Computer Vision
2012/13

# Universidade da Beira Interior
## Departamento de Informática
## 2012/13

1. Consider the following function f(x,y)=x+y. This is an example of a linear system, meaning that is simoultaneoulsy homogeous and additive.

    a. Give an example of a function $R^2 \rightarrow R$ that is not homogenous.

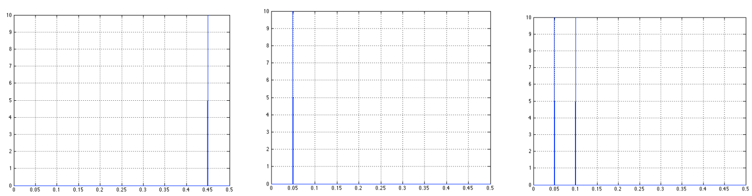
    b. Give an example of a function $R^2 \rightarrow R$ that is not additive.

2. Consider the following impulse response of a 1D signal in a system "f" (centered at index "0"): [0,0,-1,0,1,0,0].

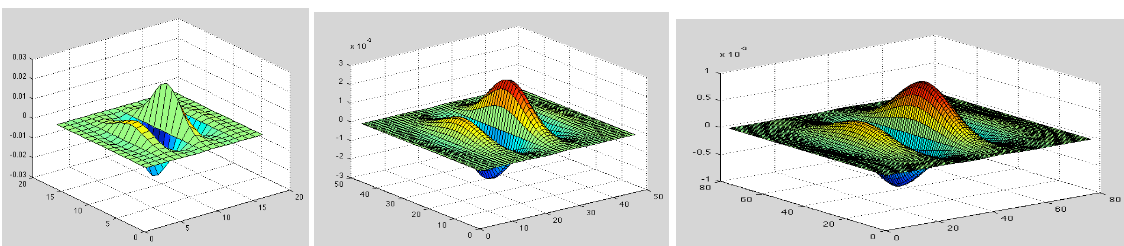
    a. Determine f([1 2 3 2 1 2 3 4 5])

3. Discuss the folowing sentence: "*in computer vision, there are some scenarious where the segmentation of an object is not strictly required for effectiveness purposes*".

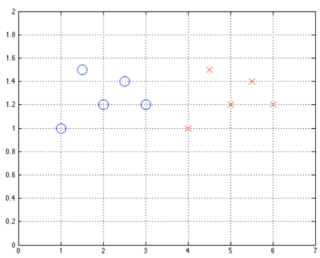
4. Analyze the following plots, regarding the magnitude of 1D Fourier transforms. For each one, draw a signal that might correspond to that Fourier transform.



5. In the scope of Gabor kernels, what the parameter varying in the examples below? If we convolve an image with these filters, what would be the major differences in the resulting images?



6. Based on the following data set, give examples of two linear combinations ($f(x,y)=\alpha_1 x + \alpha_2 y$). One of them should constitute a "bad" projection, for class discrimination. The other should constitute a good projection.

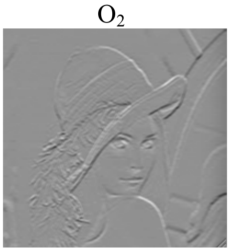


7. Consider the “Lena” image, widely used for image processing / computer vision experiments.

Each of the filters below was used to obtain a corresponding output image. Associate each filter to an output image.:

$O_1$

$O_2$



$O_3$

$O_4$

Filters :

$F_1$=[0 0 0
0 1 0
0 0 0];

$F_2$=[1 1 1
1 1 1
1 1 1];

$F_3$=[ 1 0 -1
1 0 -1
1 0 -1

$F_4$=[1 1 1
0 0 0;
-1 -1 -1];

8. Implement a MATLAB function that receives an image and a set of vectors (one vector per row of a matrix) and returns the total of these vectors that are eigenvectors of the image.

**Prototype:** total checkEigenVectors(img, vectors)

9. Consider the 4-neighborhood with the following codes: N=1, S=2, W=3, E=4. Draw a contour that is compatbile to the following chain code: [1,1,4,4,1,4,4,2,2,2,2,2,3,3,2,3,1].

10. Consider hat the image below is the accumulation map of the line Hough transform, with free parameters “m” (slope) and “b” (ordinate at the origin). Draw an image that might be the input of this accumulation map.