

Bayes Class: Manipulating Posteriors (but don't announce this)

27 January 2023

manip post: 1/2

→ let's do some basic eqn math together:

IMAGINE: Plant growth $y_i \sim ^\circ C \times \text{day length}$
 $\uparrow \qquad \qquad \qquad \uparrow$
 0/1 trmt $\qquad \qquad$ 0/1 trmt
 (10°/20°) $\qquad \qquad$ (8hr/16hr)

[Get class to write] out basic notation of above: (see below)

$$\hat{y}_i = \alpha + \beta_1 x_1 + \beta_2 x_2 + \beta_3 (x_1)(x_2) \leftarrow \text{plus } \sigma^2$$

Now → add values on top as shown:

$$\hat{y}_i = \alpha + \beta_1 + \beta_2 + \beta_3 \left[\begin{array}{l} 10 \\ \downarrow \\ \text{① growth @ } 10^\circ \text{ \& } 8\text{hr} \\ \text{② @ } 20^\circ \text{ \& } 8\text{hr} \\ \text{③ @ } 20^\circ \text{ \& } 16\text{hr} \end{array} \right] \left[\begin{array}{l} \text{w/ and} \\ \text{w/out intxn} \end{array} \right]$$

w/intxn

① $10 + 0 + 0 + 0 = 10$ (w/out is same)

② $10 + 5 + 0 = 15$ (ibid)

③ $10 + 5 + 3 - 3 = 15$ (w/out = $10 + 5 + 3 = 18$)
 minor pt: this is why it's sub-additive
 (15 w/ vs. 18 w/out)

* Why did we do this? First - for the math reminder. Smaller second:
 To remind you that you can exclude or include parameters to better understand them (e.g. plot)...

Now assume model has PP:

$$y_i = \alpha_{[sp]} + \beta_1_{[sp]} + \beta_2_{[sp]} + \beta_3_{[sp]}$$

$$\left[\begin{array}{c} 8 \\ 10 \\ 12 \\ \vdots \\ n \end{array} \right] \left[\begin{array}{c} 6 \\ 5 \\ 8 \\ \vdots \\ n \end{array} \right] \left[\begin{array}{c} 2 \\ 3 \\ 2 \\ \vdots \\ i \end{array} \right] \left[\begin{array}{c} -5 \\ -4 \\ -1 \\ \vdots \\ n \end{array} \right]$$

Calculate:
 growth: 20°, 16hr SP2

$$10 + 5 + 3 - 4 = 14$$

You can do all this w/ posteriors!

Instead of one value we need to use the full posteriors,
which are n -iterations long (for each parameter or hyperparameter) manip post: 2/2

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You can do lots of easy, intuitive math w/ posteriors so long as you...

(1) Do the math of your eqn. correctly (know your math)

→ though some packages will help w/ this for rstanarm / brms

(2) Keep your iterations together! row 1 for α , β , β_2 are to be kept together,

→ again, some packages do this for you.

MV to end.

Example! Get example code & group as requested } Do @ end of this page

These are good for a way of thinking about what might be missing from your model (non-classical retrospective check).

Examples: meta-analysis w/ spp from various continents
trophic levels etc.

How to do it? Group (usually a hierarchical component -
by these factors & look for differences

So... imagine 10 posteriors for diff. spp (10 spp) w/ this

data:

Sp	cont
1	a
2	a
3	a
4	b
5	b
6	b
:	:

} add up posteriors & divide by 3

You can also subtract, divide etc. \Rightarrow you can estimate your control
& subtract it out but, if you find an impt factor you
should add it into your Stan model! Manipulating posteriors
is not as inferentially good as adding to model.

Maybe Discuss why do it at all

easier + safer than fitting complex model (w/ raw data for it sometimes)