Intensive Computation

3rd march 2021

Objectives:

- 2D and 3D plots
- simple filters on images

Exercise 1

Write a script that:

- Creates a matrix A n x n of random values
- Visualizes the matrix A with command `imagesc` in the first subwindow of a grid 2x3
- Applies command `sort` to A and visualizes the resulting matrix A1 with command `imagesc` in the next sub-window
- Applies command `reshape` to A1 to obtain a matrix **AA** with 2 rows, and visualizes the resulting matrix AA with command `imagesc` in the next sub-window
- Repeat these 3 steps on B obtained as the transpose matrix of A
- Finally, **in a new window**, plot with different colors the 4 graphs obtained by using matrix AA and BB divided into two halves, and considering values in the first row of AA and BB as abscissas (reordered by command `sort)` and values in the second row as ordinates. Include the legend, the name of the axis and the name of the figure.

Exercise 2

- Use `meshgrid` to obtain the 3-D representation of the functions:
  $f(x,y) = x^6 + (ky)^6 * e^{(-x^2-(ky)^2)}$ where (x,y)∈[-2,2]x[-2,2] and the scale grid is equal to 0,1
- Visualize the graph in different sub-windows for different values of `k` by using instructions `mesh`, `surf`, `surfl` and `contour`. For example, create a grid of 4 rows, each for a different plot command, and 3 columns for 3 different values of k.
- Try the command `getframe` and `movie` to create an animated sequence when the value of k varies.
- Plot also $f(x,y) = \frac{\cos(2xy)}{(x^2+y^2)}$ where (x,y)∈[1,3]x[1,3] for different values of the grid scale.

Exercise 3

Write a function for each of the following filters:

- **GaussianFilter** – applied without considering the border using the kernel:

  1 2 1
  2 4 2
  1 2 1

- **MeanFilter** – mean filter with a kernel 5x5 applied without considering the border
- **HighPassFilter** - applied without considering the border using the kernel:

  -1 0 -1
  0 5 0
  -1 0 -1

Write a script that:

- load an image .tif and an image .jpg
- Divide the image in four parts and apply a different filter to each part (for the image .jpg apply the filter to each plane) leaving the fourth unaltered
- Plot on two sub-windows the original image and the filtered one.