5.3 Further preprocessing

The success of ICA for a given data set may depende crucially on performing some application-dependent preprocessing steps. For example, if the data consists of time-signals, some band-pass filtering may be very useful. Note that if we filter linearly the observed signals $x_i(t)$ to obtain new signals, say $x_i^*(t)$, the ICA model still holds for $\mathbf{x}_i^*(t)$, with the same mixing matrix.

This can be seen as follows. Denote by $\mathbf{X}$ the matrix that contains the observations $\mathbf{x}(1), ..., \mathbf{x}(T)$ as its columns, and similarly for $\mathbf{S}$. Then the ICA model can be expressed as:

$$\mathbf{X} = \mathbf{AS} \tag{38}$$

Now, time filtering of $\mathbf{X}$ corresponds to multiplying $\mathbf{X}$ *from the right* by a matrix, let us call it $\mathbf{M}$. This gives

$$\mathbf{X}^* = \mathbf{XM} = \mathbf{ASM} = \mathbf{AS}^*, \tag{39}$$

which shows that the ICA model remains still valid.