Introduction to Data Analysis & Visualization with R

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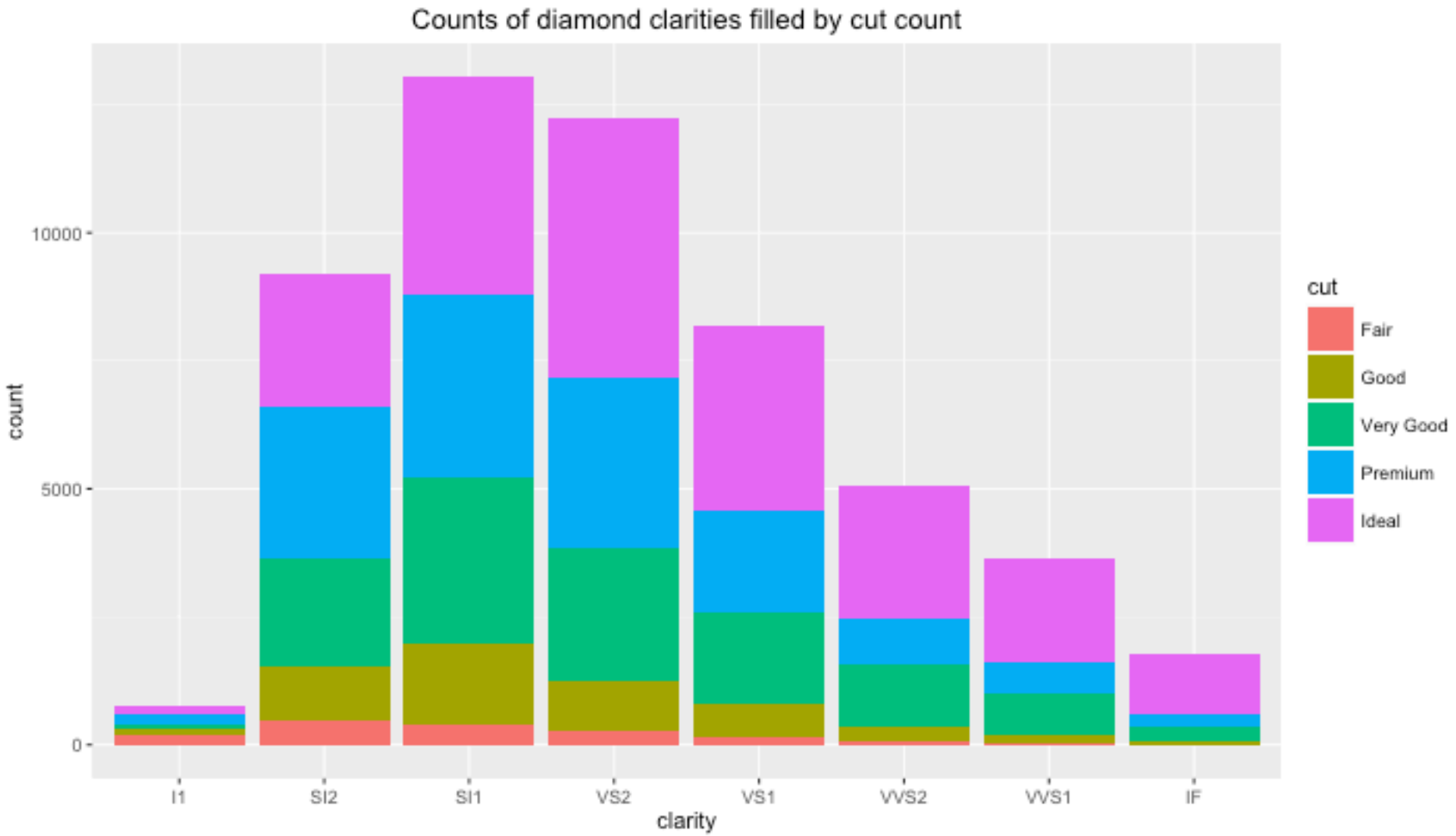
Agenda of Workshop

1. R basics
2. Installation
3. Practice
    1. Plotting data
    2. Statistical analysis

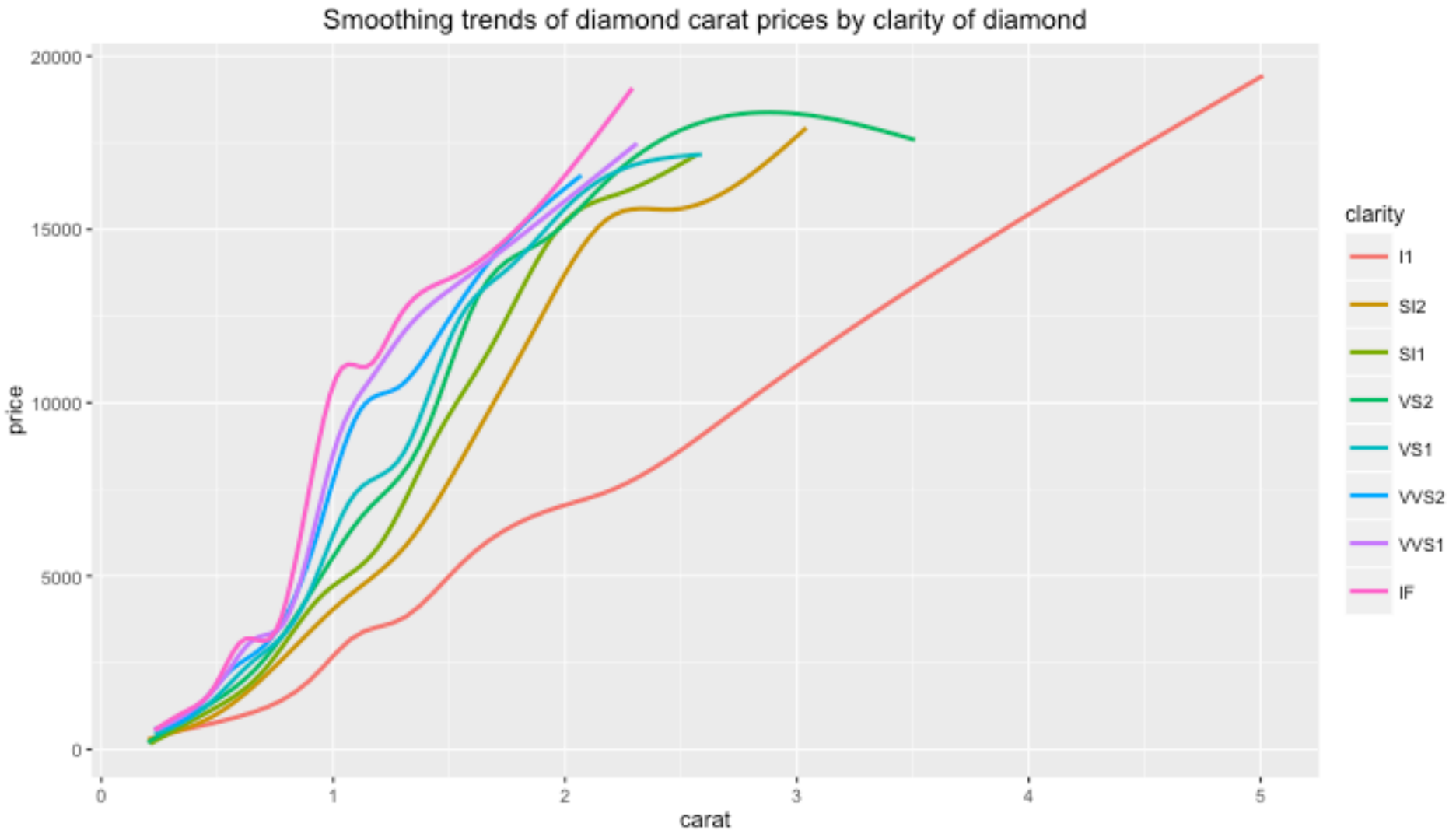
Scope of Workshop

- Demonstration over explanation of statistical concepts

Examples of Workshop Output



Examples of Workshop Output



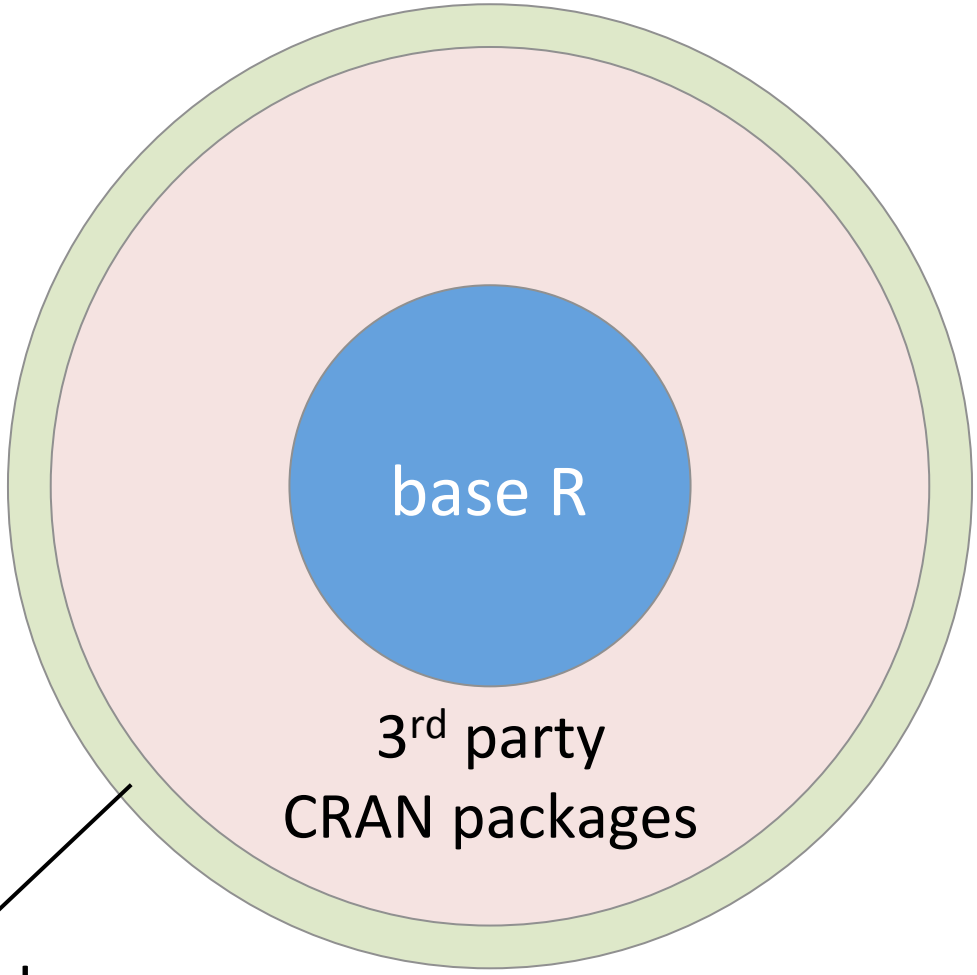
Examples of Workshop Output

```
> fit = lm(mpg ~ wt, mtcars)
> summary(fit)

Call:
lm(formula = mpg ~ wt, data = mtcars)

Residuals:
    Min      1Q  Median      3Q     Max
-4.5432 -2.3647 -0.1252  1.4096  6.8727

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  37.2851     1.8776  19.858  < 2e-16 ***
wt           -5.3445     0.5591  -9.559 1.29e-10 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 3.046 on 30 degrees of freedom
Multiple R-squared:  0.7528,    Adjusted R-squared:  0.7446
F-statistic: 91.38 on 1 and 30 DF,  p-value: 1.294e-10
```

About R

- https://www.r-project.org/
- Free and open source software
- Runs on Windows, OSX, GNU/Linux, FreeBSD, and more
- R is a programming language and environment
- Default install provides “base R” suite of packages, or tools
- Install more packages via CRAN
  - CRAN = Comprehensive R Archive Network
  - https://cran.r-project.org/
  - The main source for downloading for R and most packages
  - Each package comes with documentation
  - Very active global community of users and developers (so help and guidance can usually be found quickly online)

R's Package Ecosystem



RStudio

- https://www.rstudio.com/
- Free and open source software
- Combines the power of the command line with the usability of a graphical user interface
- Provides the same experience across operating systems (which the R application and other GUIs do not)
- Requires prior R installation

Brief Look at R Syntax for Basic Calculation

```
> #
> # Basic arithmetic
> #
>
> 3 + 5         # addition
[1] 8
> 20 - 5        # subtraction
[1] 15
> 10 * 10       # multiplication
[1] 100
> 3 / 4         # division
[1] 0.75
> 18 %/% 12     # just the integer part of the quotient
[1] 1
> 18 %% 12      # just the remainder part (modulo)
[1] 6
> 10 ^ 2        # exponentiation
[1] 100
> log(10)       # natural log (base e)
[1] 2.302585
> exp(2.302585)# antilog, e raised to a power
[1] 9.999999
> log10(100)    # base 10 logs; log(100, base=10) is the same
[1] 2
> sqrt(100)     # square root
[1] 10
>
```

Brief Look at More Useful R Syntax

```
# Working with variables
x <- 5
y <- 9
y - x
[1] 4
sqrt(y)
[1] 3
data <- read.csv("myData.csv", header = T)

# Keyword functions

install.packages("ggplot2")    # Install the ggplot2 library
library("ggplot2")             # Load the ggplot2 library into current workspace
library()                      # List all the packages built in to base R
data()                         # List all the datasets built in to base R
help(mtcars)                   # Show the description of the mtcars dataset
example("ggplot2")             # Show examples of using the ggplot2 library
getwd()                        # Get the current working directory for current workspace
setwd()                        # Set the current working directory for current workspace
list.files()                   # List the files in the working directory
```

INSTALLATION

1. R, https://cran.r-project.org/
2. RStudio, https://www.rstudio.com/

HANDS-ON DEMO

Library Guide on R

http://guides.hshsl.umaryland.edu/R