SDM4 in R: Scatterplots, Association, and Correlation (Chapter 6)

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Introduction and background

This document is intended to help describe how to undertake analyses introduced as examples in the Fourth Edition of *Stats: Data and Models* (2014) by De Veaux, Velleman, and Bock. More information about the book can be found at http://wps.aw.com/aw_deveaux_stats_series. This file as well as the associated R Markdown reproducible analysis source file used to create it can be found at http://nhorton.people.amherst.edu/sdm4.

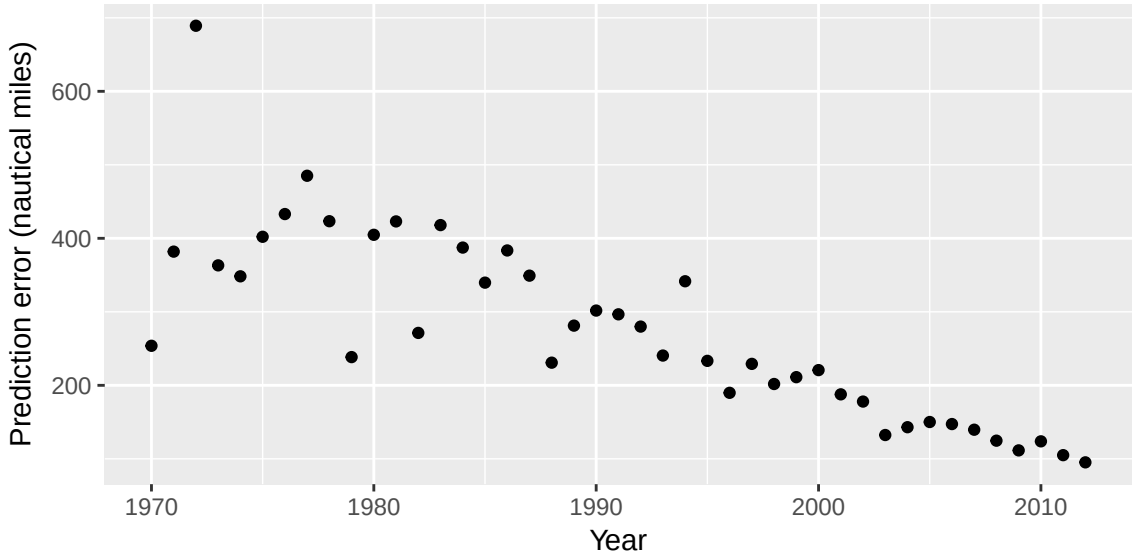
This work leverages initiatives undertaken by Project MOSAIC (http://www.mosaic-web.org), an NSF-funded effort to improve the teaching of statistics, calculus, science and computing in the undergraduate curriculum. In particular, we utilize the `mosaic` package, which was written to simplify the use of R for introductory statistics courses. A short summary of the R needed to teach introductory statistics can be found in the mosaic package vignettes (http://cran.r-project.org/web/packages/mosaic). A paper describing the mosaic approach was published in the *R Journal*: https://journal.r-project.org/archive/2017/RJ-2017-024.

Chapter 6: Scatterplots, Association, and Correlation

Section 6.1: Scatterplots

Figure 6.1 (page 152) displays the scatterplot of the average tracking error over time.

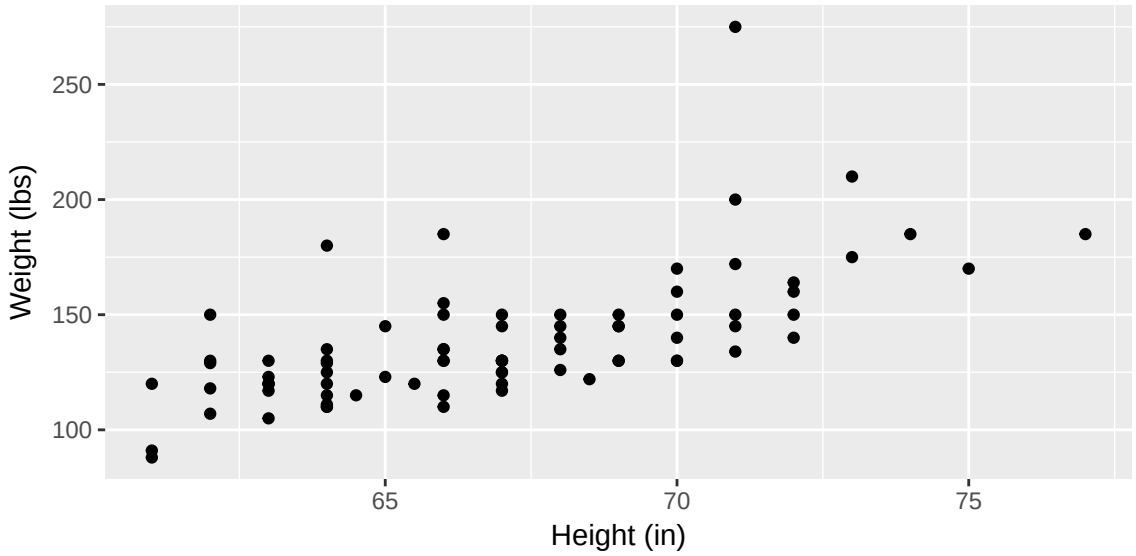
```
library(mosaic)
library(readr)
options(digits = 3)
Hurricanes <-
  read_csv("http://nhorton.people.amherst.edu/sdm4/data/Tracking_hurricanes_2012.csv")
gf_point(Error72h ~ Year, ylab = "Prediction error (nautical miles)", data = Hurricanes)
```



Section 6.2: Correlation

Figure 6.2 (page 155) displays the scatterplot of weight vs. height for a sample of students from statistics classes.

```
HtWt <- read_csv("http://nhorton.people.amherst.edu/sdm4/data/Heights_and_Weights.csv")
gf_point(Weight ~ Height, ylab = "Weight (lbs)", xlab = "Height (in)", data = HtWt)
```




```
cor(Weight ~ Height, data = HtWt)
```

```
## [1] 0.644
```

Kendall's Tau and Spearman's Rho

```
cor(Weight ~ Height, method = "kendall", data = HtWt)
```

```
## [1] 0.545
```

```
cor(Weight ~ Height, method = "spearman", data = HtWt)
```

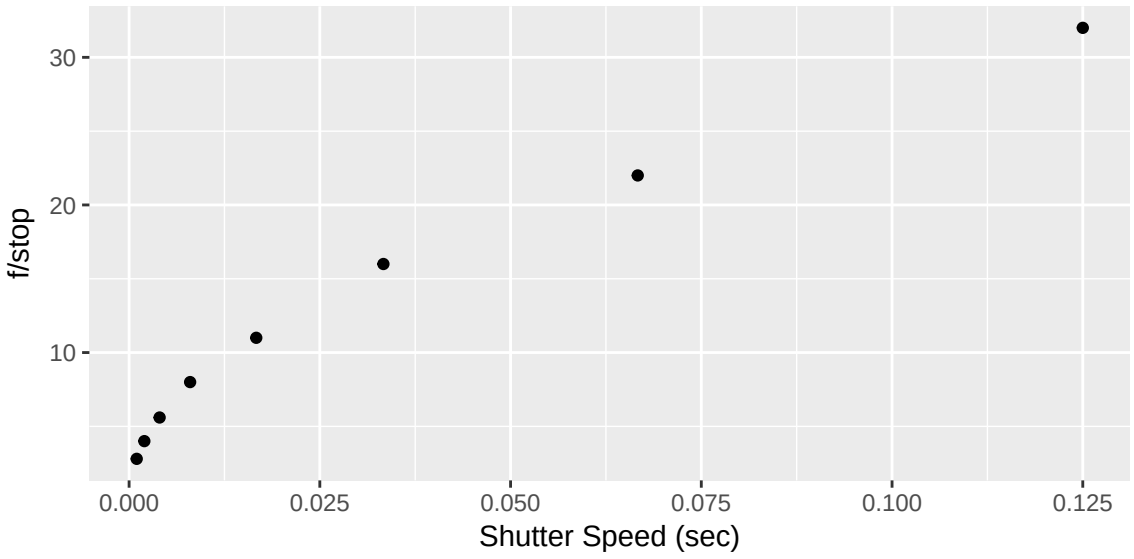
```
## [1] 0.697
```

Section 6.3: Warning: Correlation does not always equal Causation

Section 6.4: Straightening scatterplots

Since the dataset is so small for Figure 6.10 (page 165) we can enter it by hand.

```
fstop <- c(2.8, 4, 5.6, 8, 11, 16, 22, 32)
shutter <- c(1/1000, 1/500, 1/250, 1/125, 1/60, 1/30, 1/15, 1/8)
lenses <- data.frame(fstop, shutter)
gf_point(fstop ~ shutter, ylab = "f/stop", xlab = "Shutter Speed (sec)",
         data = lenses)
```



A new transformed variable can be added using the `mutate` function.

```
lenses <- mutate(lenses, fstopsq = fstop * fstop)
gf_point(fstopsq ~ shutter, ylab = "f/stop (squared)", xlab = "Shutter Speed (sec)",
         data = lenses)
```