Mixed effects models. R Lab : Fitting

Souvik Roy

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1 Introduction

We first look at the random effects model we are trying to fit.

$$y_{ij} = \mu + \alpha_i + b_j + \varepsilon_{ij}$$

where, i denotes the method, the effect of which shall be denoted by α_i, and j denotes the tablet whose effect is the random effect b_j. We are putting in two distributional assumptions namely, $\varepsilon_{ij} \sim N(0, \sigma_e^2)$ and $b_j \sim N(0, \sigma_b^2)$, and all the ε_{ij}'s and b_j's are independent. We shall finally estimate μ, α_i's, σ_e^2 and σ_b^2.

2 Fitting the model in R

We are going to fit the Linear mixed effects model, and for that we shall use our library `nlme` package. This package needs to be loaded first and this can be done upon writing the following line of code in the console :

```
library(nlme)
```

We shall use the $dat1$ file that we have made in the previous section in this section. To fit the model, the main workhorse function shall be the following :

```
fit = lme(amt  method, dat1, random = 1—tab)
```

The above line can also be changed to,

```
fit = lme(fixed = amt  method, dat1, random = 1—tab)
```

Now, let us study the parameters one by one.

- The first item `amt` $\sim$ `method` tells R that we are fitting the intercept term with the method. The intercept term is implied.
- `dat1` is the name of the dataset that we are using from the previous section.

- The third item `random = 1—tab`. Here, we have the tablet effect, and as we have already seen in a section previously, the tablet `tab` is written as a grouping factor, a vertical bar is put, and then put a vertical bar, followed by the intercept term.

It is a good idea to run the last command in R, and look at the results that appear. To do that, we can just write `fit`, and hit enter, and the results shall look somewhat like this.

```
¿ library(nlme)
¿ fit = lme(fixed = amt  method, dat1, random = 1—tab)
¿ fit
Linear mixed-effects model fit by REML
  Data: dat1
  Log-restricted-likelihood: -6.98026
  Fixed: amt  method
(Intercept)   methodNIR
      10.34         0.05

Random effects:
   Formula: 1 — tab
          (Intercept)   Residual
StdDev:     0.2988868  0.2088327

Number of Observations: 20
Number of Groups: 10
```

We see a lot of things here, and we shall look at some of the important ones.

- `10.34` is the estimate of μ. We had α_1 and α_2 in the fixed effects part, and since both of them are not estimable, R has forcefully set $\alpha_1 = 0$, and hence, we only see `methodNIR` in the output, which gives us $\hat{\alpha_2} = 0.05$.
- The number under `Residual` for `StdDev` gives us the estimate for σ_e, and the one under `(Intercept)` gives us the esimate for σ_b.