

General remarks

The data set that is used throughout this exercise sheet is found in the file “feature_gen_dataset1.csv” and can be downloaded from StudIP. To load that dataset in python use the following lines:

```
from numpy import genfromtxt
dataset1 = genfromtxt('feature_gen_dataset1.csv', delimiter=',')
```

Problem 1.1 (Filtering)

(10 P.)

Implement a low-pass filter (first order IIR, e.g., as presented in the lecture). Select different smoothing factors α between 0.0 and 1.0 and apply the filter to the second column of the data set.

- What do you notice?
- What value of α do you suggest to use in this data set? Why?

Give appropriate plots that show your findings.

Give at least one plot with a **horizontal axis unit of seconds** (the first column gives the timestamps in microseconds, remove the initial temporal offset).

Problem 1.2 (Statistic Features)

(10 P.)

Generate two new features that compute the standard deviation of a buffer of 50 (Feature 1) and 300 (Feature 2) samples of the fourth column of the data set.

Note: When you implement the features (with a “sliding window”) start generating the correct feature values after the first 50/300 samples. Before, you can generate an output of “0”, incorrect, or no values (as you prefer).

- What do you notice?
- Can you distinguish different phases in the data set?

Give appropriate plots that show your findings.

Problem 1.3 (FFT)

(10 P.)

Compute FFTs or DFTs (using a Python library) of the data in columns **two to four** of the data set (three separate spectra, one for each column).

- Describe what you see in the frequency spectrum (amplitude diagram only, you can ignore the phases) and give appropriate plots.
- Where** are differences? **Explain** common and differing parts?

Problem 1.4 (Image Features)

(10 P.)

Install the scikit-image package and run the Sobel demo script (see <http://scikit-image.org/>).

Load an image (group picture or anything else) and apply the Sobel filter to it.

- Hand in your original image and the Sobel filtered image.
- Explain** for what applications a Sobel filter is useful.

Problem 1.5 (Image Features)

(10 P.)

Run the scikit-image example for Gabor filter banks

(see http://scikit-image.org/docs/dev/auto_examples/plot_gabor.html).

Have a look at the demonstration script and understand what is done in each part.

- a) Change frequencies and orientations of the Gabor filters.
- b) Give **separate images** for your frequency and orientation changes (do not use the original values!) and **one complete image**.

On the hand-in date, **09.11.2016**, you must hand-in the following: ¹

- a) a text file stating how much time you (all together) used to complete this exercise sheet
- b) your solutions / answers / code

for problem **1.1** and **1.2** and **1.3** and **1.4** and **1.5**.

¹upload via StudIP (if there are problems with the upload contact me **beforehand**: krell@uni-bremen.de)