Bayesian Linear Regression

What is Bayesian Linear Regression?

- Itôs an approach to linear regression, which the statistical analysis is undertaken within the context of Bayesian inference.
- The prior belief about the parameters is combined with the dataôs likelihood function according to Bayes theorem to yield the posterior belief about parameters beta (ɓ) or sigma (ů).
- Uses the given data to compute the posterior probability distribution for the parameters.

Bayesian analysis:

1. Figure out the likelihood function of the data
2. Choose a prior distribution over all unknown parameters
3. Use Bayes theorem to find the posterior distribution over all the parameters

Why Bayesian?

- Can handle more complex models
- Easier to extend to many levels
- Can incorporate prior information!

How?

From a survey of the clerical employees of a large financial organization, the data are aggregated from the questionnaires of the approximately 35 employees for each of 30 (randomly selected) departments. The numbers give the percent proportion of favorable responses to seven questions in each department.

```
data("attitude")

# Classical Regression

summary(fml <- lm(rating ~ ., data=attitude))

# Compute Bayes Factors for all regression models

library(BayesFactor)

output= regressionBF (rating ~ ., data=attitude, progress=FALSE)

head(output)            #best model is 'complaints' only
```

```
model = regressionBF(rating ~ complaints*learning, data=attitude)
summary(model)
# compute the bestModel
bestModel = regressionBF(rating~complaints, data=attitude)
# pull samples
chains = posterior(bestModel, iterations=10000)
summary(chains)
plot(chains)
chains = posterior(bestModel, iterations = 100000)
```