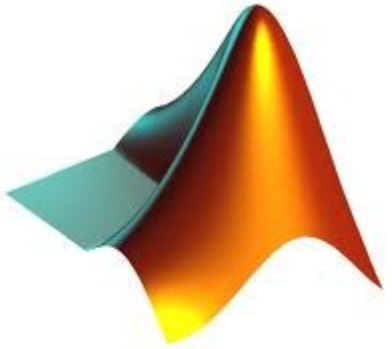
Spracovanie obrazu a GUI v MATLABe

Cvičenia z Počítačového Videnia

Zuzana Haladová

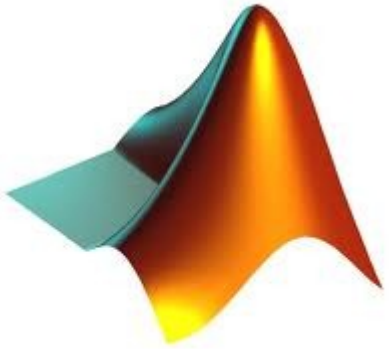
Spracovanie obrazu

- Vyhladzovanie
  - Mean, Median
- Prahovanie
- Detekcia hrán
  - Sobel, Roberts

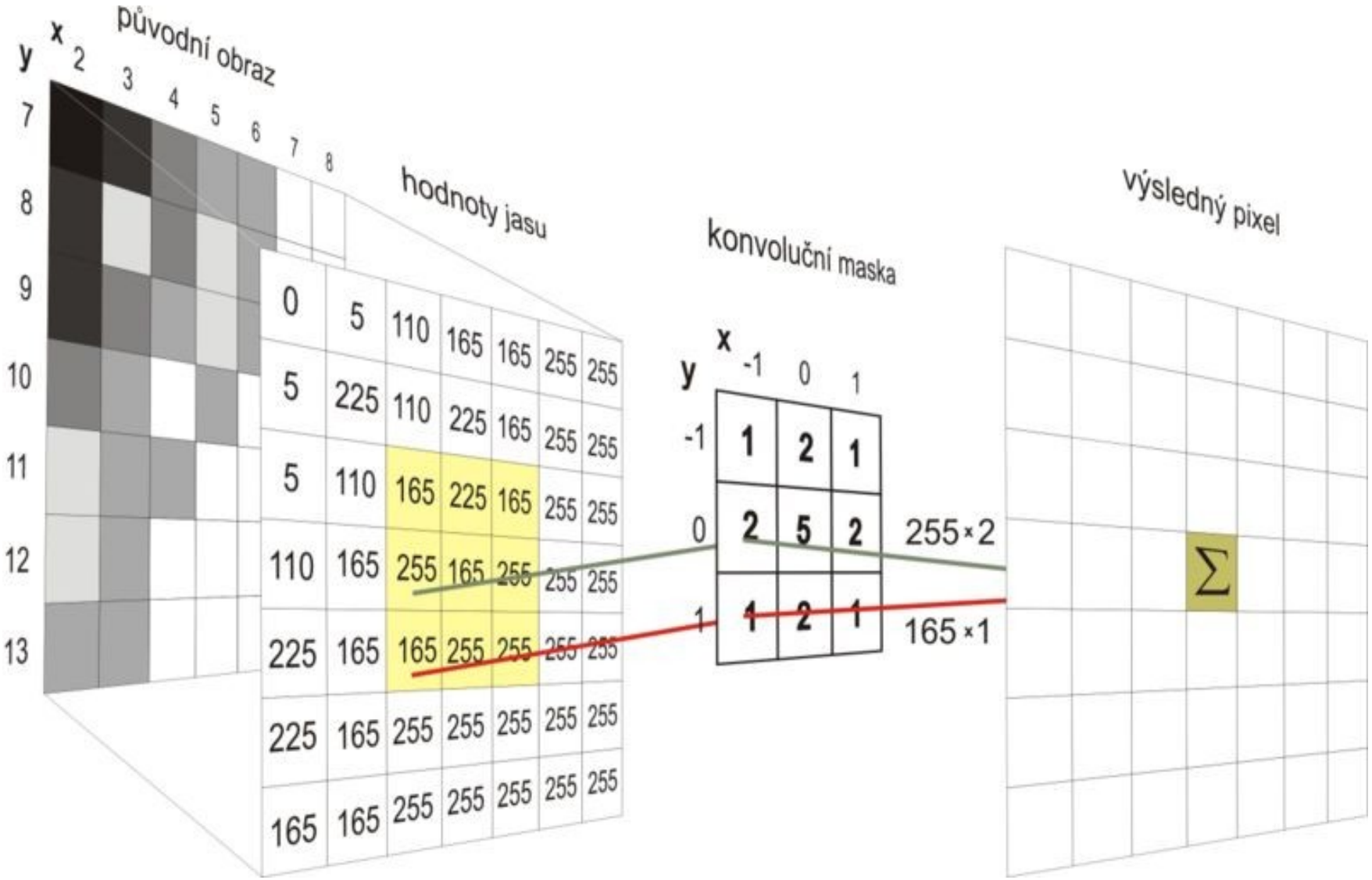


Spracovanie obrazu

- Konvolúcia a Korelácia 2D obrázku
  - Totožné pri symetrických filtroch
  - Korelacia: $$F \circ I(x,y) = \sum_{j=-N}^{N} \sum_{i=-N}^{N} F(i,j) I(x+i, y+j)$$
  - Konvolucia. $$F * I(x,y) = \sum_{j=-N}^{N} \sum_{i=-N}^{N} F(i,j) I(x-i, y-j)$$
  - Konvolucia je asociativna

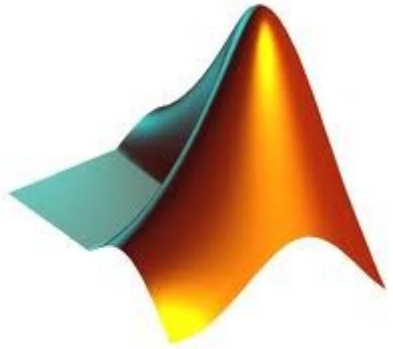


Spracovanie obrazu



Spracovanie obrazu

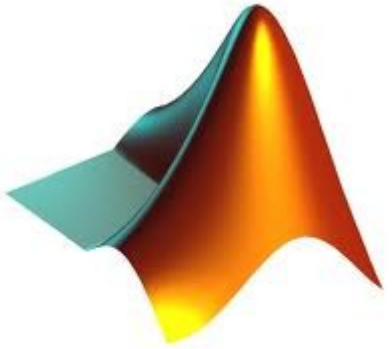
- Konvolúcia a Korelácia
  - conv2(I,h,'same')
  - conv2(I,h,'full') = conv2(h,I,'full')
  - conv2(I,h,'valid')
  - filter2(h,I, 'full') = conv2(h,I,'full') pre symetrické h
  - Otočí h o 180° a zavolá conv2



Spracovanie obrazu

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

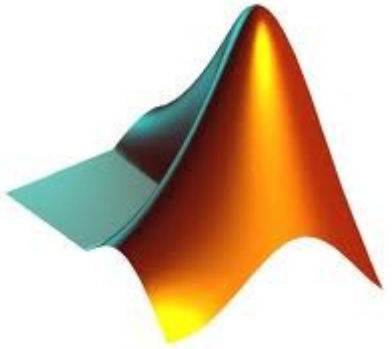
```
C =

   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
```



Spracovanie obrazu

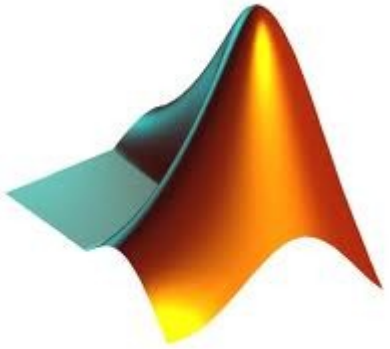
- Priemerovací filter
- a = [5 4 3 2 1; 1 2 3 4 5; 1 2 3 4 5;

  5 4 3 2 1; 1 2 4 5 3]
- h = ones(3)./9
- c = conv2(h,I, 'valid'); // konvolúcia
- c = filter2(h,I, 'valid')   //korelácia
- a(2:4,2:4)= c;



Spracovanie obrazu

- im=imread('1.jpg');
- gr = rgb2gray(im);
- h = ones(3)/9
- c = conv2(gr,h, 'valid');
- image(c);



Spracovanie obrazu

- fspecial(typ, parametre)

h = fspecial('average', hsize)

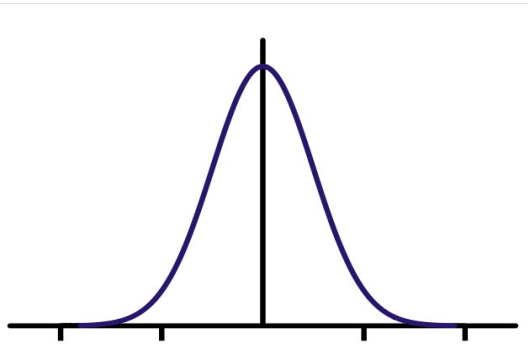
h = fspecial('disk', radius)

h = fspecial('gaussian', hsize, sigma)

Sigma- štandardná odchýlka

h = fspecial('log', hsize, sigma)

image(h*255)



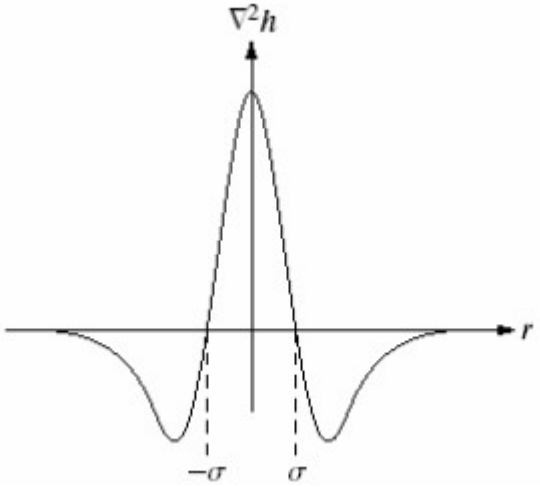


Image Processing Toolbox

- Mean
  - h = fspecial('average', 3)
  - imfilter(I,h);
- Median
  - medfilt2(I,[3,3],'symetric')

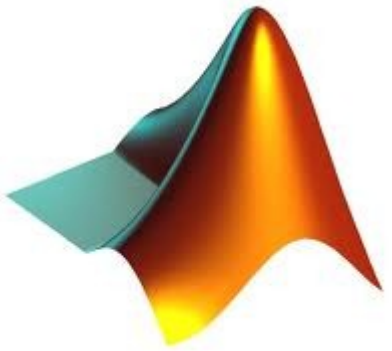


Image Processing Toolbox

Adaptívne okolie

- wiener2(I, [5,5])
- Gaussian noise

Adaptívne použitie filtra, lepšie výsledky ako pri lineárnych filtroch

Vyhladzuje viac pri nízkej variancii a menej pri vysokej

Adaptívne okolie- predná plocha/zadná plocha

Využitie pravidiel podobnosti

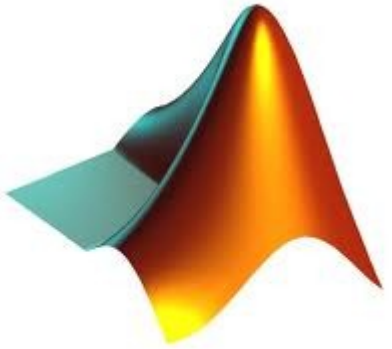
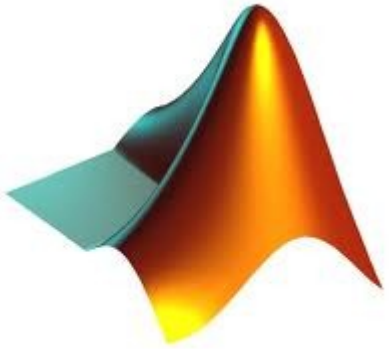


Image Processing Toolbox

- Šum

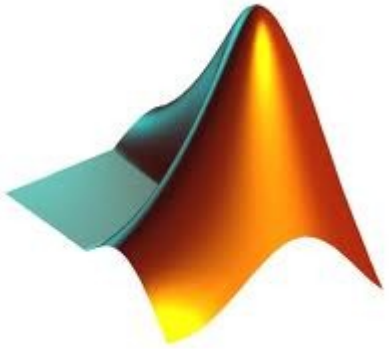
J = imnoise(I,type)

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



Spracovanie obrazu

- Prahovanie
- I = X >= 50;
- I = X < 0.5;



Spracovanie obrazu

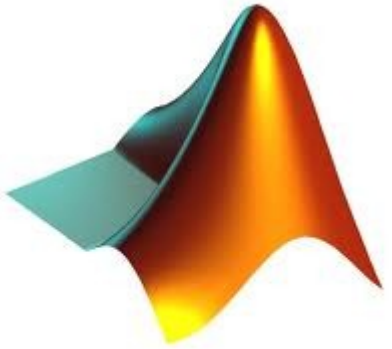
Hľadanie hrán, Diferenčné gradientné operátory

- Sobel filter
  - Obrázky Gx a Gy konvolúciou z

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

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

- Gx = conv2(GR,Sx,'same');
- X = sqrt(Gx.^2 + Gy.^2);



Spracovanie obrazu

- Hľadanie hrán
- Prewitt filter, Roberts

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

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

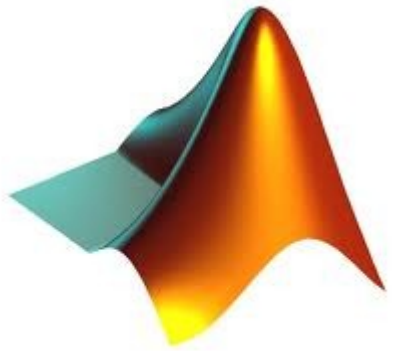


Image Processing Toolbox

- Methods
  - Sobel (Sobelova aproximácia derivácie)
  - Canny (Noise red., 4 filters, hister. thres)
  - Roberts (Robertsova aprox. derivácie)
  - Prewitt (Prewitt aprox. derivácie)
  - Log (Laplacian of Gaussian method)
  - Zero crossing

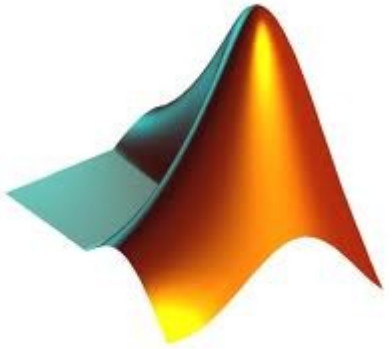


Image Processing Toolbox

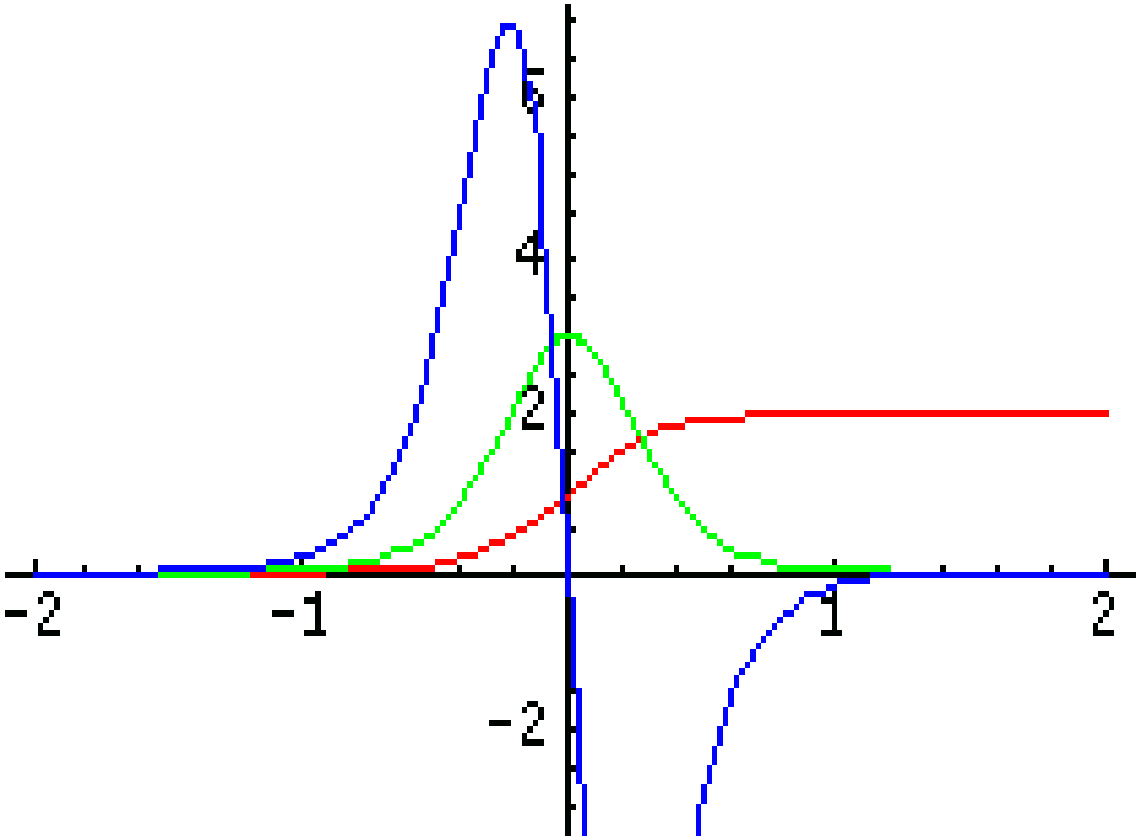


Image Processing Toolbox

- Edges
  - edge(I);
  - edge(I, 'sobel')
  - edge(I, 'log', treshold)
  - edge(I, 'canny', treshold, sigma)

BW = edge(I,'zerocross',thresh,h)

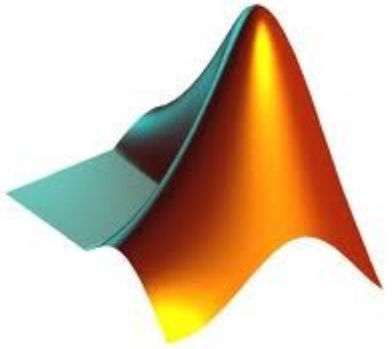
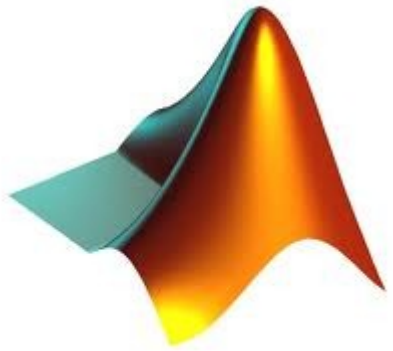


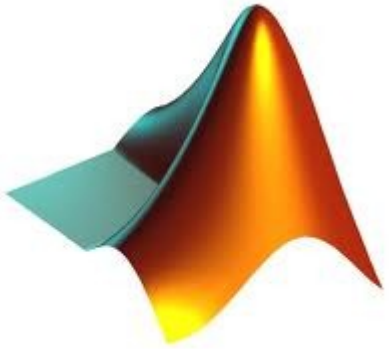
Image Processing Toolbox

- Edge detection
  - Demo
    - Toolbox
    - Image Processing
    - >>Edge detection



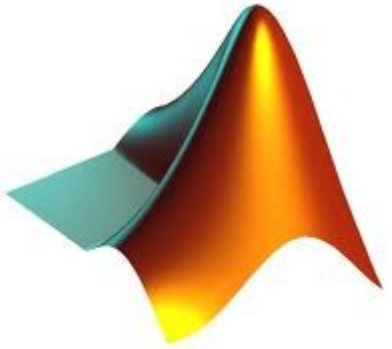
GUI

- >> guide
- Blank GUI
- Vytvorí dva súbory:
  - mojegui.fig
  - mojegui.m



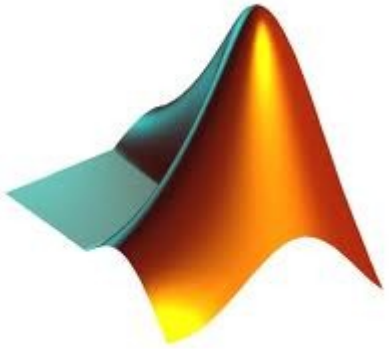
GUI

- GUI objekty:
  - Button, radio button, check box, slider
  - Edit text, Static text
  - Axes
  - Pop-up menu, list box
  - Panel, Button group...



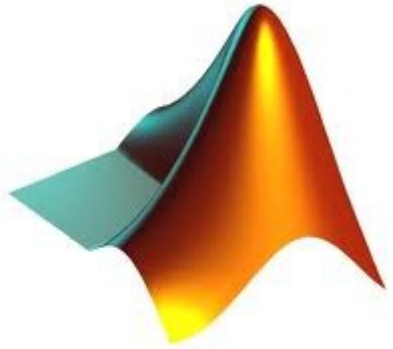
GUI

- Property Inspector
  - Color, text, name, position, opacity
- Handles
  - set(handles.text2,'Visible','on');
  - g = get(handles.radiobutton1, 'Value');



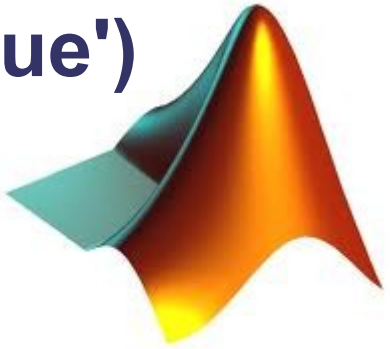
GUI

- Callbacks
  - Callback
  - ButtonDownFcn
  - KeyPressFcn
  - CreateFcn
  - ...



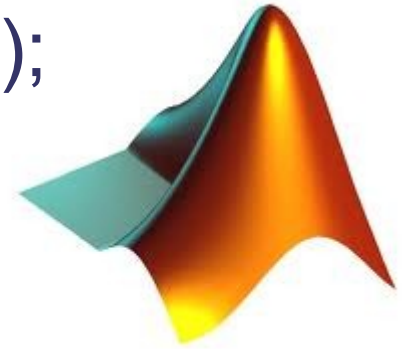
GUI

- Callbacks
  - Callbacks fungujú ako funkcie,
  - ak chceme využívať v jednom callbacku premennú ktorú sme vytvorili v inom, musíme použiť funkcie get a set
  - V get a set sa dajú okrem štandartných parametrov ako get(handles.edit1,**'Value')** využívať tzv. 'UserData'



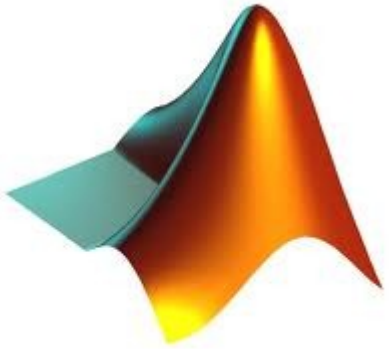
GUI

- UserData
  - môžme vložiť ľubovoľné dáta(obrázok, číslo)
- V jednom callbacku načítame
  - RGB = imread('1.jpg');
  - set(handles.pushbutton1,'UserData',RGB);
- V druhom zavoláme
  - I=get(handles.pushbutton1,'UserData');
  - imshow(I);



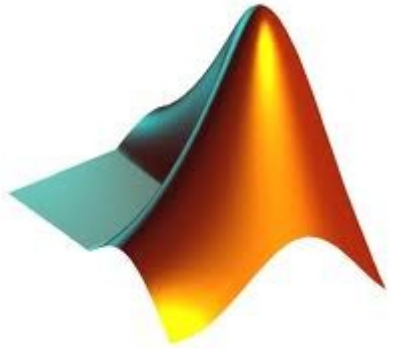
GUI

- Načítanie obrázku
  - **[FileName,PathName]=uigetfile('*.jpg','Vyber .jpg');**
  - **I = imread(fullfile(PathName, FileName));**
  - **figure; imshow(I);**
- Načítanie údajov
  - gg = get(handles.edit1,'Value')



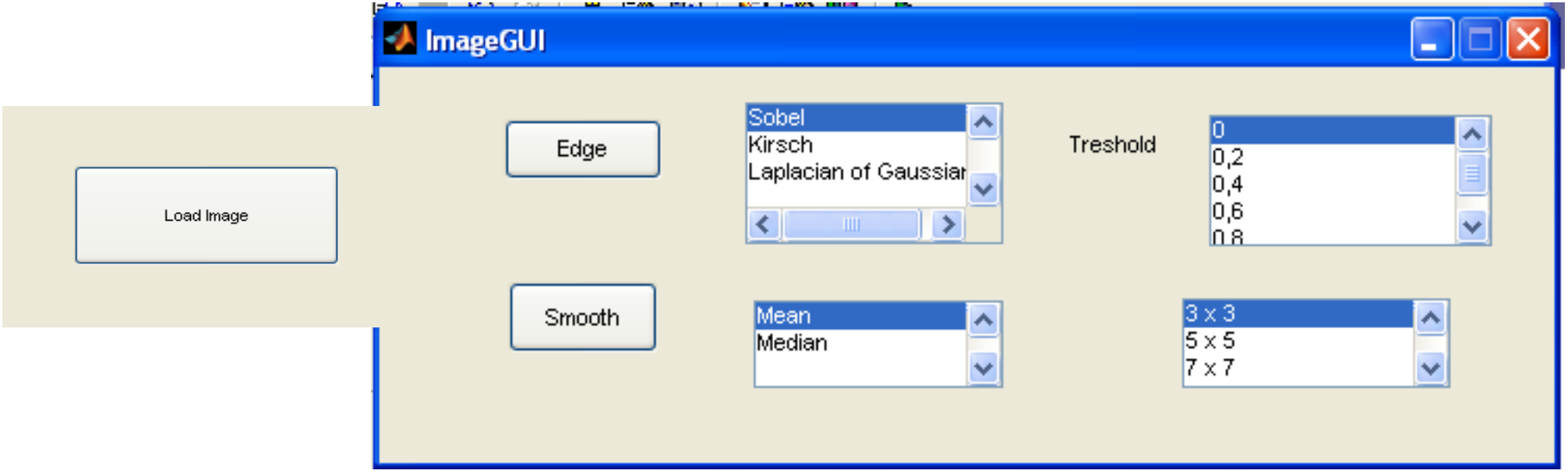
GUI

- ListBox
- Pridávanie Probert. Inspec./ String
- Max, Min počet vybraných položiek
- s = get(handles.listbox,'value'); (1,2,3)
- PopUp Menu
- Podobne ako ListBox



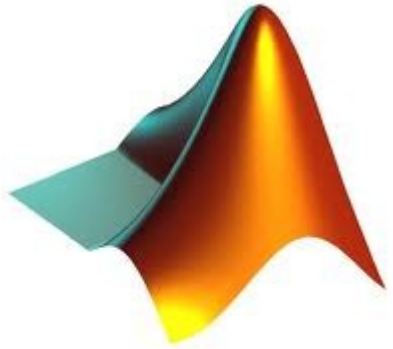
Úloha 2

- Do 17.10 23:59
  - ImageGUI.fig, ImageGUI.m
  - Email: DUvidenie@gmail.com
  - Subjekt spravy: CV1 DU1



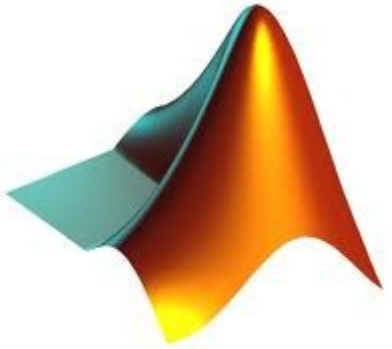
Úloha 2

- Musí spĺňať
- Načítanie obrázku z adresárovej štruktúry pomocou dialógového okna
- Konverzia na šedoúrovňový obrázok
- 3 metódy na hľadanie hrán, (bez použitia funkcie edge) možnosť výberu prahu (thresholdu) ==> binárny obrázok



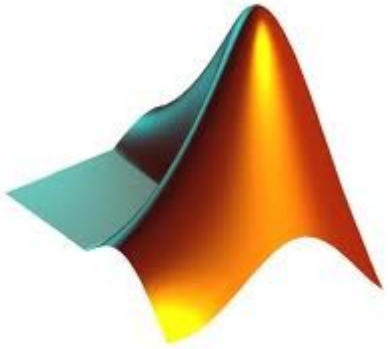
Úloha 2

- Musí spĺňať 2
- Možnosť výberu z aspoň 2 filtrov na vyhladenie (odstránenie šumu)
- + zadanie veľkosti filtra
- Po každej úprave by sa mal zobraziť výsledný obrázok



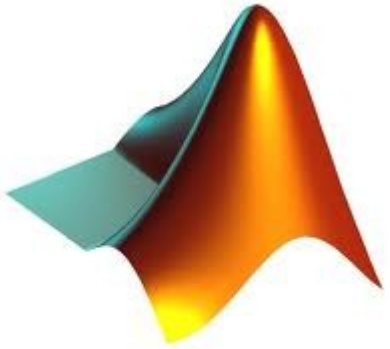
Úloha 2

- Typy
- Môžete si vytvoriť GUI aké chcete
- Namiesto ListBox ==> PopUpMenu, Edit, Slider...
- Kto urobí niečo naviac dostane bonusové body



Úloha 2

- Typy:
- Pomocné fcie hrana.m a smooth.m
- function X = hrana (I,method,treshold)
- function Y = vyhlad(I,method)
- Vykreslujte obrazky pomocou
  - figure; imshow();



Prednasky Vieden

18.10. 14:15-15:45

Toward Room-sized 3D Telepresence Systems

25.10. 14:15-15:45

Optimizing photo-consistency in image-based 3D and appearance modeling

http://www.qualcomm.com/about/research/locations/vienna