ANALYTICS FOR INDUSTRIAL INTERNET 2018

EXAM - 9 November 2018
Room 115A, Agora, 12.30 - 16.30, using own laptop

Solve 3 of the following 4 tasks. How to turn in the answers:

(i) Make a ZIP file, with the name `AII_2018_<YOUR_STUDENT_NUMBER>.zip`, add the following

    (a) A report in PDF format, where you explain you ansers in text, supported with pictures etc as needed

    (b) Supporting files (such as m-files, data files, results files)

(ii) 2. Upload the ZIP-file to `abacus.abo.fi/ro.nsf`

Task 1:
A snippet of Beach Boys is found in `users.abo.fi/jbjorkqv/beachboys.mat` , the sampling frequency is 8 kHz. The music player system available only support 48 kHz. Explain the process of producing a 48 kHz signal, make a matlab script that does the job, and verify the results by plotting the FFT (relevant parts) of both the 8kHz signal and the 48kHz signal. NOTE. This time, using inbuilt function `resample()` is not allowed. Save the 48 kHz signal and attach to your answer.

Task 2:
An 3-axis accelerometer was installed in an elevator to record the the movement of the elevator car, data is found in file `users.abo.fi/jbjorkqv/ElevAcc.mat`. Unfortunately, the accelerometer was installed misaligned, i.e. the axis of the accelerometer is not align with the axis of the elevator car. This can be verified e.g. by plotting the acceleration in X, Y and Z directions, the main elevator car acceleration profile is seen in all axis. However, now it is believed that PCA could easily solve the issue (the main movement of an elevator car is in one dimension - up/down (normally assigned to Z-axis). Show using PCA how you can estimate and compensate for the installation error. Give information on how the sensor element should be turned to correct for installation error. Describe the process, plot the realigned accelerometer readings.

Task 3:
The file `users.abo.fi/jbjorkqv/Vessel.mat` consists of measurements from Nov-21-2017 to Apr-09-2018 on radio measurements on a Vessel in the Turku archipelago, with the following columns:

```
1: Timestamp (posixtime)
2: Latitude (deg)
3: Longitude (deg)
4: Altitude (m)
5: Speed (m/s)
6: Height
7: Course over ground
8: RSSI (dBm) - Received Signal Strength Indicator (Radio system)
9: Relative humidity (%)
10: Barometric pressure (mbar)
11: Temperature (C)
12: Relative wind direction average
13: Relative wind direction maximum
```

```
14: Relative wind direction minimum
15: Relative wind speed average (m/s)
16: Relative wind speed maximum (m/s)
17: Relative wind speed minimum (m/s)
```

Make a histogram of the relative humidity and the temperature during the measurement campaign. Can you draw any conclusions / observations?

It is believed that there is a correlation between humidity and received signal strength (RSSI). Can we from the data see such correlation? Analyze the data and argue around and motivate your conclusion.

Task 4:

The following 2 pictures are linear combinations of original 2 pictures. Do your best to find the original two pictures. The source pictures are in `users.abo.fi/jbjorkqv/picmix1.png` and `users.abo.fi/jbjorkqv/picmix2.png`. Explain the logic and the process how you separate pictures. You might have help of functions `imread()`, `imwrite()`, and `reshape()`