Introduction to R

Graphing Data Using GGPlot

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GGplot vs Base

`ggplot` attempts to create a consistent framework for build graphs 'layer by layer' in R.

You construct a graph by specifying:

1. The data.
2. An aesthetic (e.g., colors, line styles, the coordinate system, etc).
3. A graph "geometry" (e.g., boxplot, scatterplot, etc). This is where you specify the kind of graph you want.
4. Labels. The plot title, axis labels, etc.

A scatterplot

Creating the graph object and specifying the dataset.

```
library(ggplot2)
car.graph <- ggplot(mtcars)
```

- Specifying what aesthetics to use.
- In this case, the coordinate system to use -- meaning the x-y axis.
- This is sometimes also referred to as the "mapping" being used.

```
car.graph <- car.graph + aes(wt, mpg)
```

Specifying the plot

```
## Specifying the plot "geometry" in this case, a scatter plot.
car.graph + geom_point()
```

Without intermediate states

We can also create the plot without storing all of the intermediate states

```
ggplot(mtcars) + aes(wt, mpg) + geom_point()
```

Exercise: ggplot with the Ames Housing dataset

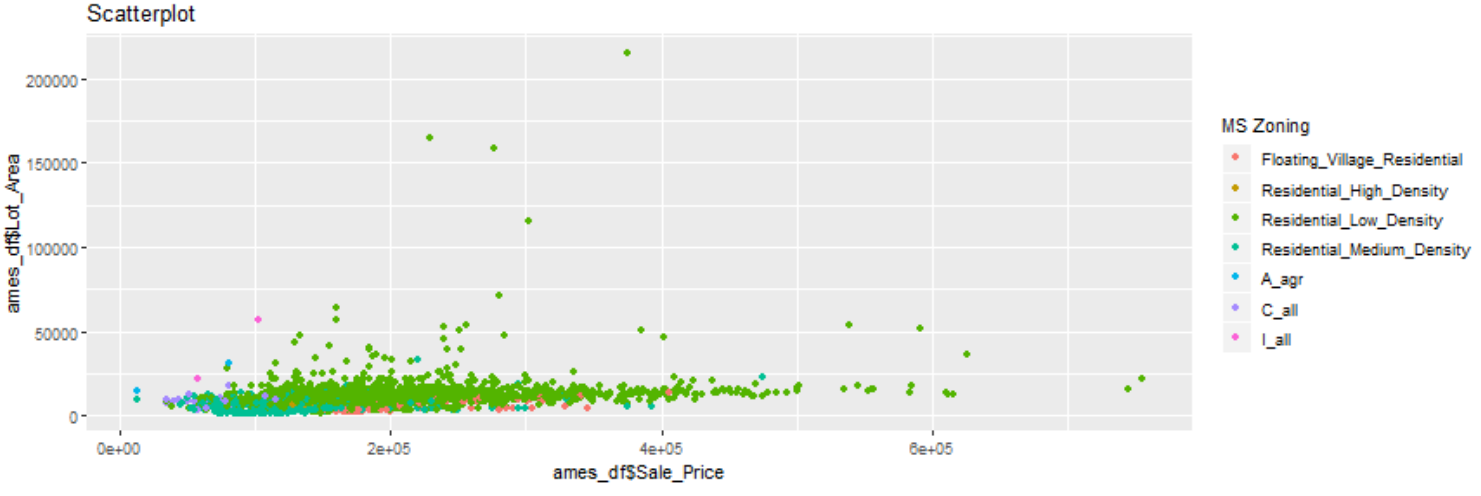
- Load the Ames Housing dataset

```
ames_df <- AmesHousing::make_ames()
```

- Make a scatterplot with the variables sale price and lot area
- If you have that try to color the points according to MS Zoning

What the result should look like

```
ggplot(ames_df) +
    aes(x=ames_df$Sale_Price, y=ames_df$Lot_Area) +
    geom_point(aes(col=as.factor(ames_df$MS_Zoning))) +
    labs(title="Scatterplot", color="MS Zoning") +
    theme(legend.title=element_text(color="black"))
```



The themes in ggplot

```
## Minimal theme
ggplot(mtcars) + aes(wt, mpg) + geom_point() +
    theme_minimal()
```

Themes

```
## the default
ggplot(mtcars) + aes(wt, mpg) + geom_point() + theme_gray()
## Dark, usually not recommended.
ggplot(mtcars) + aes(wt, mpg) + geom_point() + theme_dark()
## Very traditional
ggplot(mtcars) + aes(wt, mpg) + geom_point() + theme_classic()
## Use if you don't want an axis.
ggplot(mtcars) + aes(wt, mpg) + geom_point() + theme_void()
```

- There are a number of other built in themes, but you get the idea.
- You can also create your own themes if one of the built in ones doesn't do what you want.

Colors

```
car.graph <- ggplot(mtcars) + aes(wt, mpg) +
    geom_point(color="red")
car.graph
```

point/line styles.

```
car.graph <- ggplot(mtcars) + aes(wt, mpg) +
    geom_point(shape=21) + geom_line(linetype=2)
car.graph
```

A boxplot

```
ggplot(mtcars) + aes(as.factor(gear), mpg) +geom_boxplot()
```

Adding a title/changing labels

- geom_text() adds text to a plot.
- geom_label() adds stuff to make the text easier to read (e.g., a box around the text).
- labs() modifies your labels/title.
- theme() lets us manipulate stuff like the inclusion of a legend, its position, etc.

Adding a title/changing labels

```
ggplot(mtcars) + aes(as.factor(gear), mpg) +
    geom_boxplot() +
    geom_text(aes(label=as.factor(gear), col="red")) +
    geom_label(aes(label=as.factor(gear), col="red"))+
    labs(x="A different label than earlier.", title="A boxplot, with
    theme(legend.position="none")
```

Saving a graph

```
## Saving to pdf
ggsave(car.graph, file="car_graph.pdf")

## Saving to pdf, while specifying dimensions of plot
ggsave(car.graph, file="car_graph.pdf", width = 20,
       height = 20, units = "cm")

## Saving to png
ggsave(car.graph, file="car_graph.png")

## Other formats are possible.
# See ?ggsave for more information.
```

A barplot

```
## Data + aesthetics + geometry.
ggplot(mtcars)+aes(gear)+geom_bar()
```

A histogram

```
## Data + aesthetics + geometry.
ggplot(mtcars)+aes(mpg)+geom_histogram()
```

A density plot

```
ggplot(mtcars)+aes(mpg)+geom_density()
```

Exercise: Histogram and density plot

Using your data from the scatterplot exercise, produce a histogram for cont.var.x, and a density plot for cont.var.y.

Links to read on

- **Top 50 ggplot2 Visualizations**
- R cookbook for graphs