Suppose that you are listing to your favorite Beethoven piece in a noisy New York street. Can we separate the traffic noise from the music?

Since one does not know exactly neither the music nor the road noise, we will have two microphones that capture different combinations of both sounds. The goal of the project is to separate the music from the road noise using independent component analysis.

In the course website you can find two wave files instantaneously mixed from the two microphones, and the goal of the project is to separate the two signals as well as possible.

I would like you to use two algorithms and compare their performance. Please implement Bell and Sejnowski algorithm (infomax) and the minimization of Renyi’s mutual information (MRMI).

The success of the demixing will be established by computing

\[ SDR = -10 \log_{10} \left[ \frac{1}{M(M-1)} \sum_{i=1}^{M} \left( \frac{\sum_{j=1}^{M} |B_{ij}|}{\max_{j} |B_{ij}|} - 1 \right) \right], \]

With B=WA where W is the demixing weights and A the source mixing matrix (that in principle you do not have, but for this calculation use \[ \begin{bmatrix} -0.4326 & 0.1253 \\ -1.6656 & 0.2877 \end{bmatrix} \]). Please provide the wave files with the demixed signal and your estimation of the demixing matrix.

The parameters in your algorithm are the learning rates and the input data file length. Please use for training the demixer windows of size 10,000, 1,000 and 100 samples. Show the performance as a function of these window sizes. You should also attempt to do the demixing on-line and in batch mode (the algorithm may have to go several times over the window of data to seek the optimal solution).