Final Report On REP Research Project

Project title: Specification of Prior Distributions in Bayes Variable Selection
Principle investigator: Wen Cui
Department affiliation: Department of CIS and QMST

1. Abstract of findings:

In-depth investigation of the impact of various choices of hyperpriors on Fully Bayes (FB) variable selection procedures was done. For hyper parameter C, the priors studied were incomplete inverse gamma (IIG), a modified Jefferys prior (MJP), RIC point mass prior and two modified RIC point mass priors, linear RIC and exponential RIC. For hyper parameter ω, uniform prior was adopted. For each of the hyper prior chosen, close-form posteriors and FB selection criteria were developed, and intensive simulations were done to compare the performance among these FB criteria.

The simulation results revealed that

i) When the number of variables considered is relatively small, say 20 ~ 100, IIG prior and exponential RIC outperformed other FB criteria. And IIG usually does better than exponential RIC for parsimonious models while exponential RIC usually achieve better performance than IIG for saturated models.

ii) When the number of variables considered is large, say 500 ~ 1000, exponential RIC provides best performance over broad range of model space. The behavior of IIG is very close to RIC, although its performance is not as good as that of exponential RIC.

iii) Regardless the number of variables considered, MJP usually does well when the true model is saturated, but can be worst when the true model is parsimonious.

iv) RIC and linear RIC usually favor smaller models over larger models due to much shrinkage they put on the model coefficients, $\boldsymbol{\beta}$.

2. Presentation:

"Choices of Priors and Predictive Performance of Bayes Variable Selection Procedures", *2004 Joint Statistical Meetings,* August 9, 2004, Toronto, Canada.

3. Paper in progress:

A paper based on these results and with expansion and modification is in progress.