Title:
Bayesian Blind Deconvolution

Abstract:
Deconvolution consists in estimating the input of a linear and invariant system from its output knowing its Impulse Response Function (IRF). When the IRF of the system is unknown, we are face to Blind Deconvolution. This inverse problem is ill-posed and needs prior information to obtain a satisfactory solution. Regularization theory, well known for simple deconvolution, is no more enough to obtain a satisfactory solution.

Bayesian inference approach with appropriate priors on the unknown input as well as on the IRF has been used successfully, in particular with a Gaussian prior on the IRF and a sparsity enforcing prior on the input. Joint Maximum A posteriori (JMAP), Expectation-Maximization (EM) algorithm for marginalized MAP and Variational Bayesian Approximation (VBA) are the methods which have been considered recently with some advantages for the last one. In this talk, first I review these methods and give some original insights by comparing them, in particular for their respective properties, advantages and drawbacks and their computational complexity. Then, I propose to use a Student-t prior law for the unknown input which has the property of sparsity enforcing and which gives the possibility to give a hierarchical graphical structure for the generating model of the observations. Finally, I present detailed algorithms of JMAP, EM and VBA for the joint estimation of the input, the IRF and the hidden variables of the infinite Gaussian mixture model of the Student-t probability law.
At the end, I will show some applications in geophysical signal processing as well as in hyperspectral image processing.