

Bayesian Models for Principal Curves and Manifolds

Ludger Evers

University of Glasgow, Glasgow, UK, ludger@stats.gla.ac.uk

This talk is concerned with Bayesian models for principal curves and manifolds. So far, almost all methods proposed for computing principal curves and manifolds are based on largely heuristic algorithms. Whilst these algorithms are usually very fast and efficient, it is very difficult to ascertain the uncertainty of their results. Yet, in many real world examples, there is more than one plausible principal curve. Based on Tibshirani's probabilistic model and algorithm for principal curves, Bayesian models for principal curves (and manifolds) are presented, starting with a simple polygonal line model, which due to its simplicity allows for integrating out the projection indices in closed form. More sophisticated models based on Gaussian processes and mixtures will be presented. However in these models the projection indices cannot be integrated out in closed form, resulting in bulky MCMC algorithms. Finally an approximation to the aforementioned model is presented. It is based on a mixture of directionally aligned distributions and allows for faster MCMC algorithms.