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Comments on Article by Celeux et al.

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I would like to congratulate the authors for developing a major extension of the deviance information criterion (DIC) introduced by Spiegelhalter et al. (2002) in the setting of missing data models. Recently, DIC is becoming increasingly popular for model assessment and model comparison. One of the main reasons for this is that DIC is well defined under improper priors as long as the resulting posteriors are proper and it is generally easy to compute.

Missing data models are routinely encountered in practice. There are several challenges posed by missing data. First, it is very difficult to reconstruct missing data. In most cases, the lost information due to missing data is not easy to recover. Second, it is more challenging to develop a measure of model complexity, which is a key issue in developing a model comparison criterion. Computation is another obstacle in dealing with such models. I am glad to see that the authors tackle this difficult problem and propose several natural extensions of DIC for these models.

Other Bayesian criterion based tools for model assessment and model comparison are available but not mentioned in the article. The Conditional Predictive Ordinate (CPO) statistic has been widely used in the statistical literature under various contexts. A detailed discussion of the CPO statistic and its applications to model assessment can be found in Geisser (1993), Gelfand and Dey (1994), and Gelfand et al. (1992). As shown in Gelfand and Dey (1994), asymptotically the CPO statistic has a similar dimensional penalty as AIC. In this perspective, the CPO statistic may be similar to DIC. The L measure criterion is another useful tool for model comparison. The L measure is constructed from the posterior predictive distribution of the data, and can be written as a sum of two components, one involving the means of the posterior predictive distribution and the other involving the variances. The L measure was introduced by Ibrahim and Laud (1994) for normal linear models and Gelfand and Ghosh (1998) for generalized linear models. The theoretical properties were examined in detail by Ibrahim et al. (2001). Chen et al. (2004) proposed the weighted L measure, which is a natural extension of the L measure. Both the CPO statistic and the L measures are well defined under improper priors. Thus, these criteria are similar to the DIC in this sense.

To examine performance of various DICs, I consider a small simulation study using a binary regression model with probit link. Suppose y_i takes values 0 or 1 with probability

$$p_i = P(y_i = 1|\beta, x_i) = \Phi(\beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \beta_3 x_{i3} + \beta_4 x_{i4}), \tag{1}$$

where Φ is the standard normal cumulative distribution function, $x_i = (1, x_{i1}, \ldots, x_{i4})'$ is a 5×1 vector of covariates, which includes an intercept, and $\beta = (\beta_0, \beta_1, \ldots, \beta_4)$. The

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