

Getting Started with Lattice

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1 Introduction

The `lattice` package implements the Trellis graphics system and provides high-level functions for visualization of multivariate data. This lab covers some of the basics of the `lattice` package.

Although the `lattice` package is included in R, you must explicitly load the package to make use of the functions it provides:

```
> library("lattice")
```

Lattice provides several plotting functions, some of the commonly used ones are listed below.

Lattice functions	
<code>xyplot()</code>	Scatter plot
<code>dotplot()</code>	Cleveland dot plot
<code>bwplot()</code>	Box and whisker plot
<code>histogram()</code>	Histogram
<code>densityplot()</code>	Kernel density plot
<code>qq()</code>	Two sample quantile plot

Table 1: Commonly used high-level lattice functions

2 Basic ideas

A typical call to the lattice function `xyplot` is shown below.

```
> xyplot(y ~ x | c, data, groups = g)
```

The arguments to a lattice function can be summarized in terms of

1. lattice function: A lattice plotting function such as `xyplot`, `dotplot` etc.
2. formula: The first argument to a lattice method is a formula. The formula for our example is `y ~ x | c`. If the lattice method takes only a single vector as input, the formula can be expressed as `~ x | c`.
 - primary variables: Variables `y` (Y axis of the plot) and `x` (X axis of the plot) that defines the lattice display separated by the `~` character.
 - conditioning variable: Variable `c` in the example separated from the primary variables by the character `|`. The conditioning variable divides the plot into separate panels.
3. grouping variable: The variable `g` in the example. The grouping variable segregates data into subgroups within each panel.
4. data: A `data.frame` with column names corresponding to the variables `y`, `x`, `c` and `g`.

Lattice functions do not, in fact, generate a visual display. They return an object of class `trellis` which will generate the desired display when printed using the `print` function.

3 Scatter plot (`xyplot`)

We will use the Indometh data that contains plasma concentrations of the drug indomethicin for six subjects over a period of eight hours to illustrate a few aspects of `lattice`. First, we will use `xyplot` to produce a scatterplot of concentration of the drug over time. (Figure 1(a))

```

> data(Indometh)
> df <- Indometh
> head(df)

  Subject time conc
1        1 0.25 1.50
2        1 0.50 0.94
3        1 0.75 0.78
4        1 1.00 0.48
5        1 1.25 0.37
6        1 2.00 0.19

```

Exercise 1

Reproduce the concentration vs time plot from Figure 1(a) by following the steps described below.

1. Create a scatter plot using `xyplot`. Use the formula `conc ~ time` with `df` as the data argument.
2. Change the X-axis label to “Time (hours)” by adding an `xlab` argument to the `xyplot` call.
3. Similarly, change the Y-axis label to “Concentration (mcg/ml)” using `ylab`
4. Finally, change the title of the plot by adding a `main` argument.

```

> myplot <- xyplot(conc ~ time, data = df,
+                 xlab = "Time (hours)",
+                 ylab = "Concentration (mcg/ml)",
+                 main = "Pharmacokinetics of Indomethicin")

```

A scatter plot with the concentration profile for each patient appearing in a separate panel can be seen in Figure 1(b). This plot was produced by making use of `Subject` as the conditioning variable.

Exercise 2

1. Create a scatter plot by adding the conditioning variable `Subject` to the formula from Exercise 1.
2. Modify the conditioning variable in the formula to `factor(Subject, levels = 1:6)` and observe the difference in the order of plots.

```

> myplot <- xyplot(conc ~ time | factor(Subject, levels = 1:6),
+                 data = df, main = "Pharmacokinetics of Indomethicin",
+                 ylab = "Concentration (mcg/ml)",
+                 xlab = "Time (hours)")

```

A scatter plot produced by superimposing the concentration profiles from all the subjects to a single panel can be seen in Figure 1(c). The figure makes use of lines instead of points and also has a legend to help distinguish the concentration profiles of different subjects.

Exercise 3

1. Create a single scatter plot of the superimposed concentrations by making use of formula `conc ~ time` and the additional argument `groups = Subject` to the `xyplot` function.
2. Add an additional argument `type='l'` to the function and observe what effect it has on the plot.
3. Add an additional argument `auto.key = list(space = "right")`. to the `xyplot` to add a legend to the right of the plot.

```
> myplot <- xyplot(conc ~ time, data = df, groups = Subject, type='l',
+                 auto.key = list(space = "right"),
+                 main = "Pharmacokinetics of Indomethicin",
+                 ylab = "Concentration (mcg/ml)",
+                 xlab = "Time (hours)")
```

4 Box and whisker plots (bwplot)

We are interested in finding out differences in the plasma concentration of Indomethicin amongst the six subjects. A box and whisker plot of the concentration of Indomethicin produced using the `bwplot` method can be observed in Figure 1(d)

Exercise 4

1. Create a boxplot using the formula `~ conc` and the lattice function `bwplot`.
2. Update the formula to `~ conc | Subject` in order to add a conditioning variable to the boxplot.
3. Add an additional argument `layout=c(6,1)` to the `bwplot` and observe its effect on the plot.

```
> myplot <- bwplot(~ conc | Subject, data = df, layout = c(1,6),
+                 main = "Concentration of Indomethicin",
+                 xlab = "Concentration (mcg/ml)"
+                 )
```

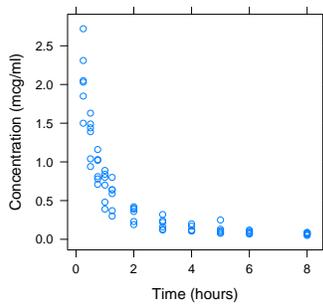
5 Further Reading

- The lattice package includes many detailed help pages. You can get an overview using the R command `help(package="lattice")`.
- A good source of several lattice plots along with the code that produced them is <http://lmdvr.r-forge.r-project.org>
- *Multivariate Data Visualization with R* by Deepayan Sarkar the author of lattice. See <http://lmdvr.r-forge.r-project.org/>.

6 Session information

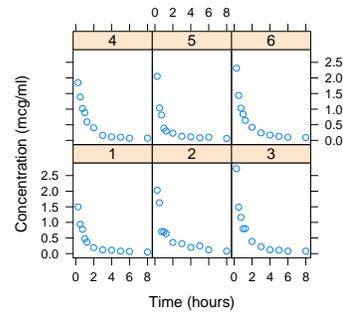
- R version 2.10.1 Patched (2009-12-14 r50736),
i386-apple-darwin10.2.0
- Locale: C/C/C/C/en_US.utf-8
- Base packages: base, datasets, grDevices, graphics, methods, stats, tools, utils
- Other packages: ALL 1.4.7, AnnotationDbi 1.8.1, Biobase 2.6.1, DBI 0.2-5, RSQLite 0.8-0, genefilter 1.28.2, hgu95av2.db 2.3.5, lattice 0.17-26, org.Hs.eg.db 2.3.6
- Loaded via a namespace (and not attached): annotate 1.24.1, grid 2.10.1, splines 2.10.1, survival 2.35-7, xtable 1.5-6

Pharmacokinetics of Indomethicin



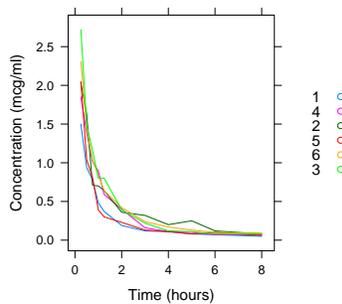
(a) Concentration of Indomethicin over time produced using `xyplot`

Pharmacokinetics of Indomethicin



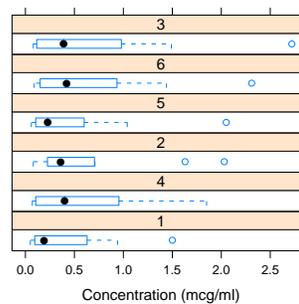
(b) Concentration of Indomethicin over time using `Subject` as the conditioning variable

Pharmacokinetics of Indomethicin



(c) Concentration vs Time of Indomethicin for 6 subjects using the Grouping variable `Subject`.

Concentration of Indomethicin



(d) Box and whisker plots for drug concentration of Indomethicin

Figure 1: Example lattice plots. By following the exercises in this lab, you should be able to reproduce these graphics.