Exercises on

“General Aspects of Vision”

Part I: Groundwork

1) Verify if the software is working:
   Enter virtual machine:
      Name of Virtual Machine: scikit
      Password: ensta01
   Is ipython/Jupyter installed?
   Is Scikits-learn installed?
   Is Scikits-image installed?
2) Choose one visual system from the following:
   A) Fish
   B) Autonomous car
   C) Domestic robot
   D) Airport surveillance.

From now on, you will work on analysis and modeling of such system.

Part II: The second order statistics of natural images

Hint: For this part I recommend that you start to work with a small database of 10 images and thereafter you run the code with the complete dataset. A script with the function that solves 2) is attached (free points!), it is called “imagesNormalization.py”. To run, you have to introduce the absolute path of the input directory (where the RGB images are stored) and the absolute path of output directory (where the gray images will be stored). The script that it will be used to evaluate your code is attached, the file name is “RUNME.py”. To run, you have to introduce the absolute path of the input directory (where the gray images are stored) and the absolute path of results directory (where the results will be stored). There is also a script, called “PSpy.py”, with headers and description of the functions that are called in RUNME.py. You should put your functions there. There are some functions already implemented, use them.

1) Download your database in your local directory
2) Convert the images into images of 256x256, grayscale, .png

Hint 1: you can use convert (a tool from imagick) or scikits.image or use the script imagesNormalization.py

3) Estimate the 2D power spectrum of samples of 64x64 pixels of this data

Hint 1: to download images into python you can use scipy.ndimage or scikits.image

Hint 2: make a function generates randomly the top left corner position of the sample in the image. You can use numpy.random. From the top left corner position and the sample size you can define the bounds of the sample and extract the sample from the image

Hint 3: make a function that calculates the power spectrum of an image sample. You can use numpy.fft

4) Estimate the radial power spectrum of samples of 64x64 pixels of this data

Hint 1: the function that gets the radial frequencies is already implemented. You just have to estimate the average power spectrum for each radial frequency

5) Repeat 3 considering only local statistics of the images. For that consider a grid of 3x3 that define 9 regions and repeat 3 on each region.

Hint 1: Figure 1 shows how to define the regions.

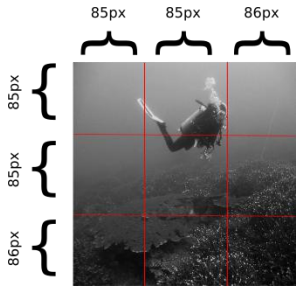

Figure 1: Example of grid 3x3 dividing the image into 9 regions

6) Compare with the position invariant approach.

Part III: The structure of a visual system

1) From the tasks below choose 3 that you think it is desirable on your visual system. Face recognition, motion detection, pedestrian detection, anomalies detection, predators detection, peers recognition, vehicles detection, indoor classification, multicamera integration, pose estimation, people counter, traffic sign recognition, depth estimation, road detection, other (specify which)

2) Choose the desirable hardware properties for the system to solve these tasks: (please note that visual systems should be energetically cheap, meaning, resources should be well distributed for the system tasks)

A. Number of cameras: 1, 2, many (how much?)
B. Resolution: low, medium, high, mixture (of what?)
C. Frame rate: low, medium, high
D. Field of view: small, medium, large
E. Color: Grayscale, RGB, infrared, ultraviolet, other (which?)
F. Dynamic range: low, medium, high
G. Cameras/Eyes: static/ moving

H. Other (which?)

3) Explain the choices on 2 in light of the tasks selections on 1).