A visualization of random effects model and fixed effects model

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Random intercept model

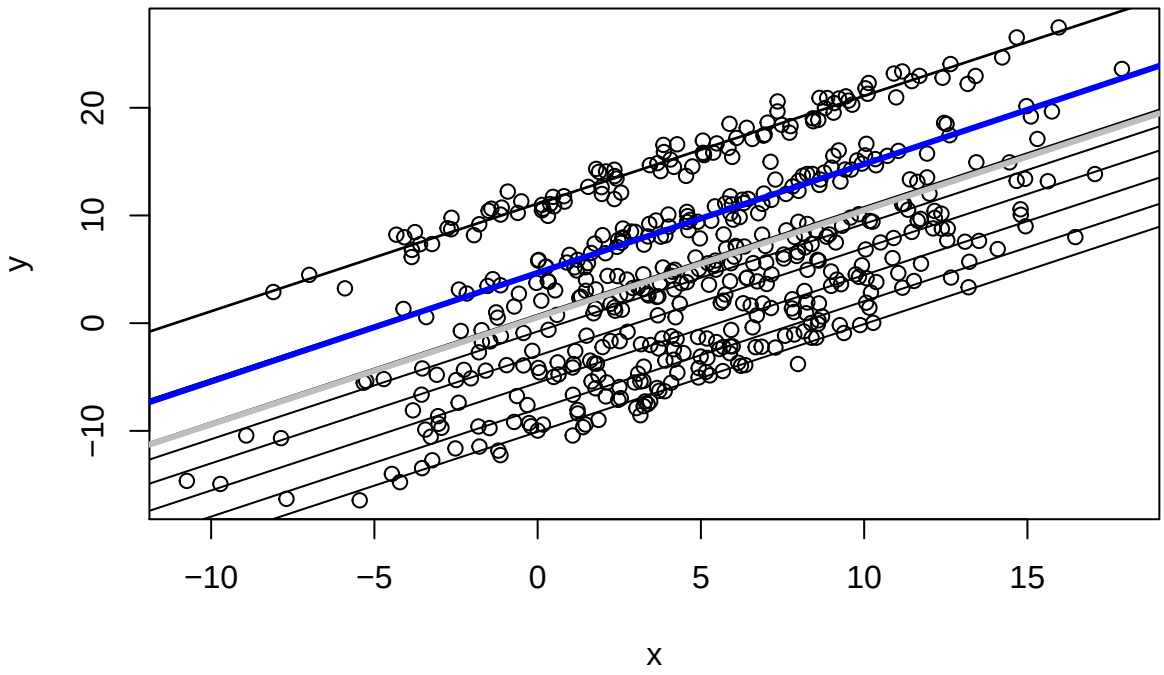
$$y_{ij} = \beta_{0j} + \beta_1 * x + \epsilon \tag{1}$$
$$\beta_{0j} \sim N(\mu, \sigma^2) \tag{2}$$

Let's assume $\mu = 1, \sigma = 1$.

```
set.seed(666)

Total_obs = 500
group = 10
Group_Obs = Total_obs/group

b1 = 1
mu = 1
sigma = 1
epsilon = 2

# y = b0 + b1 + e
j = rep(1:group, Group_Obs)
b0 = rnorm(group, 1, 5)
x = rnorm(Total_obs, 5, 5)

y = rep(b0, Group_Obs) + b1*x + rnorm(Total_obs)

dat = data.frame(y, j, x, b0, b1)

plot(x, y)
for (i in 1:group) {
  abline(b0[i], b1)
}

reg1 <- lm(y ~ x,data = dat)
abline(reg1, col = "grey", lwd = 3)

reg2 <- lm(y ~ factor(j) + x,data = dat)
reg2_b0 = reg2$coefficients[labels(reg2$coefficients) == "(Intercept)"]
reg2_b1 = reg2$coefficients[labels(reg2$coefficients) == "x"]
abline(reg2_b0, reg2_b1, col = "blue", lwd = 3)


require(lme4)
```

```
## Loading required package: lme4
```

```
## Loading required package: Matrix
```




```
reg3 <- lmer(y ~ x + (1|j), dat)
summary(reg3)
```

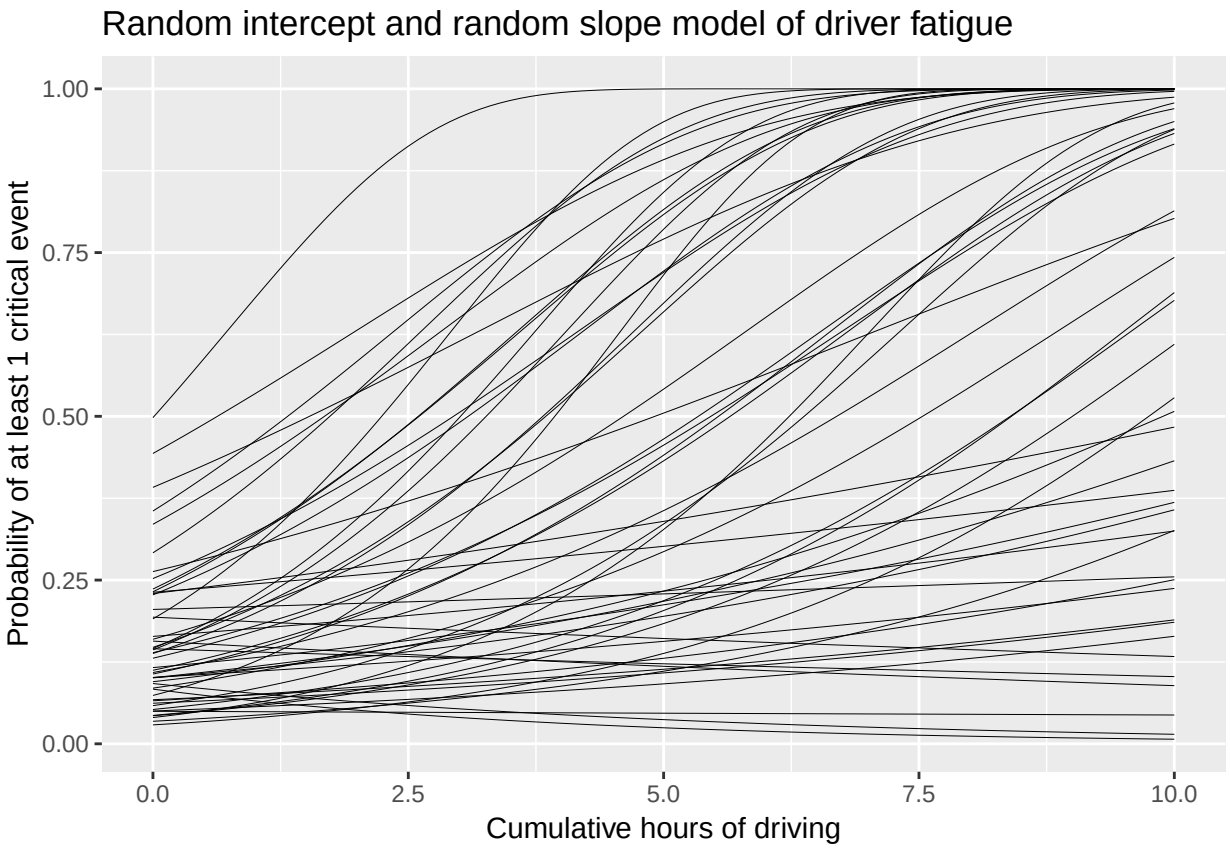
```
## Linear mixed model fit by REML ['lmerMod']
## Formula: y ~ x + (1 | j)
##    Data: dat
##
## REML criterion at convergence: 1457.1
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -3.3453 -0.6681  0.0133  0.6596  2.9236
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  j        (Intercept) 54.7499  7.3993
##  Residual              0.9157  0.9569
## Number of obs: 500, groups:  j, 10
##
## Fixed effects:
##             Estimate Std. Error t value
## (Intercept) 0.470216   2.340625   0.201
## x           1.009554   0.008575 117.736
##
## Correlation of Fixed Effects:
```

```
##   (Intr)
## x -0.018
```

Including Plots

You can also embed plots, for example:

```
## Loading required package: ggplot2
```



Note that the `echo = FALSE` parameter was added to the code chunk to prevent printing of the R code that generated the plot.