

ggplot2

Enhanced Graphics Package



About ggplot2

- Package ggplot2 provides a method of creating innovative graphs based on graphical grammar
- There are four graphic systems in R currently.



Four Graphics Systems in R

- 1. The base Graphics System written by the Ross Ihaka included by default in every R installation
- 2. The grid graphics system written by Paul Murrell (2011)
- 3. The lattice graphics system written by Deepayan Sarkar (2008)
- 4. The ggplot2 graphics system written by Hadley Wickham (2009)



Base Graphics

- We have already covered it in the previous sessions
- Composed of functions like plot(), boxplot(), barplot() etc.



Grid Graphics

- Implemented by package grid
- Offers a low level alternative to the standard graphics system
- But the grid package doesn't provide functions for producing statistical graphics or complete plots



Lattice Graphics

- Implements trellis graphs with package lattice
- Provides a comprehensive system for creating statistical graphics
- Built using package grid

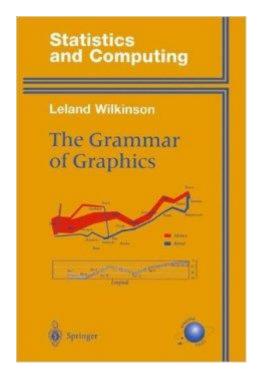


Ggplot2 Graphics

The package ggplot2 has been written by Hadley Wickham

 Provides a system for creating graphs based on the grammar of graphics described by Wilkinson and

expanded by Wickham





Function qplot

- Before we look into the ggplot function, let us first have a look at the function qplot() (Quick Plot), which is a basic plotting function in package ggplot2.
- The function qplot() hides what goes on underneath (inside)

Syntax : qplot(x , y , data , ...)

Where

x : variable to be considered on X-axis

y : variable to be considered on Y-axis (If not

specified scatter plot won't be drawn)

data: data frame object



Function ggplot

 With ggplot function, the plots are created by putting together functions in a chain-like manner using plus (+) sign

Syntax:

```
ggplot(data,aes(x=,y=,...)) + geom function(s)
```

Where

data: data frame object

aes(): a function for specifying the role of

variables



Basic Components of ggplot()

- Data Frame
- Aesthetic mappings: data mapping by color, shape etc.
- **Geoms**: Geometric object like points, shapes etc.
- Facets: Trellis plotting
- **Stats**: Statistical Transforms
- Scales: scale used by aesthetic map
- Coordinate System



Building Plots in ggplot()

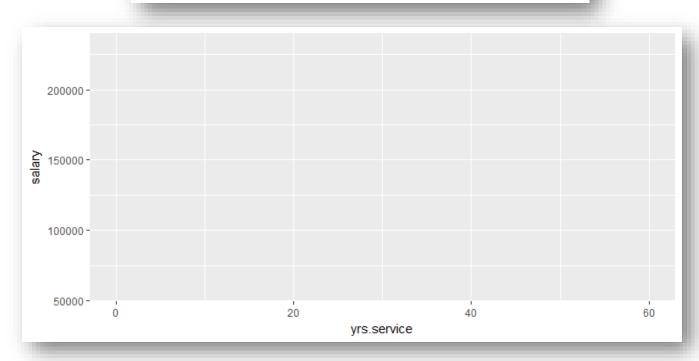
- Plots are built up in layers
 - Plotting the data
 - Overlaying the summary
 - Annotating the graph
- Let us have a simple example of displaying the scatter plot with yrs.service as X-axis and salary as Y-axis



Plotting by ggplot()

• We will find here that just specifying the dataset and the axes is not sufficient for generating graph.

```
p <- ggplot(Salaries,aes(yrs.service,salary))
print(p)</pre>
```





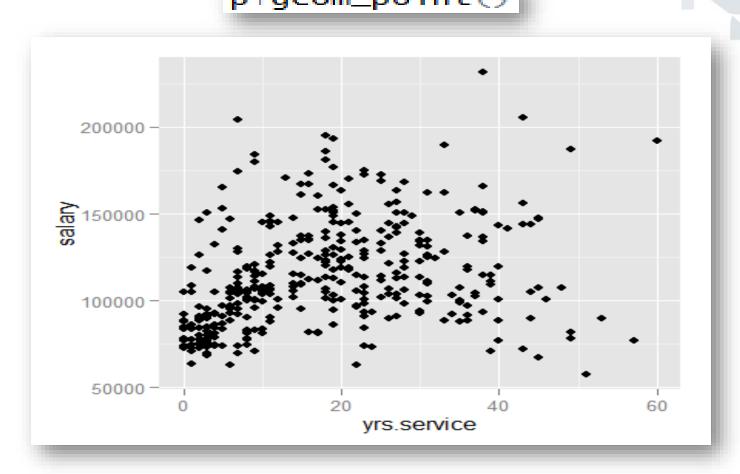
geom_*() functions

Geom	Graph Type
geom_point()	Scatter Plot
geom_line()	Line Graph
geom_histogram()	Histogram
geom_density()	Density Plot
geom_smooth()	Regression Line
geom_boxplot()	Boxplot
geom_bar()	Bar PLot



Scatter Plot

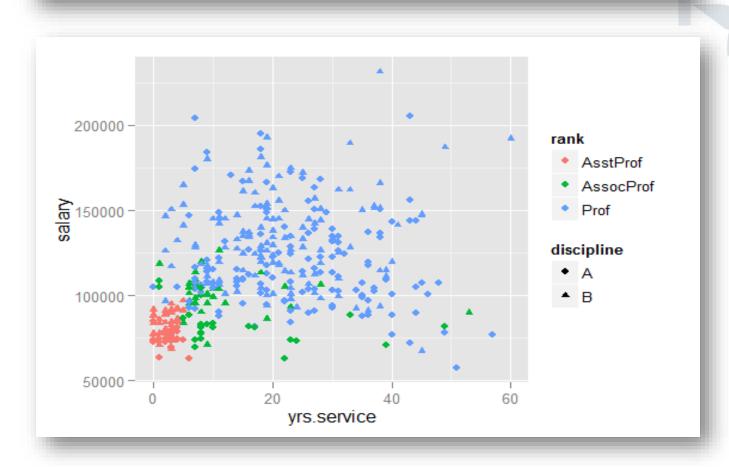
Scatter plot can be generated with geom_point()
 function





Grouping in Scatter Plot

ggplot(Salaries,aes(yrs.service,salary,color=rank,shape=discipline))+
 geom_point()

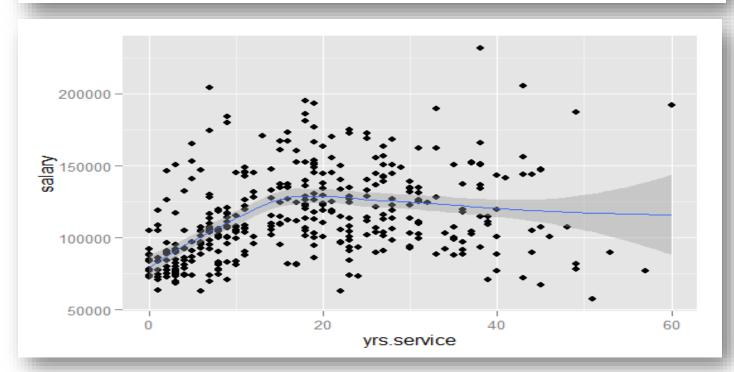




Smoothening

- By default, the smoothening happens with loess method.
- We need to specify Im method if we want linear regression line

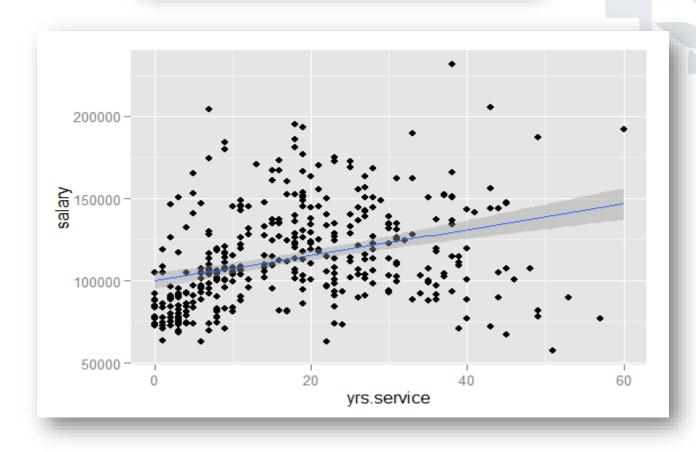
```
> p+geom_point()+geom_smooth()
geom_smooth: method="auto" and size of largest group is <1000, so using loess.
Use 'method = x' to change the smoothing method.</pre>
```





Smoothening

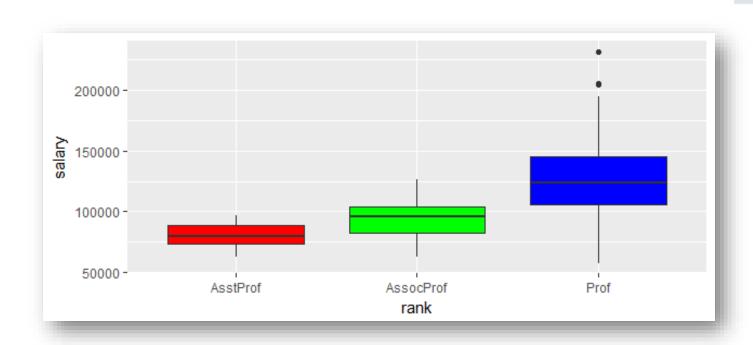
p+geom_point()+geom_smooth(method="lm")





Boxplot

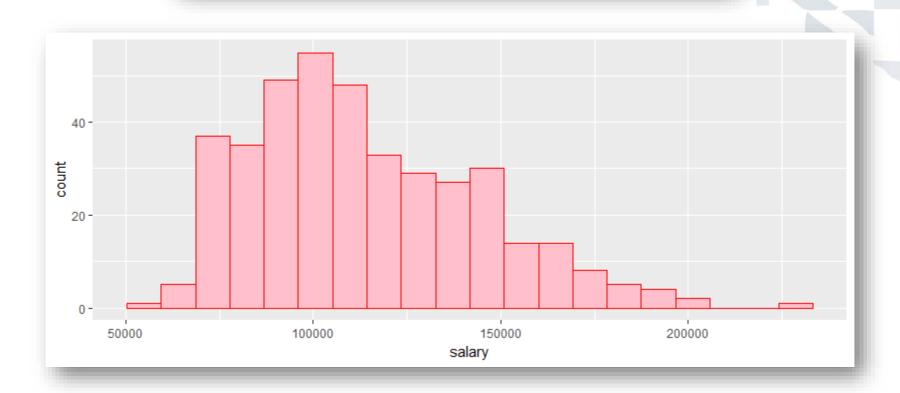
ggplot(Salaries, aes(x=rank,y=salary))+
 geom_boxplot(fill=c("red","green","blue"))





Histogram

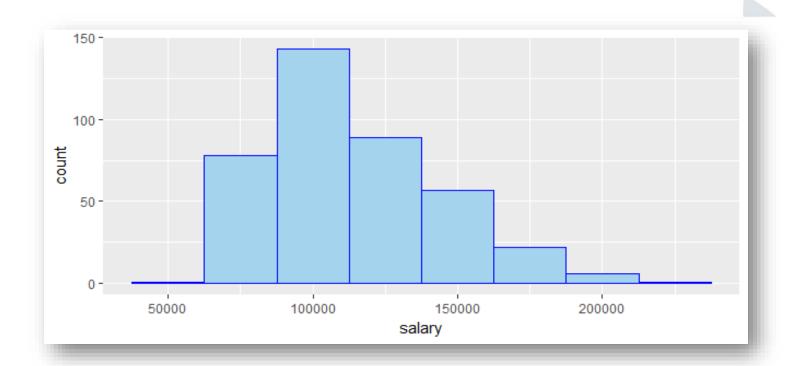
```
ggplot(Salaries,aes(x=salary)) +
  geom_histogram(bins=20,fill="pink",color="red")
```





Histogram

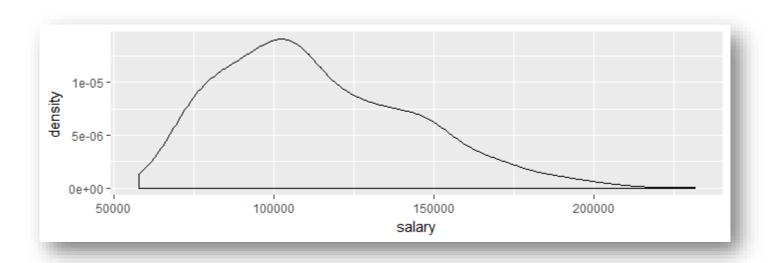
```
ggplot(Salaries,aes(x=salary)) +
  geom_histogram(binwidth = 25000,fill="lightskyblue2",color="blue")
```





Density Plot

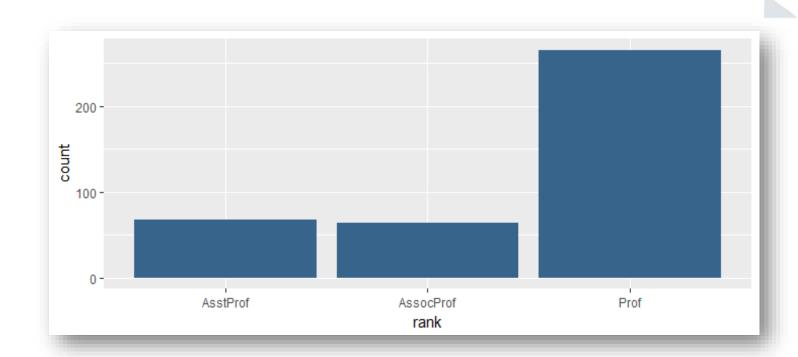
ggplot(Salaries, aes(x=salary))+geom_density()





Barplot

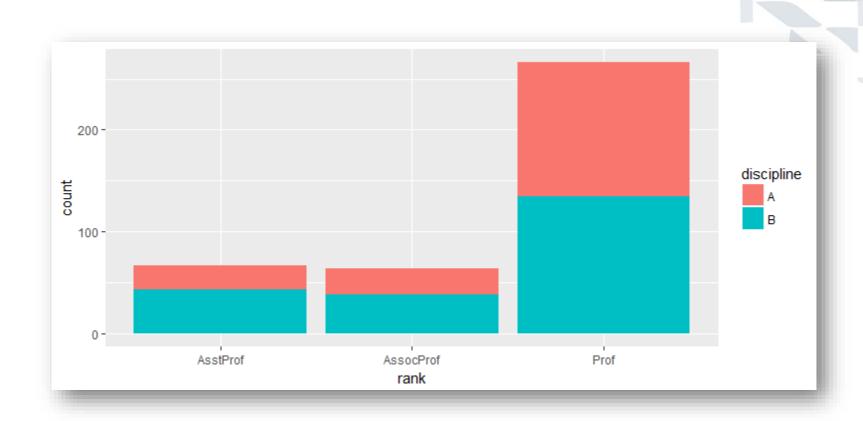
ggplot(Salaries, aes(rank))+geom_bar(fill="steelblue4")





Barplot

ggplot(Salaries, aes(rank,fill=discipline))+geom_bar()





Facets

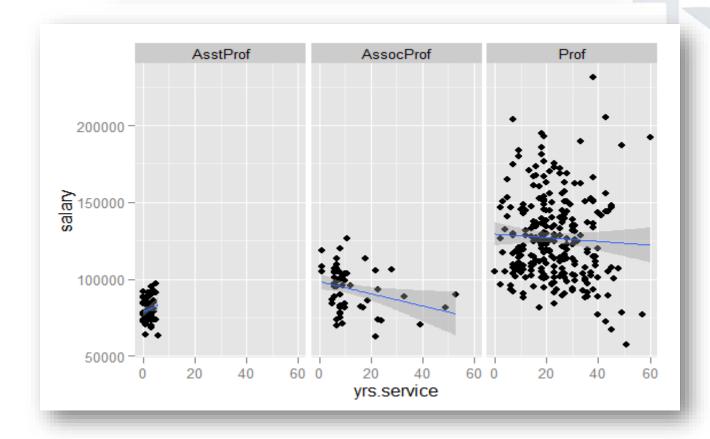
- Sometimes, the relationship become clearer if the graphs are shown side by side
- These are also called trellis graphs

Syntax	Effect
facet_grid(rowvar ~ colvar)	Separate plots for each combination of rowvar and colvar in grid form
facet_grid(rowvar ~ .)	Separate plots of each category in rowvar into a single column
facet_grid(. ~ colvar)	Separate plots of each category in colvar into a single row



Facet Examples

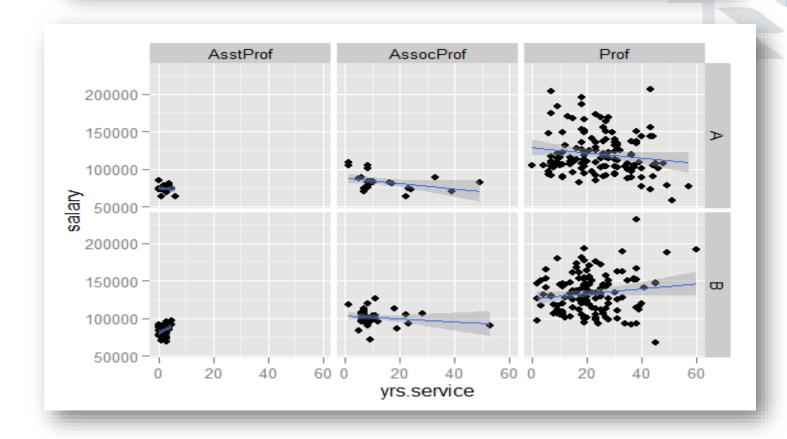
p+geom_point()+geom_smooth(method="lm")+facet_grid(.~rank)





Facet Examples

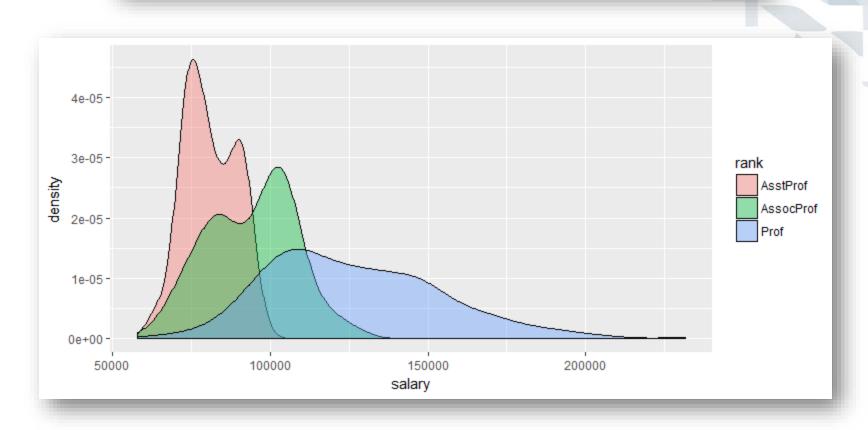
p+geom_point()+geom_smooth(method="lm")+facet_grid(discipline~rank)





Boxplot

ggplot(Salaries, aes(x=salary,fill=rank))+geom_density(alpha=0.4)





Rendering labels

> p+geom_point(aes(color=rank), size=2, alpha=3/4)+labs(title="Plot by Rank")
+labs(x="Years in Service",y="Salary")

