```
library(quantmod)
```

```
## Warning: package 'quantmod' was built under R version 3.4.2
```

```
## Loading required package: xts
```

```
## Loading required package: zoo
```

```
##
## Attaching package: 'zoo'
```

```
## The following objects are masked from 'package:base':
##
##     as.Date, as.Date.numeric
```

```
## Loading required package: TTR
```

```
## Version 0.4-0 included new data defaults. See ?getSymbols.
```

```
options("getSymbols.warning4.0"=FALSE)
```

R and Finance: Using Quantmod to better understand Stocks

Introduction

One of my interests is finance and investing, and after starting this course, I wondered about how I could use R to better understand financial data and the movement of stock prices. R packages we have used in this course such as ggplot and ggvis weren't the most useful available to visualize financial data.I came across a R package called Quantmod. Quantmod is meant to "assist the quantitative trader in the development, testing, and deployment of statistically based trading models." This was built specifically to provide a better framework and workflow for financial data analysis and visualization. I will go over the basics of quantmod and show how to use this package visualize financial data in an informative way.

Getting Data using Quantmod

Quantmod can load financial data from the web from a variety of sources, including online ones. It can access Yahoo Finance, Google Finance, local data, .csv files, Federal Reserve Bank of St. Louis economic files, and more.

```
#Loading Data
getSymbols("STZ", src = "google") #loading data from stock "STZ", from Google finance
```

```
## Warning in as.POSIXlt.POSIXct(Sys.time()): unknown timezone 'zone/tz/2017c.
## 1.0/zoneinfo/America/Los_Angeles'
```

```
## [1] "STZ"
```

```
getSymbols("VOOG", src = "yahoo") #Stock AAPL from Yahoo Finance
```

```
##
## WARNING: There have been significant changes to Yahoo Finance data.
## Please see the Warning section of '?getSymbols.yahoo' for details.
##
## This message is shown once per session and may be disabled by setting
## options("getSymbols.yahoo.warning"=FALSE).
```

```
## Warning: VOOG contains missing values. Some functions will not work if
## objects contain missing values in the middle of the series. Consider using
## na.omit(), na.approx(), na.fill(), etc to remove or replace them.
```

```
## [1] "VOOG"
```

```
#Loading and saving the data
setSymbolLookup(STZ = 'google', VOOG = 'yahoo')
setSymbolLookup("VOOG", src = "google")
saveSymbolLookup("symbols.rda") # Save the Data
loadSymbolLookup("symbols.rda")
getSymbols(c("STZ", "VOOG"))
```

```
## Warning: VOOG contains missing values. Some functions will not work if
## objects contain missing values in the middle of the series. Consider using
## na.omit(), na.approx(), na.fill(), etc to remove or replace them.
```

```
## [1] "STZ"  "VOOG"
```

```
#Look at the data
head(STZ)
```

```
##            STZ.Open STZ.High STZ.Low STZ.Close STZ.Volume
## 2007-01-03    28.80    29.17   28.21     28.40    2501000
## 2007-01-04    26.50    26.60   25.10     25.15    9150100
## 2007-01-05    24.76    24.92   24.07     24.41    7236600
## 2007-01-08    24.84    24.90   24.60     24.71    3062200
## 2007-01-09    24.68    24.95   24.60     24.65    1764400
## 2007-01-10    24.67    25.05   24.56     24.92    2598400
```

This will show the stocks opening, closing, highest, and lowest points for every day.

Data Handling Functions

Looking at variables

Recently, quantmod has added new data handling features to make quickly looking at various variables easier. Once you load the data, you can load variables using the following functions. Op(): opening price Cl(): closing price Lo(): lowest price Hi(): highest price Vo(): volume

Subsetting by Time and Date

Subsetting by time is possible to look at certain time periods

```
head(VOOG['2014']) #Look at the 2014 data from the VOOG stock, a ETF that tracks the S&P 500
```

```
##            VOOG.Open VOOG.High VOOG.Low VOOG.Close VOOG.Volume
## 2014-01-02     88.11     88.11    87.38      87.64       29800
## 2014-01-03     87.85     87.85    87.37      87.38       28400
## 2014-01-06     87.71     87.71    86.99      87.23       27700
## 2014-01-07     87.53     87.85    87.53      87.85       17200
## 2014-01-08     87.72     88.03    87.57      87.85       29700
## 2014-01-09     88.43     88.43    87.65      87.94       13900
##            VOOG.Adjusted
## 2014-01-02      82.98158
## 2014-01-03      82.73541
## 2014-01-06      82.59338
## 2014-01-07      83.18044
## 2014-01-08      83.18044
## 2014-01-09      83.26564
```

```
head(VOOG['2014-5']) #Look at data from 05-2014
```

```
##            VOOG.Open VOOG.High VOOG.Low VOOG.Close VOOG.Volume
## 2014-05-01     89.55     90.01    89.52      89.57       13400
## 2014-05-02     89.67     90.03    89.49      89.60       35600
## 2014-05-05     89.25     90.02    88.91      89.97       10500
## 2014-05-06     89.70     89.84    89.18      89.18        8600
## 2014-05-07     89.44     89.44    88.51      89.36       14000
## 2014-05-08     89.37     90.08    89.00      89.24       21900
##            VOOG.Adjusted
## 2014-05-01      85.04452
## 2014-05-02      85.07301
## 2014-05-05      85.42432
## 2014-05-06      84.67423
## 2014-05-07      84.84514
## 2014-05-08      84.73119
```

```
head(VOOG['2014::2016']) #Data from 2014 through 2016
```

```
##            VOOG.Open VOOG.High VOOG.Low VOOG.Close VOOG.Volume
## 2014-01-02     88.11     88.11    87.38       87.64        29800
## 2014-01-03     87.85     87.85    87.37       87.38        28400
## 2014-01-06     87.71     87.71    86.99       87.23        27700
## 2014-01-07     87.53     87.85    87.53       87.85        17200
## 2014-01-08     87.72     88.03    87.57       87.85        29700
## 2014-01-09     88.43     88.43    87.65       87.94        13900
##            VOOG.Adjusted
## 2014-01-02      82.98158
## 2014-01-03      82.73541
## 2014-01-06      82.59338
## 2014-01-07      83.18044
## 2014-01-08      83.18044
## 2014-01-09      83.26564
```

```
head(Cl(VOOG)) # Closing price
```

```
##            VOOG.Close
## 2010-09-09      50.83
## 2010-09-10      50.92
## 2010-09-13      51.61
## 2010-09-14      51.69
## 2010-09-15      51.77
## 2010-09-16      51.91
```

```
#combine functions to look at price change between data points
head(OpCl(VOOG)) #percent change from open to close
```

```
##               OpCl.VOOG
## 2010-09-09 -0.003137870
## 2010-09-10  0.003152088
## 2010-09-13  0.003890313
## 2010-09-14  0.003299670
## 2010-09-15  0.002517448
## 2010-09-16  0.002123571
```

Charting Data

Quantmod allows you to use various charts to visualize any data that you load. The chartSeries function allows for very useful visualization in different forms, such as line charts, candle charts, and bar charts.

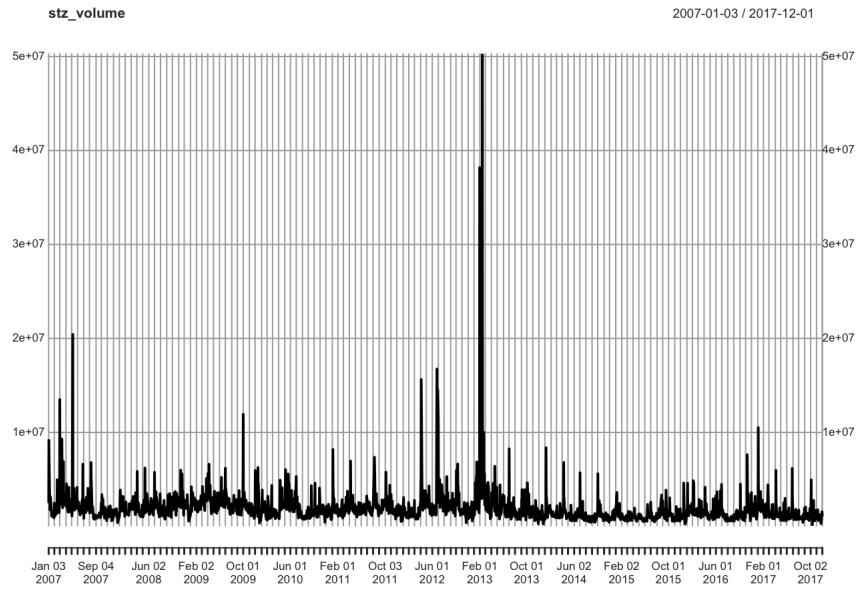
```
barChart(STZ)
```


```
barChart(VOOG)
```

The X-axis represents time, and the y-axis represents the stocks price. It also shows the volume of stock that was traded

We can select a certain variable and chart it. Here we will choose the volume of the Constellation Brand (STZ) stock.

```
#setting a variable to volume of STZ
stz_volume = Vo(STZ)
plot(stz_volume)
```

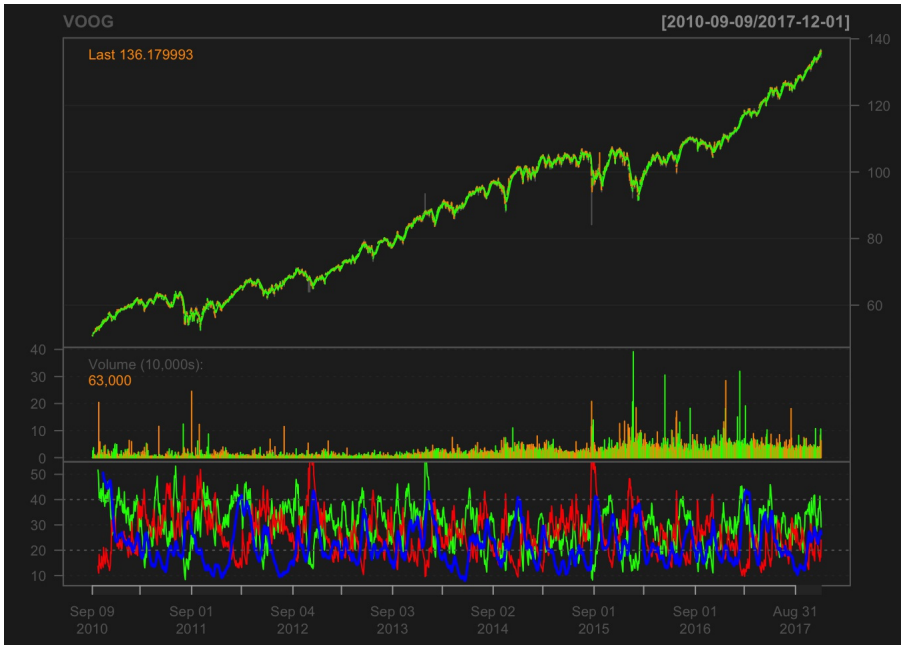


We can also use quantmod to add various technical indicators using the chartSeries function.

```
chartSeries(VOOG) #load the chart
```

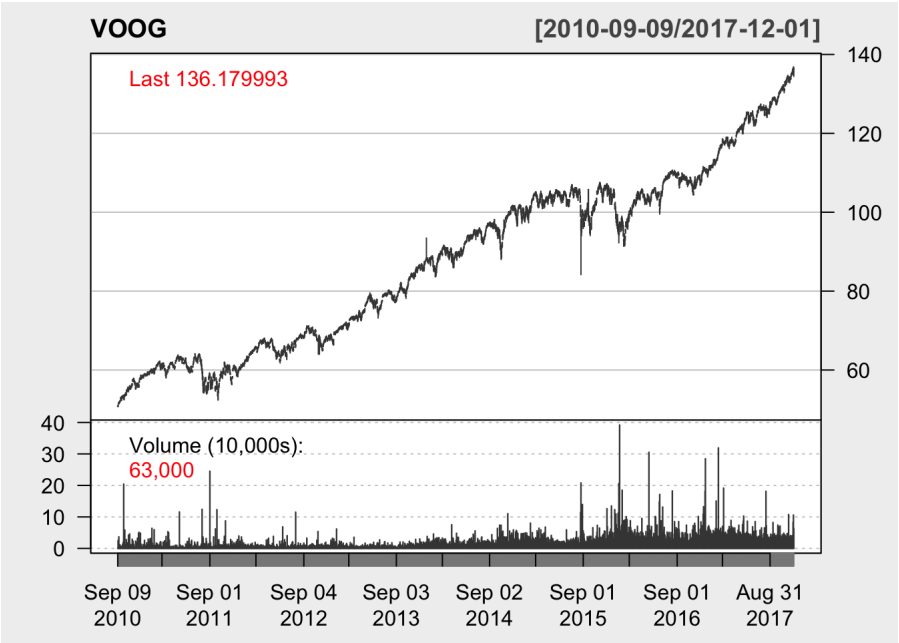

```
addWMA() #Add weighted moving average
```


```
addADX() #add directional movement indicator
```



You can also use other styles of charts, such as Candle Charts

```
candleChart(VOOG, multi.col = TRUE, theme = 'white')
```



A more useful extention of this is to chart a subsetted time period of the data.

```
candleChart(VOOG, subset = "2016-1::2016-6", multi.col = TRUE, theme = 'white') #Subsetted from January 2014 to December 2016
```

This allows us to get a closer look at any time period.

Conclusion Quantmod allows us to access financial data from the web and manipulate data in our console. There are many functions and chart additions that allow for analysis and visualization of that analysis very quickly. We can use this when researching stocks.

Resources: - R-Bloggers - Charting Examples - Intro to QuantMod - Documentation - Data Handling - Cran resource - [http://amunategui.github.io/wallstreet/]