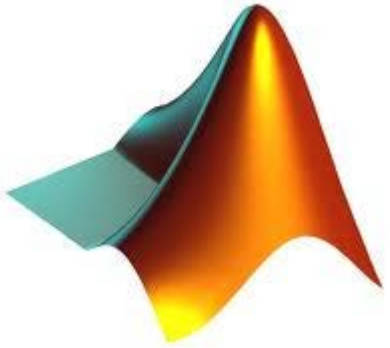
Spracovanie obrazu
Veľká domáca úloha 1

Cvičenia z Počítačového Videnia I.

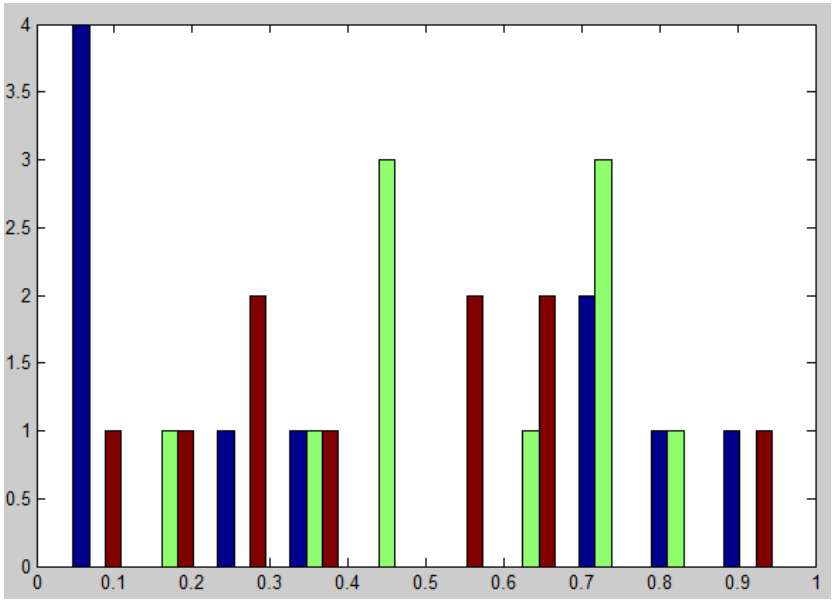
Spracovanie obrazu

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

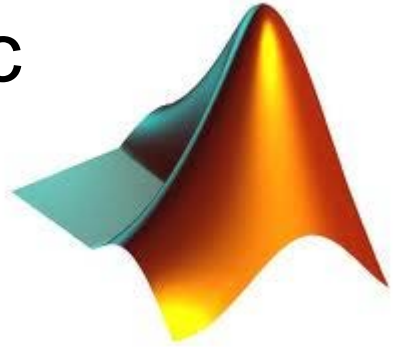


Histogram

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



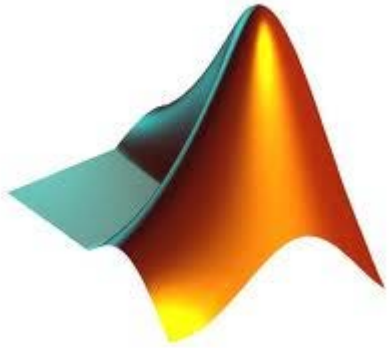
- nbins - počet tried histogramu
- pri N-D vráti histogram pre každý stĺpec spoločne v jednom grafe



Histogram

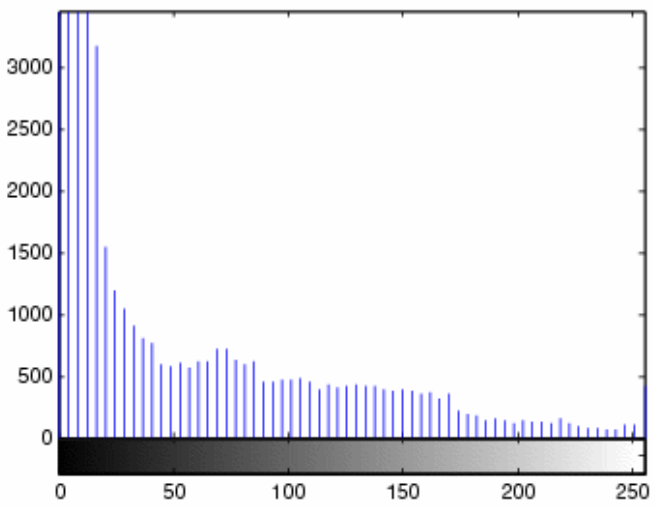
- I je obrázok, n počet tried histogramu

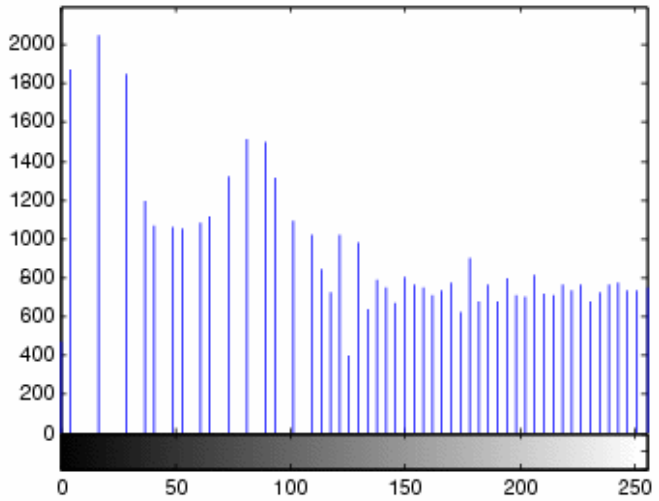
```
imhist(I);
imhist(I, n);
imhist(X, map)
```



Úprava histogramu

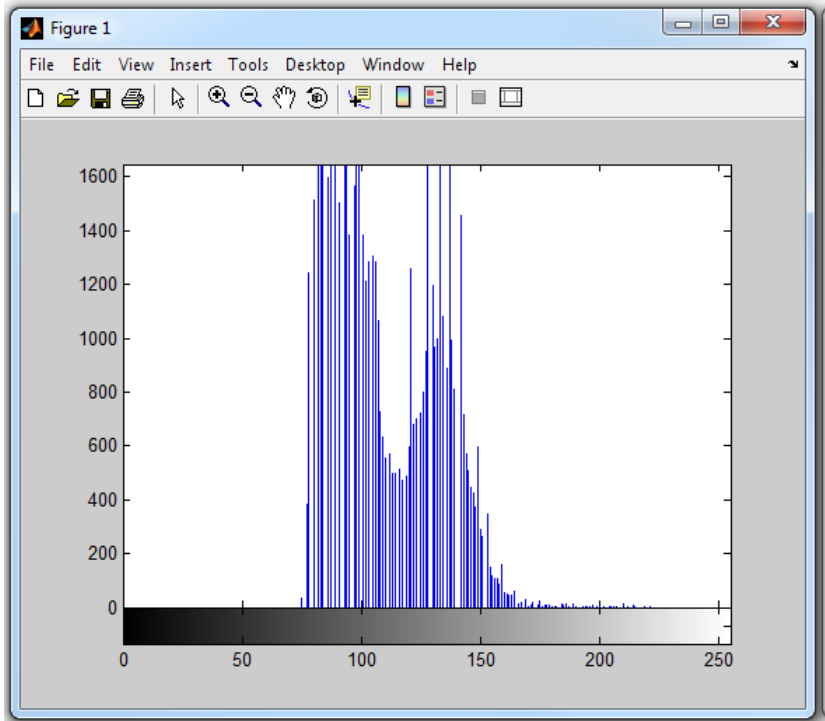
```
J = histeq(I, n)
```

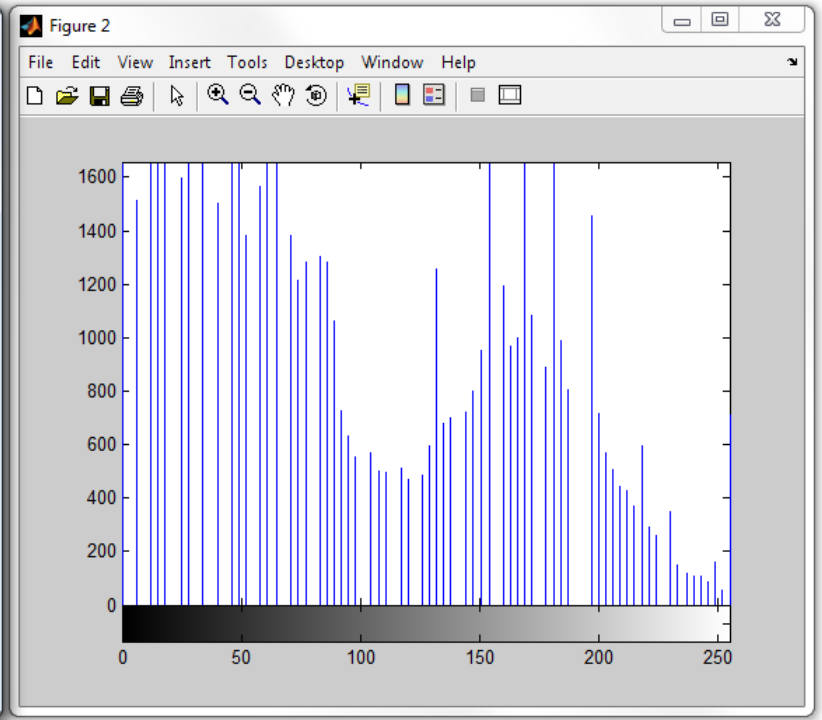


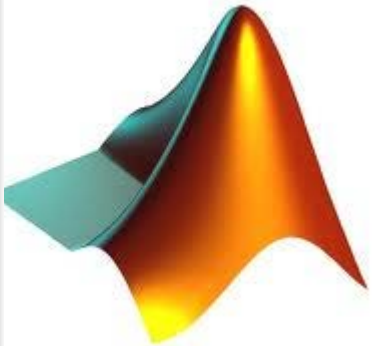



```
J = imadjust(I)
```

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

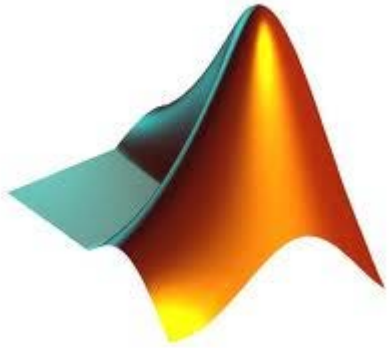






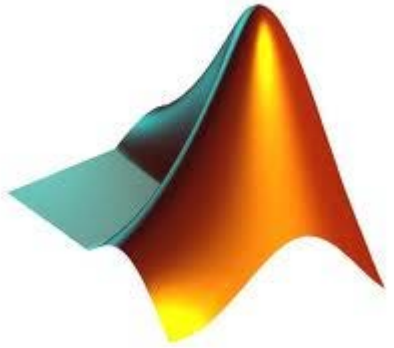
Úprava histogramu

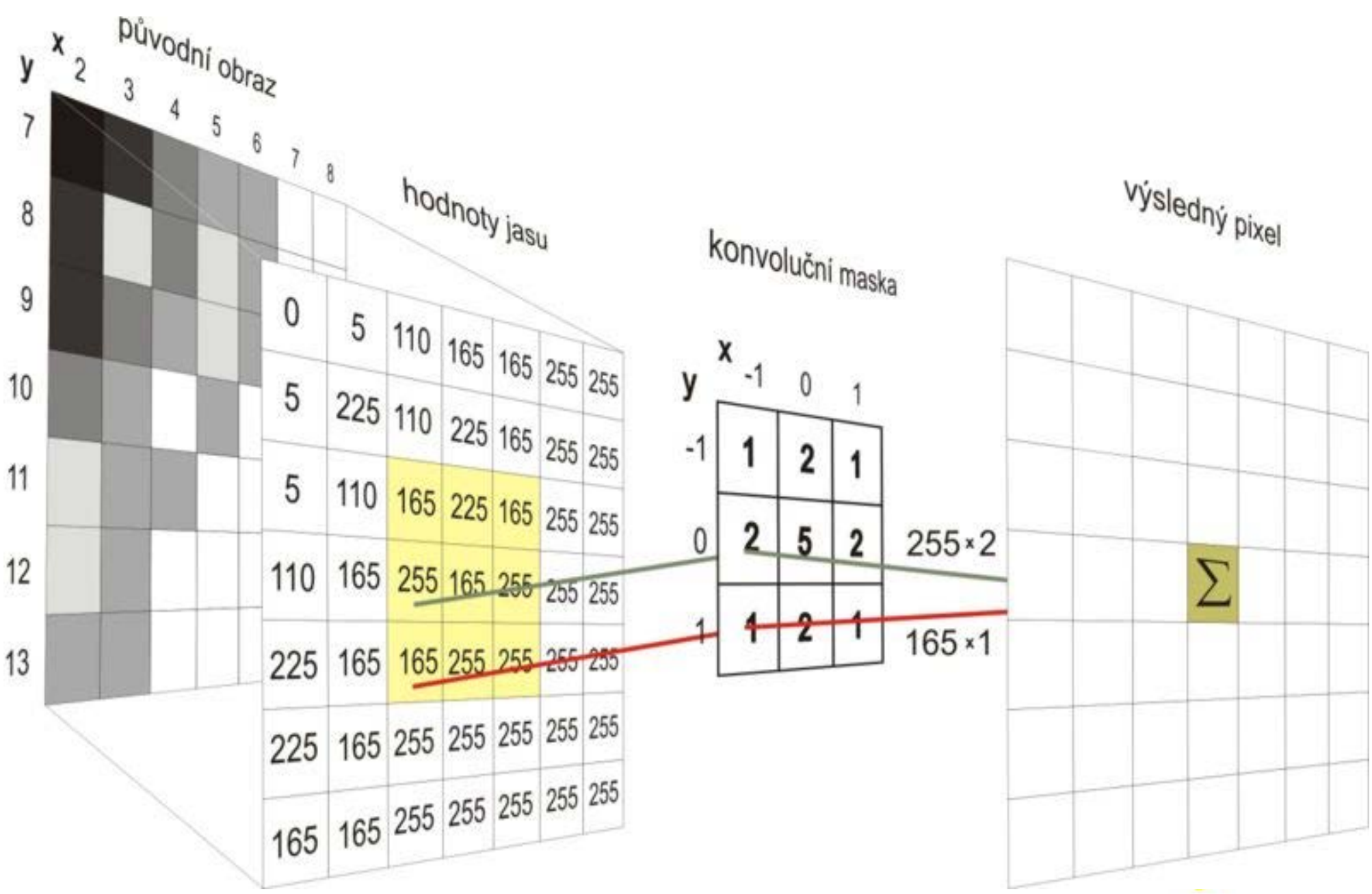
```
I = imread('pout.tif');
J = imadjust(I);
imshow(I), figure, imshow(J);
K = imadjust(I,[0.3 0.7],[]);
figure, imshow(K);
L = histeq(I);
figure, imshow(L);
```



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
0
1
1 2 1
2 5 2
1 2 1
255 × 2
165 × 1
Σ

- Konvolúcia

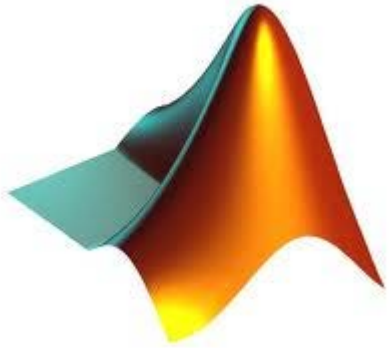
```
conv2(I,h,'same')

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

conv2(I,h,'valid')

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

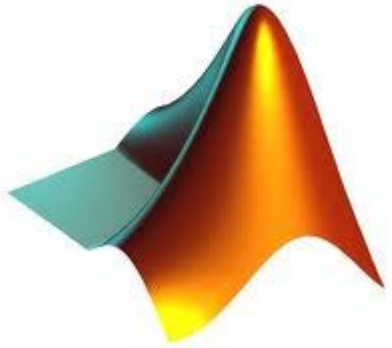
  – Otočí h o 180˚ a zavolá conv2



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

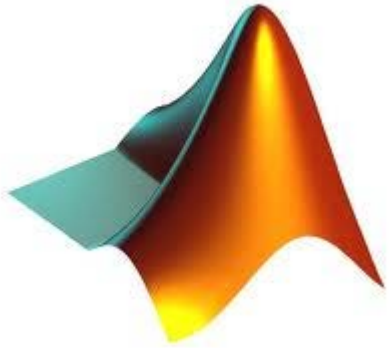
```
C =

   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('apple.jpg');
gr = rgb2gray(im);
h = ones(3)/9
c = conv2(gr,h, 'valid');
imshow(double(c)/max(c(:)));
```

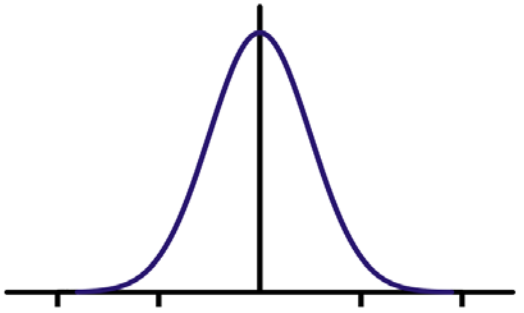


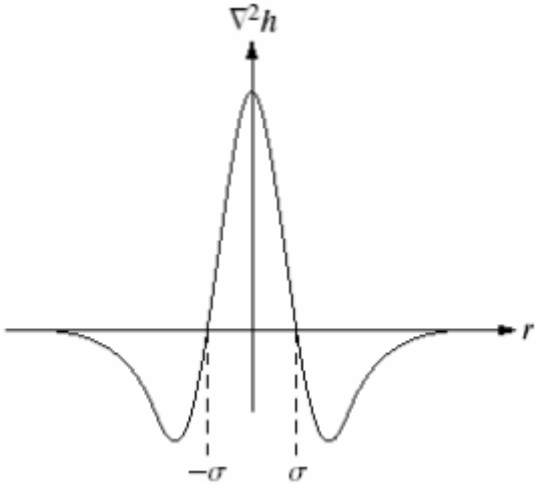
Typy filtrov

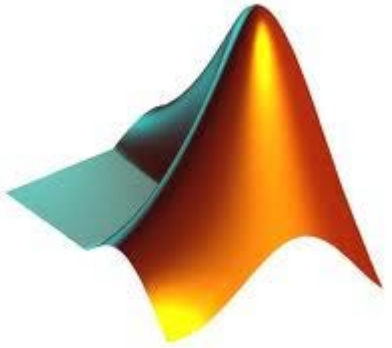
```
fspecial(typ, parametre)


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)
```







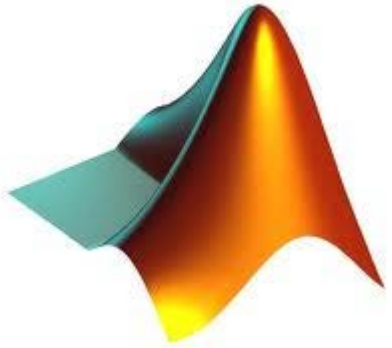
Priemer, Medián

- Priemer

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

- Medián

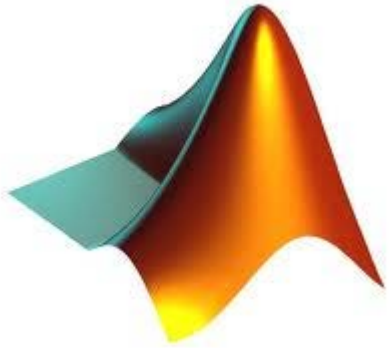
```
medfilt2(I,[3,3],'symmetric')
```



imfilter

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

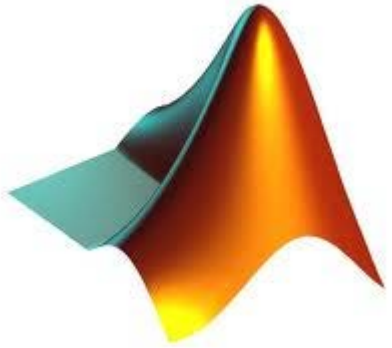
- X=0, 'symmetric', 'replicate', 'circular'
- 'same', 'full,
- 'corr', 'conv'



Šum

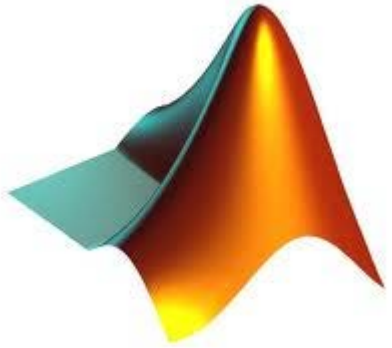
```
J = imnoise(I,type)
```

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



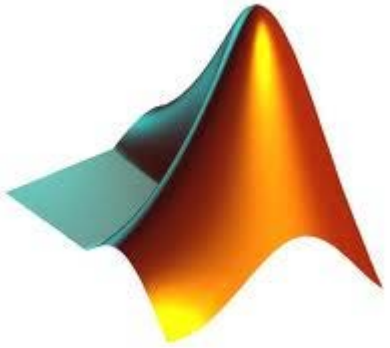
Adaptívne okolie

- `wiener2(I, [5,5])`
- Gaussovský šum



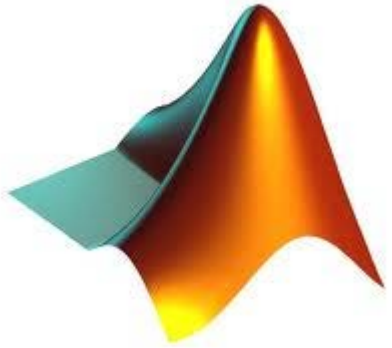
Prahovanie

```
I = X >= 50;
I = X < 0.5;
```



Hľadanie hrán, Diferenčné gradientné operátory

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



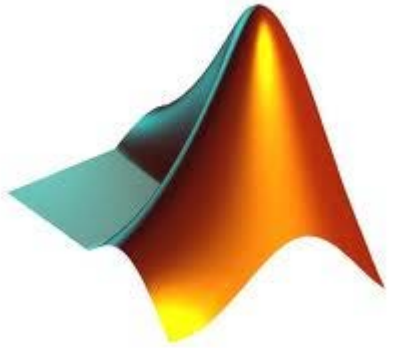
Sobel filter

- 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);
```



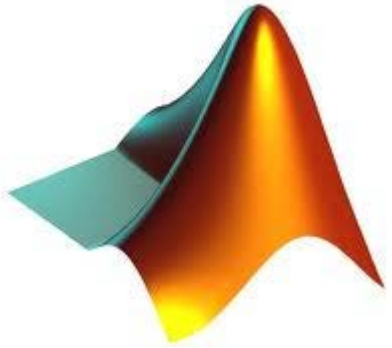
Prewitt filter, Roberts filter

- **Prewitt**

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

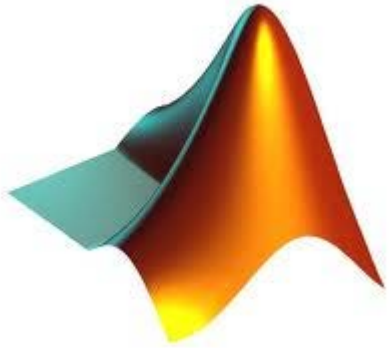
- **Roberts**

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



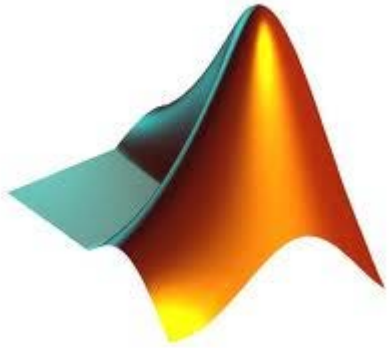
IPT Metódy hľadania hrán

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



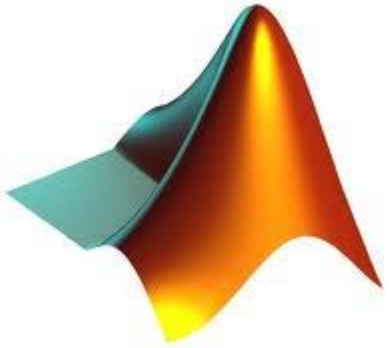
IPT Metódy hľadania hrán

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



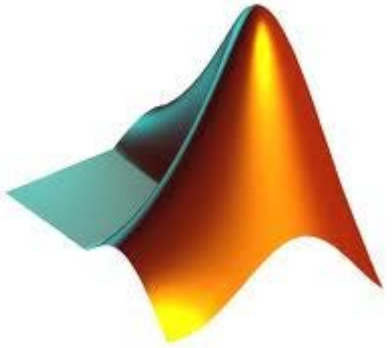
Veľká úloha 1

- Do 24.10.2014 23:59
- *priezvisko*_GUI.fig, *priezvisko*_ GUI.m
- Email: DUvidenie@gmail.com
- Subjekt správy: CV1 DU1



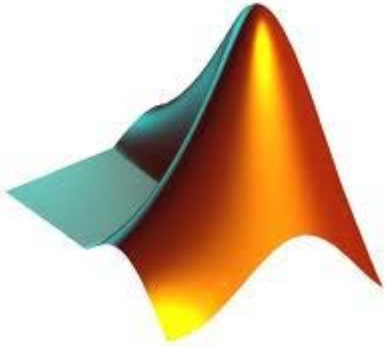
Musí spĺňať

- 2 vykresľovacie plochy (axes)
  - 1. Originál (farebný alebo šedoúrovňový)
  - 2. Výsledok aplikovanej metódy
- Načítanie obrázka z adresárovej štruktúry pomocou dialógového okna (menu)
- Konverzia na šedoúrovňový obrázok (menu alebo tlačítko)
- Možnosť pridania šumu (button group alebo popup menu)



Musí spĺňať

- 3 metódy na hľadanie hrán (menu, popup menu alebo button group)
  - bez použitia funkcie edge
  - možnosť výberu prahu (edit text alebo slider)
  - výsledok bude binárny obrázok
- 2 metódy vyhladenia obrázka (odstránenie šumu) (menu, popup menu alebo radiobutton)
  - zadanie veľkosti filtra (edit text, popup menu alebo radiobutton)
- po každej úprave zobraziť výsledok



Typy

- Vytvoriť prehľadné GUI
- Vytvoriť pomocné funkcie na detekciu hrán a vyhladenie obrázka, ktoré majú na vstupe obrázok, zvolenú metódu a nastavené parametre (veľkosť filtra, prah)