

Exercise 4

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Part A

In this task the principal component analysis (PCA) is performed on some position data. The result is expected to represent characteristics of the data.

i)

The result is as expected, as seen in figure 1 the first principal component points in the direction of the longitude which has the largest variance.

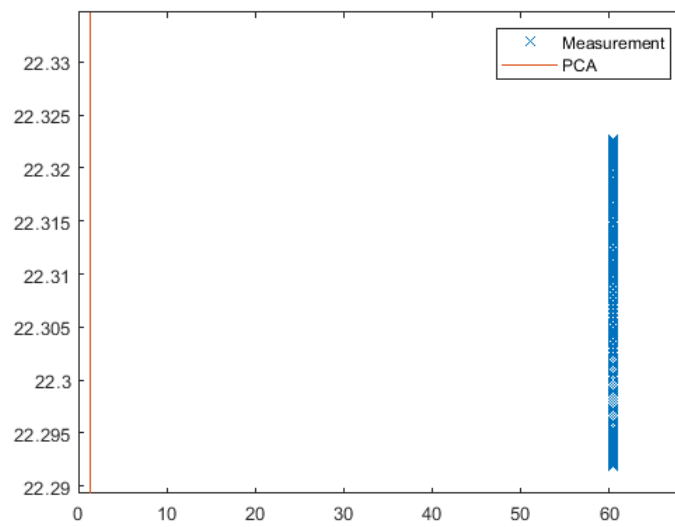


Figure 1: Plot of the first principal component of the latitude and longitude measurements. The PCA plot is scaled up 50 times to be more visible.

ii)

The result shows that the altitude component has the largest variance.

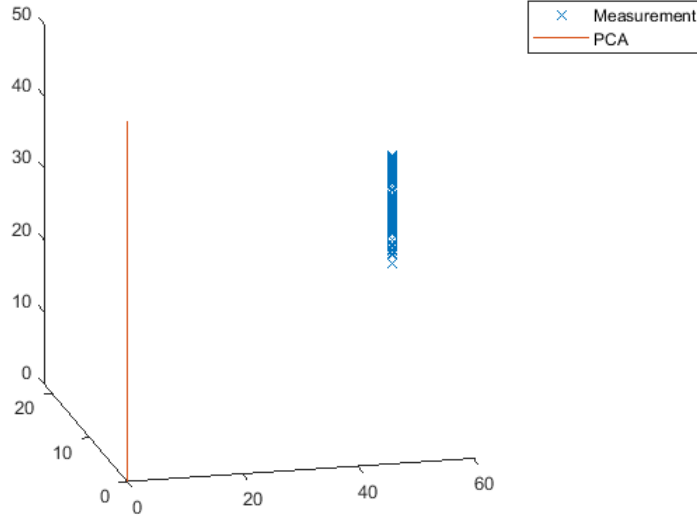


Figure 2: Plot of the first principal component of the latitude, longitude and altitude measurements. The PCA plot is scaled up 50 times to be more visible.

Part B

In this task the independent component analysis (ICA) is performed on some audio data. The result is expected to be individual sound signals separated from a messy combination of them.

i)

When comparing figure 3 and figure 4 it is clear that the components has been separated. This comes also clear when listening to the sounds signals.

The estimate of the mixing matrix A is
$$\begin{bmatrix} -0.0612 & -0.2233 \\ -0.1693 & -0.1296 \end{bmatrix}$$

ii)

As seen in figure 5 the noise is quite heavy when comparing the mixed signals and the original. The result is satisfactory when listening to the separated component, even though the graph representation still contains noise.

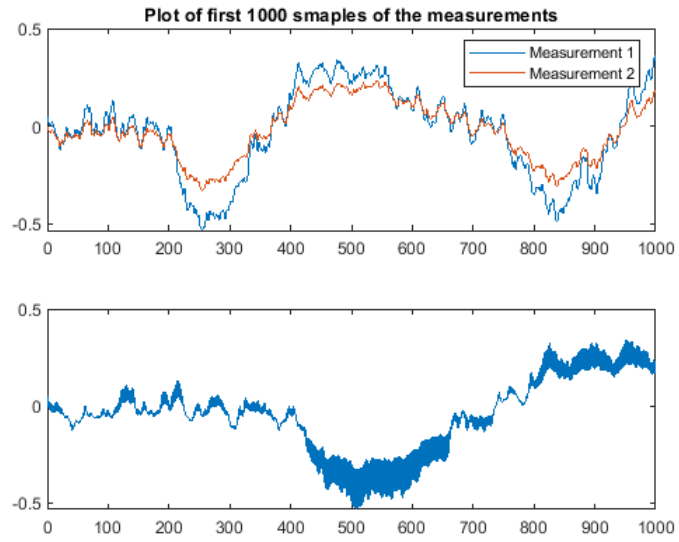


Figure 3: Plot of the measurements

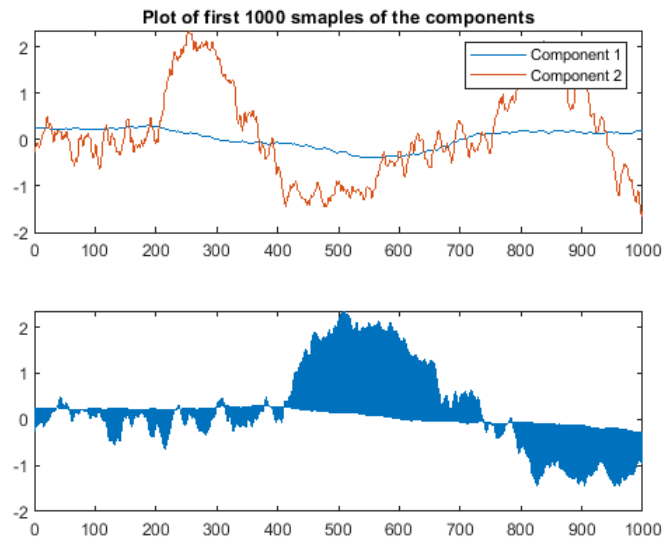


Figure 4: Plot of the components

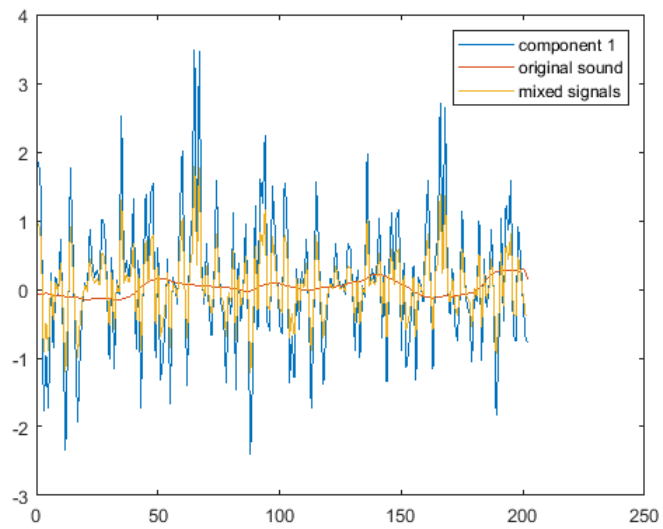


Figure 5: Plot of the relevant signals. The original signal was upsampled by a factor of 2 to fit the graph.