Lesson 7 Part B

Quiz, 6 questions

6/6 points (100%)

Congratulations! You passed!

Next Item

1 / 1 points

1.
What is the primary interpretation of the penalty term in the deviance information criterion (DIC)?

- It estimates the optimal number of predictor variables (covariates) to include in the model.
- It gives an estimate of how much your mean squared error would increase for each additional parameter estimated.
- It penalizes overly simple models.
- It gives an effective number of parameters estimated in the model.

Correct
It penalizes overly complicated models which fit this particular data set well, but may fail to generalize. This penalty will be particularly useful for hierarchical models.

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1 / 1 points

2.
DIC is a helpful tool for selecting among competing models. Which of the following changes to a linear model is **not** appropriate to evaluate with DIC?

- Minor changes to the prior distributions

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Correct

If we optimize the model with respect to the prior, we might as well have not used priors. This practice can lead to inflated confidence and misleading results.

One exception is if we use a completely different class of priors or prior structure that has a specific purpose, like variable selection. We will explore this in the next lesson.

- ○ Choice of distribution for the likelihood
- ○ Adding or removing candidate covariates (predictors)
- ○ Transformation of covariates (predictors)

✓ 1 / 1 points

3.

Although the residual analysis of the Anscombe data showed no major problem that we will pursue, it is still worthwhile to compare some competing models. First, calculate and report the DIC for the original model (that you fit for the previous quiz). Round your answer to the nearest whole number.

Hint: Use the `dic.samples` function in the `rjags` package and use a large number of samples (around 100,000) for a reliable answer. DIC is the last number reported with the title "Penalized deviance."

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Correct Response

This number by itself is not very useful. We now need to compare it to the DIC from other models and see which is lowest.

✓ 1 / 1 points

4.

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We will consider two alternative models for the Anscombe data. Because `income` and `urban` may be more highly correlated with each other than with `education`, and since `urban` was less significant than `income` in our models so far, we'll consider dropping it (we'll discuss correlated covariates more in the next lesson).

The two alternative models we will try are based on these adjustments:

1) Remove the term in the linear model for `urban`.

2) In addition to dropping `urban`, add an interaction term $\beta_3 \times$ `income` $\times$ `youth`.

Fit both models in JAGS and calculate the DIC for each. If predictive performance is our criterion, which model would you conclude performs best?

- The DIC is indistinguishable among the three models. We cannot clearly identify a preferred model.
- The DIC is lowest for the original model with all covariates. This is our preferred model.

Correct
With DIC, a decrease of even a few points can indicate significant gains in model predictive performance.

- The DIC is lowest for the third model with the interaction term. This is our preferred model.
- The DIC is lowest for the second model without the `urban` covariate. This is our preferred model.

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1 / 1 points

5.
Using the model favored by the DIC, obtain a Monte Carlo estimate of the posterior probability that the coefficient for `income` is positive (greater than 0.0). Round your answer to two decimal places.

1.00

Correct Response

There is strong evidence that increases in per-capita income are associated with increases in per-capita education expenditures. We cannot conclude that one causes the other since these data are merely observational, but we do know they are correlated.

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1 / 1 points

6.
Which of the following accurately summarizes our conclusions based on the model favored by the DIC?

- Increases in per-capita income and percent youth are associated with decreases in mean per-capita education expenditures. Increases in percent urban are irrelevant.
- Increases in per-capita income and percent youth are associated with increases in mean per-capita education expenditures. Increases in percent urban are associated with decreases in mean per-capita education expenditures.

Correct
There is pretty strong evidence for each of these statements in the data. We cannot conclude that there are causal relationships since these are observational data (e.g., there may be another unmeasured variable that causes the co-variability in all of these observed variables). However, there appear to be strong correlations among these variables.

- Increases in per-capita income and percent urban are associated with increases in mean per-capita education expenditures. Increases in percent youth are associated with decreases in mean per-capita education expenditures.
- Increases in per-capita income and percent youth are associated with decreases in mean per-capita education expenditures. Increases in percent urban are associated with increases in mean per-capita education expenditures.

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