Helsinki University of Technology
Lab of Computer and Information Science

Tik-61.184 Special Course in Information Technology
autumn 2000

Exercises, session 9

1. Assume that the random vector $\mathbf{x} = (x_1, x_2, ..., x_n)$ has a joint zero-mean gaussian density:

$$p(\mathbf{x}) = \frac{1}{(2\pi)^{n/2}|\mathbf{C}|^{1/2}} \exp(-\frac{1}{2}\mathbf{x}^T\mathbf{C}^{-1}\mathbf{x}) \tag{1}$$

   where $\mathbf{C}$ is the covariance matrix.
   a) Compute the entropy of $\mathbf{x}$.
   b) Compute the mutual information of (the components of) $\mathbf{x}$.

2. Apply the preceding to prove Eq. (2.1) in the Becker-Hinton paper. (First, formulate the exact relationship between d_a and d_b as noise-corrupted versions of the underlying signal which we denote by s. Because all the variables are gaussian, the mutual information can be expressed as a function of the covariance matrices as in the preceding exercise, so the point is to compute these matrices.)