Helsinki University of Technology
Lab of Computer and Information Science

Tik-61.184 Special Course in Information Technology
autumn 2000

Exercises, Session 4

1. Discuss the validity of the instantaneous mixing model when considering EEG data. Discuss how appropriate the instantaneous mixing model is for the case of electrocardiogram (ECG) output.

2. If the strict assumptions of the standard linear ICA model hold outline a procedure for estimating the number of sources which form the observed mixture

3. Consider the following linear model $\mathbf{x} = \mathbf{A}\mathbf{s} + \boldsymbol{\epsilon}$ where $\mathbf{s}$ satisfies the ICA assumptions and $\boldsymbol{\epsilon}$ is independent zero-mean noise with full covariance $\boldsymbol{\Sigma}$. After applying a transform $\mathbf{y} = \mathbf{W}\mathbf{x}$ to the observation show that $E\{\mathbf{y}\mathbf{y}^T\} = \mathbf{W}[\mathbf{A}\mathbf{A}^T + \boldsymbol{\Sigma}]\mathbf{W}^T$. From this make some statements about the effect of additive noise on the ICA signal model if a pre-whitening transform is performed.

4. For the linear model described in (3) outline a method for estimating the dimensionality of $\mathbf{s}$.