Homework #2

One dimensional Gaussian is defined as

[1]
$$p(x) = \frac{1}{\sqrt{2\pi}\sigma} \exp\left[-\frac{(x-\mu)^2}{2\sigma^2}\right]$$

x is input, mean is μ and variance is σ^2.

1) You will implement 1D - Gaussian function.

- X values are range of $[-100, 100]$
- $step\ size = 1$
- Variance σ^2 is in different values which are $0.2, 1.0, and\ 5.0\,0$.
- Mean $\mu = 0$

You can use built-in exp function of Python.
Use plot function to see the results. Put them into your assignment report.

2) Use 3x3, 5x5, 7x7 Gaussian kernels given below. You will do normalization on filters dividing by the sum of coefficient. [2] Implement each kernel to the each given image in 'sample images1' directory in the zip file. Put the results into your assignment report.

[2]

- 3x3

```
[1 2 1]
[2 4 2]
[1 2 1]
```

- 5x5

```
[1 1 2 1 1]
[1 2 4 2 1]
[2 4 8 4 2]
[1 2 4 2 1]
[1 1 2 1 1]
```

- 7x7

```
[1 1 2 2 2 1 1]
[1 2 2 4 2 2 1]
[2 2 4 8 4 2 2]
[2 4 8 16 8 4 2]
[2 2 4 8 4 2 2]
[1 2 2 4 2 2 1]
[1 1 2 2 2 1 1]
```

3) Use Gaussian kernels given in question#2 as sharpening filter. According to lecture slides,

$$F + \alpha\,(F - \underbrace{F * H}_{\text{blurred image}})$$

↑ image

H will be Gaussian Kernel. Use different α values. Implement each filter to your own face image. Put the results into your assignment report.

4) In zip file, there are salt and pepper noise added images in 'sample images2' directory. Apply 3x3, 5x5 and 7x7 median filters to these images. Put the results into your assignment report.

IMPORTANT :
Besides image reading and writing and exponential (exp) functions, do not use any image processing function from Python and OpenCV.

All the operations have to be coded from scratch, i.e. filtering, sliding window scheme, etc.

You should comment your code, so that it can be easily understood.

Use Python/Ipython. Your code has to be in script file with .py/.ipynb extension.

You must explain what you implement in the report. You must show your output images in the related parts of the report. Please zip and upload all your files.

Cheating and plagiarism on assignments will be punished according to ITU regulation.

References:

[1]Alpaydin, Ethem. Introduction to machine learning. MIT press, 2010.

[2]http://users.polytech.unice.fr/~lingrand/Ens/up/Lesson6-noise.pdf