Dr Sarah Heaps, School of Mathematics, Statistics and Physics, Newcastle University, UK

Title: Enforcing stationarity through the prior in vector autoregressions

Abstract:

Stationarity is a very common assumption in time series analysis. A vector autoregressive process is stationary if and only if the roots of its characteristic equation lie outside the unit circle, constraining the autoregressive coefficient matrices to lie in the stationary region. However, the stationary region has a highly complex geometry which impedes specification of a prior distribution. In this work, an unconstrained reparameterization of a stationary vector autoregression is presented. The new parameters are partial autocorrelation matrices, which are interpretable, and can be transformed bijectively to the space of unconstrained square matrices through a simple mapping of their singular values. This transformation preserves various structural forms of the partial autocorrelation matrices and readily facilitates specification of a prior. Properties of this prior are described along with an important special case which is exchangeable with respect to the order of the elements in the observation vector. Posterior inference and computation are described and implemented using Hamiltonian Monte Carlo via Stan. The prior and inferential procedures are illustrated with an application to a macroeconomic time series which highlights the benefits of enforcing stationarity and encouraging shrinkage towards a sensible parametric structure.