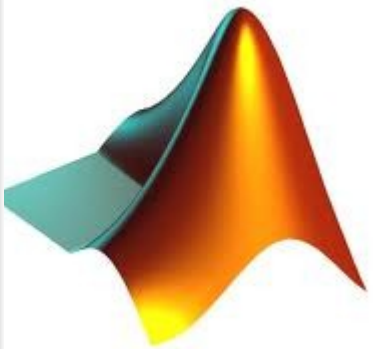



```
J = imadjust(I)
```

```
J = imadjust(I,[low_in; high_in], [low_out;high_out])
```

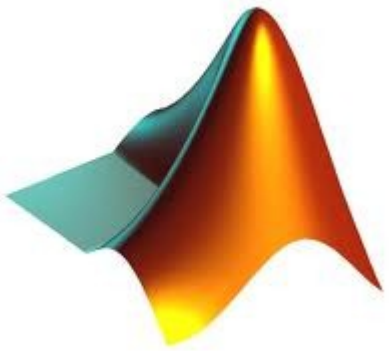






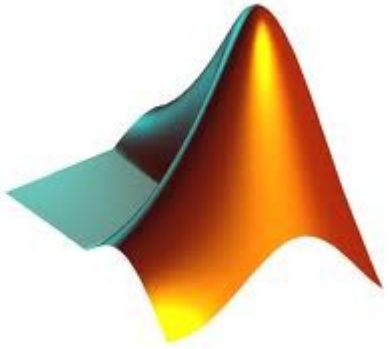
Úprava histogramu

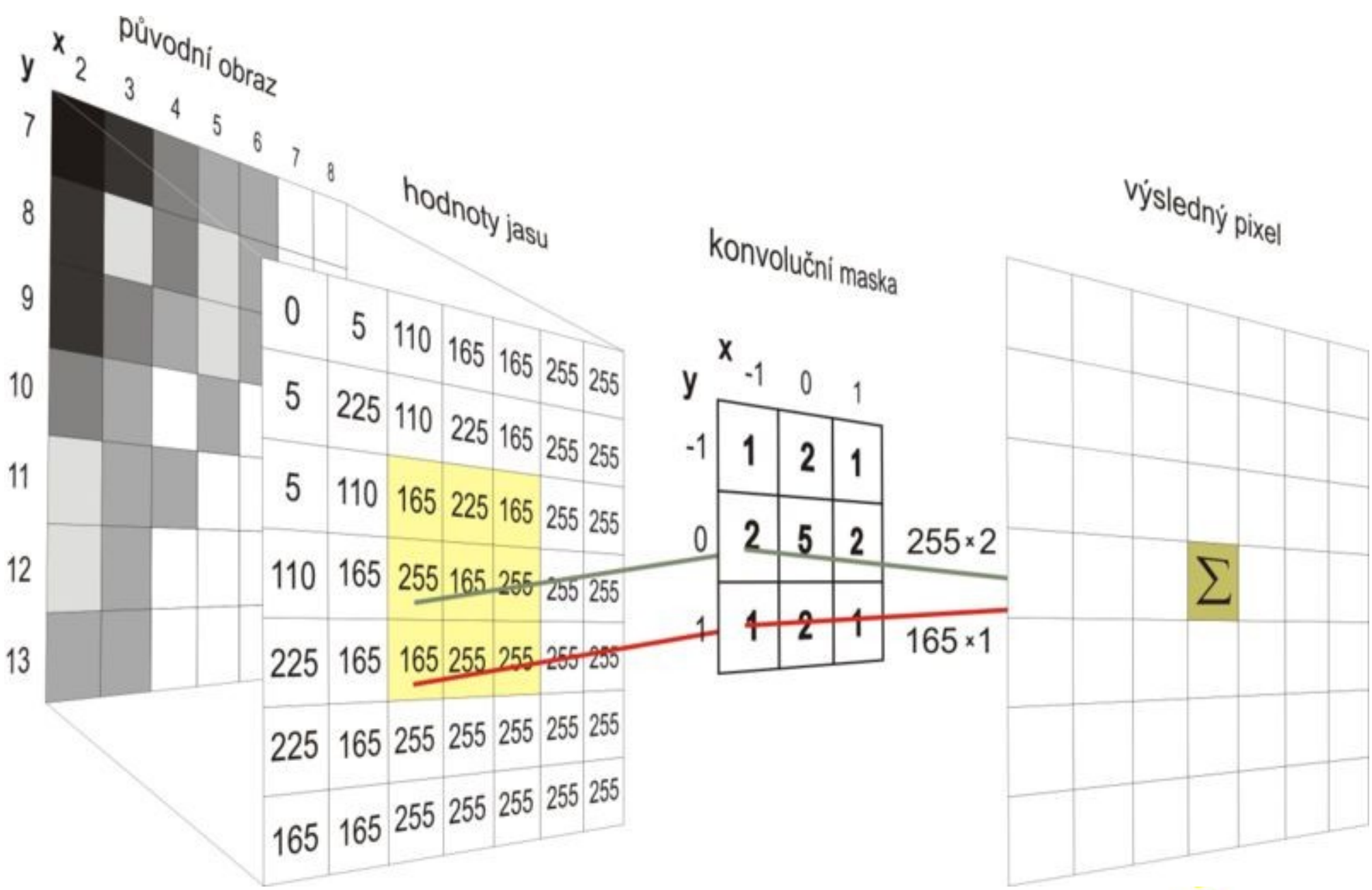
```
I = imread('pout.tif');
J = imadjust(I);
imshow(I), figure, imshow(J);
K = imadjust(I,[0.3 0.7],[]);
figure, imshow(K);
L = histeq(I);
figure, imshow(L);
```



Konvolúcia a korelácia 2D obrázka

- Korelácia: $$F \circ I(x,y) = \sum_{j=-N}^{N} \sum_{i=-N}^{N} F(i,j) I(x+i, y+j)$$
- Konvolúcia: $$F * I(x,y) = \sum_{j=-N}^{N} \sum_{i=-N}^{N} F(i,j) I(x-i, y-j)$$
  - Konvolúcia je asociatívna
- Totožné pri symetrických filtroch

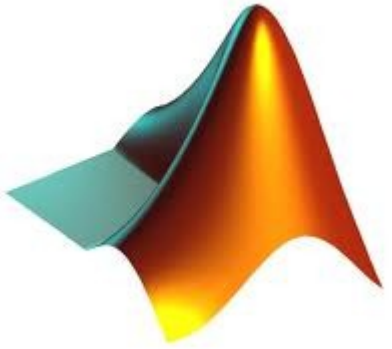



původní obraz
hodnoty jasu
konvoluční maska
výsledný pixel
x
y
2
3
4
5
6
7
8
7
8
9
10
11
12
13
0 5 110 165 165 255 255
5 225 110 225 165 255 255
5 110 165 225 165 255 255
110 165 255 165 255 255 255
225 165 165 255 255 255 255
225 165 255 255 255 255 255
165 165 255 255 255 255 255
x
y
-1
0
1
-1 1 2 1
0 2 5 2
1 1 2 1
255 × 2
165 × 1
Σ

- Konvolúcia

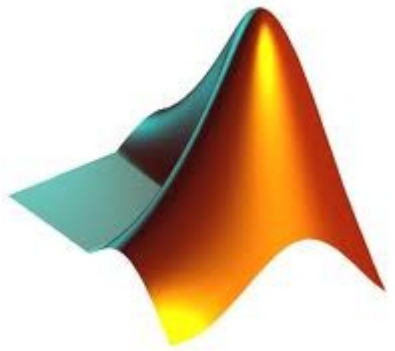
```
conv2(I,h,'same')

conv2(I,h,'full') = conv2(h,I,'full')

conv2(I,h,'valid')

filter2(h,I, 'full') = conv2(h,I,'full')
%pre symetrické h
```

  - Otočí h o 180° a zavolá conv2



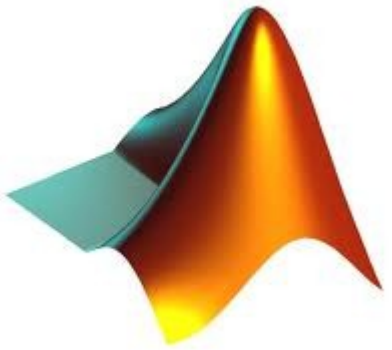
```
A = rand(3);
B = rand(4);
C = conv2(A,B)    % C is 6-by-6
```

```
C =

   0.1838   0.2374   0.9727   1.2644   0.7890   0.3750
   0.6929   1.2019   1.5499   2.1733   1.3325   0.3096
   0.5627   1.5150   2.3576   3.1553   2.5373   1.0602
   0.9986   2.3811   3.4302   3.5128   2.4489   0.8462
   0.3089   1.1419   1.8229   2.1561   1.6364   0.6841
   0.3287   0.9347   1.6464   1.7928   1.2422   0.5423
```



Priemerovací filter

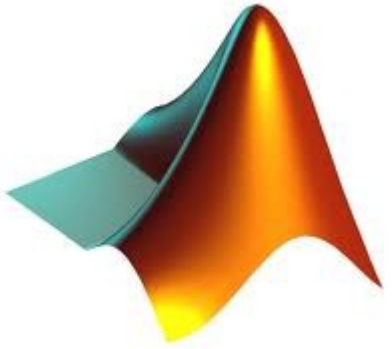
```
im=imread('peppers.png');
gr = rgb2gray(im);
h = ones(3)/9
c = conv2(double(gr),h, 'valid');
imshow(c/255);
```



Šum

```
J = imnoise(I,type)
```

```
'gaussian', 'salt & pepper', 'speckle'
```

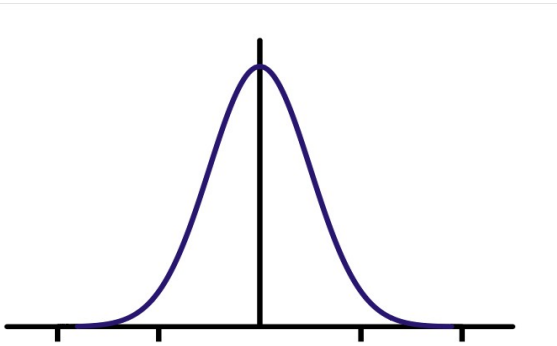


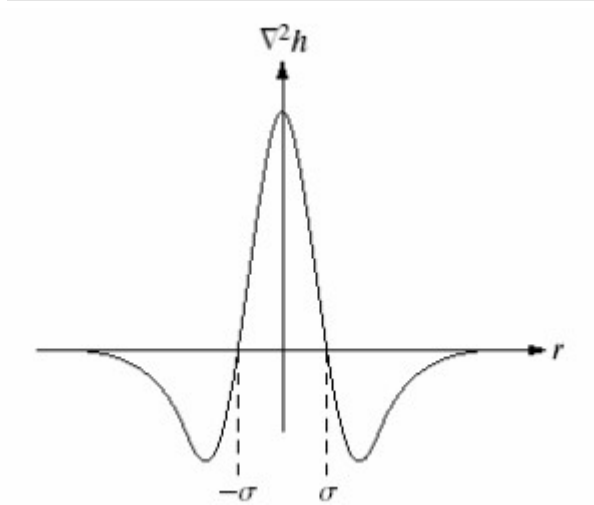
Typy filtrov

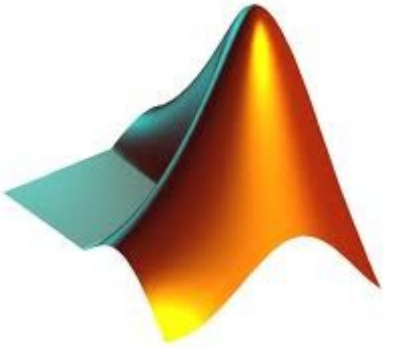
```
fspecial(typ, parametre)
```

```
h = fspecial('average', hsize)
h = fspecial('disk', radius)
h = fspecial('gaussian', hsize, sigma)
h = fspecial('log', hsize, sigma)
h = fspecial('prewitt')
h = fspecial('sobel')
```

```
image(h*255)
```







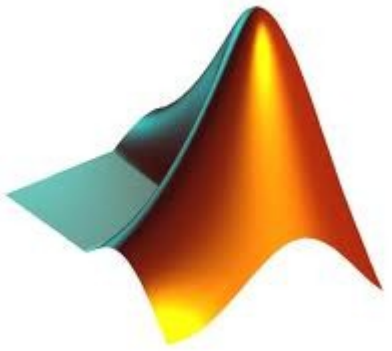
Priemer, Medián

- Priemer

```
h = fspecial('average', 3)
imfilter(I,h);
```

- Medián

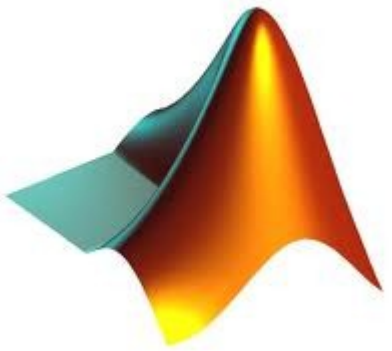
```
medfilt2(I,[3,3],'symmetric')
```



imfilter

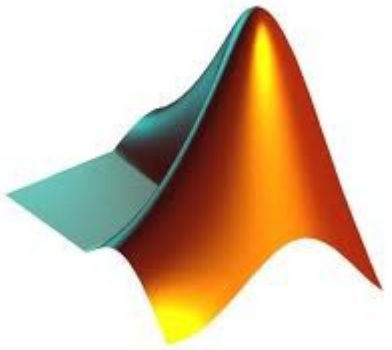
```
B = imfilter(A, h, option1, option2,...)
```

- X=0, 'symmetric', 'replicate', 'circular'
- 'same', 'full,
- 'corr', 'conv'



Hľadanie hrán, Diferenčné gradientné operátory

- Sobel (Sobelova aproximácia derivácie)
- Prewitt (Prewittovej aproximácia derivácie)
- Roberts (Robertsova aproximácia derivácie)



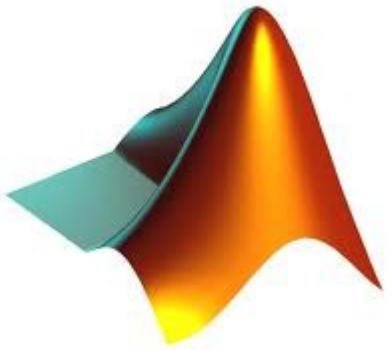
Sobel filter

- Obrázky Gx a Gy konvolúciou filtrov s A

$$\mathbf{G}_y = \begin{bmatrix} +1 & +2 & +1 \\ 0 & 0 & 0 \\ -1 & -2 & -1 \end{bmatrix} * \mathbf{A} \quad \text{and} \quad \mathbf{G}_x = \begin{bmatrix} +1 & 0 & -1 \\ +2 & 0 & -2 \\ +1 & 0 & -1 \end{bmatrix} * \mathbf{A}$$

$$\mathbf{G} = \sqrt{\mathbf{G}_x^{\,2} + \mathbf{G}_y^{\,2}}$$

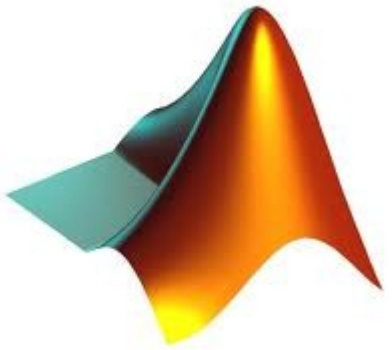
```
Gx = conv2(A,Sx,'same');

X = sqrt(Gx.^2 + Gy.^2);
```



Prahovanie

```
I = X >= 50;
```

```
I = X < 0.5;
```



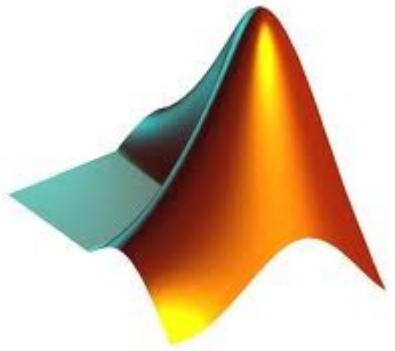
Prewitt filter, Roberts filter

- **Prewitt**

$$\mathbf{G_x} = \begin{bmatrix} -1 & 0 & +1 \\ -1 & 0 & +1 \\ -1 & 0 & +1 \end{bmatrix} * \mathbf{A} \quad \text{and} \quad \mathbf{G_y} = \begin{bmatrix} -1 & -1 & -1 \\ 0 & 0 & 0 \\ +1 & +1 & +1 \end{bmatrix} * \mathbf{A}$$

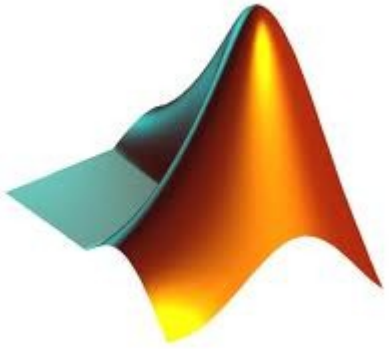
- **Roberts**

$$\begin{bmatrix} +1 & 0 \\ 0 & -1 \end{bmatrix} \quad \text{and} \quad \begin{bmatrix} 0 & +1 \\ -1 & 0 \end{bmatrix}$$



IPT Metódy hľadania hrán

- Sobel
- Canny (potlačenie šumu, 4 filtre, prahovanie pomocou hysterézy)
- Roberts
- Prewitt
- LoG (Laplacián Gaussiánu) = Zero crossing (Marrov–Hildrethovej algoritmus)



IPT Metódy hľadania hrán

```
edge(I);
edge(I, 'sobel')
edge(I, 'log', treshold)
edge(I, 'canny', treshold, sigma)
BW = edge(I,'zerocross',thresh,h)
```