Errata File for Second Edition

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This errata file contains a list of errors, short clarifications and modifications to the manuscript's second edition.

1. Page 170, bottom half of the page, bracket missing:
   CHANGE:
   $$\mathrm{Var}\left(\hat{a}-a\right)=\mathrm{E}_y(\mathrm{Var}(a|y)$$
   TO.
   $$\mathrm{Var}\left(\hat{a}-a\right)=\mathrm{E}_y\left(\mathrm{Var}(a|y)\right)$$

2. Page 171, the first partial derivative below Eq. (4.62).
   CHANGE:
   $$\frac{\partial \ln p\left(a,b|y,b_0,a_0,B,G,R\right)}{\partial b}=-B^{-1}(b-b_0)+XR^{-1}\left(y-Xb-Za\right)$$
   TO:
   $$\frac{\partial \ln p\left(a,b|y,b_0,a_0,B,G,R\right)}{\partial b}=-B^{-1}(b-b_0)+X'R^{-1}\left(y-Xb-Za\right)$$

3. Page 172, top.
   CHANGE: "When B^{-1} implying $B=\infty$ ..."
   TO: "When and if $B^{-1}=0$ implying $B=\infty$ ..."

4. Page 172,
   CHANGE:
   Finally, add and subtract $\hat{\theta}'\left(W'R^{-1}W+\Sigma\right)\hat{\theta}$ and rearrange to yield
   $$y'R^{-1}y+\left(\theta-\widehat{\theta}\right)'\left(W'R^{-1}W+\Sigma\right)\left(\theta-\widehat{\theta}\right)'-\widehat{\theta}'\left(W'R^{-1}W+\Sigma\right)\widehat{\theta}$$
   $$+\theta_0'\Sigma\theta_0$$

TO:
Finally, add and subtract $\hat{\theta}'\left(W'R^{-1}W+\Sigma\right)\hat{\theta}$ and rearrange to yield

$$y'R^{-1}y+\left(\theta-\widehat{\theta}\right)'\left(W'R^{-1}W+\Sigma\right)\left(\theta-\widehat{\theta}\right)-\widehat{\theta}'\left(W'R^{-1}W+\Sigma\right)\widehat{\theta}$$
$$+\theta_0'\Sigma\theta_0$$

5. Page 172, equation at the bottom,
CHANGE:

$$\ln p\left(\theta|y,\theta_0,B,G,R\right)\propto-\frac{1}{2}\left(\theta-\widehat{\theta}\right)'\left(W'R^{-1}W+\Sigma\right)\left(\theta-\widehat{\theta}\right)'$$

TO:

$$\ln p\left(\theta|y,\theta_0,B,G,R\right)\propto-\frac{1}{2}\left(\theta-\widehat{\theta}\right)'\left(W'R^{-1}W+\Sigma\right)\left(\theta-\widehat{\theta}\right)$$

6. Page 353, Eq. (7.41), remove "comma" before "$i=1,\ldots,m$"
CHANGE:

$$y|\mu,\alpha,\delta,\sigma^2\sim N\left(1\mu+\sum_{i=1}^{m}X_i\left(\alpha_i\delta_i\right),I\sigma^2\right),\quad ,i=1,\ldots,m \tag{7.41}$$

TO:

$$y|\mu,\alpha,\delta,\sigma^2\sim N\left(1\mu+\sum_{i=1}^{m}X_i\left(\alpha_i\delta_i\right),I\sigma^2\right),\quad i=1,\ldots,m \tag{7.41}$$

7. Page 373, paragraph above Eq. (8.23), defines the number of false discoveries $V(A)$, given that k hypotheses are rejected, as binomially distributed $Bi(k,\Pr(H=0|z\in A)$. Another definition can be found on page 376, paragraph above Eq. (8.33), concerning the expected number of false discoveries. Both may benefit from a little explanation that is provided below.

Background

Let the binary random variable $V_i=1$ if hypothesis i is rejected and if hypothesis i is a true null; $V_i=0$, otherwise. Using the notation on page 363, we can write $V_i=I(H_i=0,R_i=1)$, where $R_i=1$ if $z_i\in A$ and z_i is the observed value of the scalar random variable Z_i. Treating the hypotheses as random, it follows that V_i is a Bernoulli random variable with probability $\Pr(H_i=0,Z_i\in A)$; that is $V_i\sim Br(\Pr(H_i=0,Z_i\in A)$.

$$V_i\sim Br(\Pr(H_i=0,Z_i\in A).$$

- **Page 373**. Consider the binary random variable $V_i|R_i = 1$ that takes the value 1 if $H_i = 0$ and 0 otherwise. Then $[V_i|R_i = 1] \sim Br(\Pr(H_i = 0|Z_i \in A)$, a Bernoulli distributed random variable. If in a series of independent trials the total number of rejections is $R = k$, among these k rejections, the total number of false discoveries is binomially distributed:

  $$[V|R = k] \sim Bi(k, \Pr(H = 0|Z \in A).$$

  The expected number of false discoveries among the k rejections is

  $$\mathrm{E}(V|R = k) = k \ \Pr(H = 0|Z \in A).$$

  The subscript i has been omitted because $\Pr(H_i = 0|Z_i \in A)$ is the same for each i.

- **Page 376**. Consider an experiment where m independent hypotheses are tested. Given the definition of V_i and the independence assumption, the total number of false discoveries, $V = \sum_{i=1}^{m} V_i$, is then binomially distributed

  $$V \sim Bi(m, \Pr(H = 0, Z \in A)),$$

  with expected value

  $$\mathrm{E}(V) = m \ \Pr(H = 0, Z \in A)) = m \ \Pr(Z \in A|H = 0)\pi_0,$$

  where $\pi_0 = \Pr(H = 0)$, the prior probability of a true null.

Note that: (i) hypotheses H_i are treated as random (with a common prior π_0), (ii) random vectors (H_i, Z_i), $i = 1, 2, \ldots, m$, are independently distributed, (iii) the rejection region A is data-independent and fixed in advance.