MA 750: HW2

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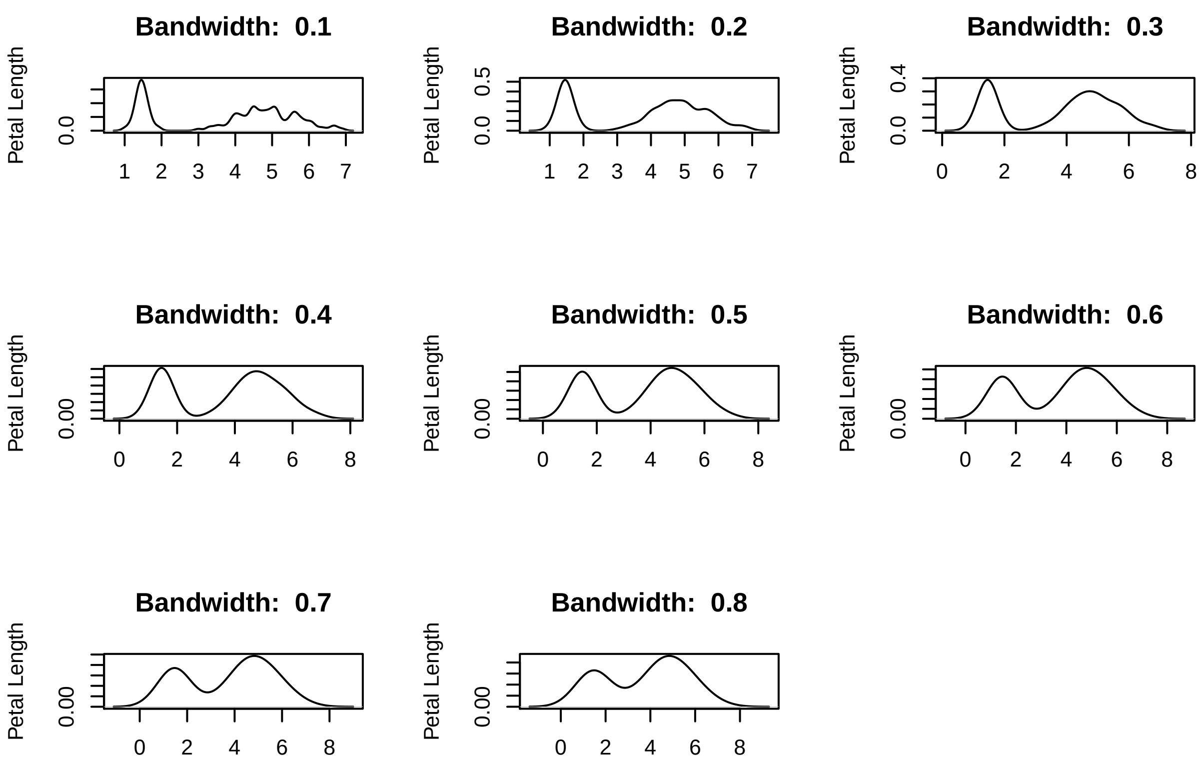
Exercise 2.4

```r
# take a peak at the data
head(iris)
```

```
##   Sepal.Length Sepal.Width Petal.Length Petal.Width Species
## 1          5.1         3.5          1.4         0.2  setosa
## 2          4.9         3.0          1.4         0.2  setosa
## 3          4.7         3.2          1.3         0.2  setosa
## 4          4.6         3.1          1.5         0.2  setosa
## 5          5.0         3.6          1.4         0.2  setosa
## 6          5.4         3.9          1.7         0.4  setosa
```

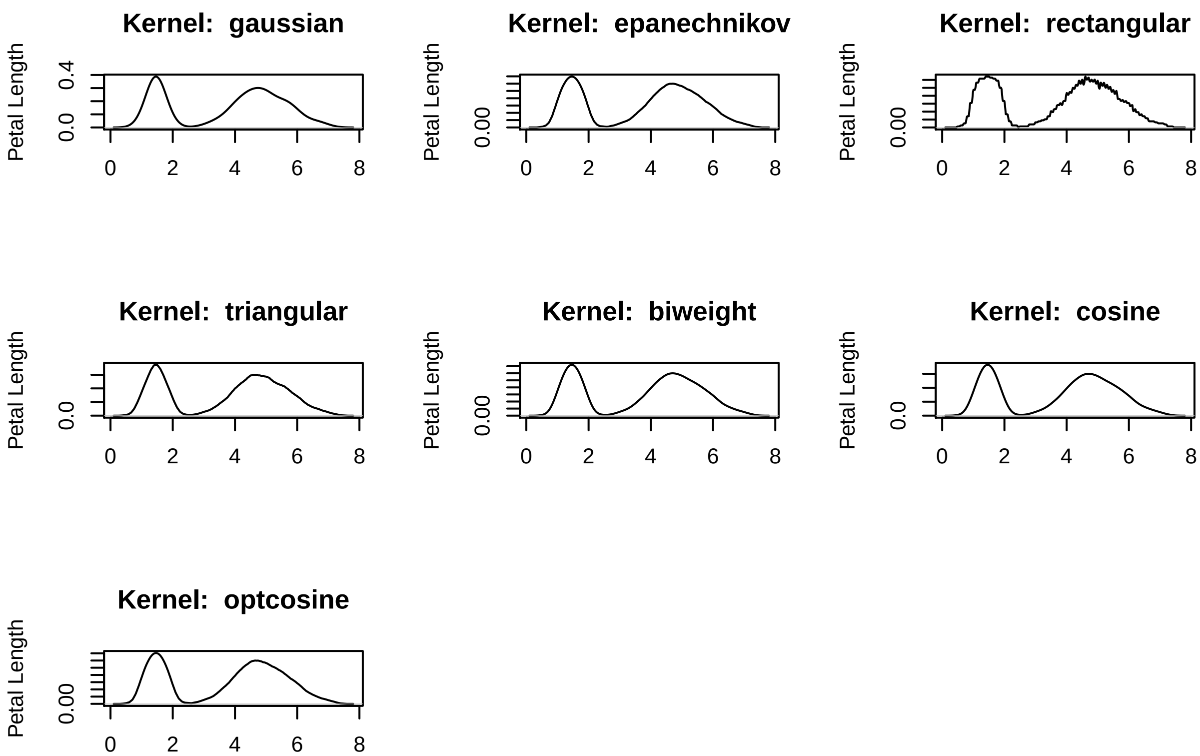
```r
# Take a look at multiple bandwidths
par(mfrow = c(3, 3))
for (h in seq(0.1, 0.8, 0.1)) {
    plot(density(iris$Petal.Length, bw = h, kernel = "gaussian"),
        xlab = "", ylab = "Petal Length", main = paste("Bandwidth: ",
            h))
}
```



It appears that bandwidths of $h > .4$ oversmooth the data. In fact, we see at $h \approx 0.45$ that the mode changes from the first feature to the second. This behaviors shows how bandwidth selection can dramatically change the results of this sommthing method. It appears that both $h = 0.1, 0.2$ undersmooth the data with several rigid edges. A bandwidth of $h = 0.3$ seems to best smooth the data - preserving local features while smoothing the data.

```r
# Take a look at multiple kerenels
kernels = c("gaussian", "epanechnikov", "rectangular", "triangular",
    "biweight", "cosine", "optcosine")

par(mfrow = c(3, 3))
for (kern in kernels) {
    plot(density(iris$Petal.Length, bw = 0.3, kernel = kern),
        xlab = "", ylab = "Petal Length", main = paste("Kernel: ",
            kern))
}
```



This chart shows how little effect the choice of kernel has on our model results. Aside from the rectangular kernel, all charts appear *relatively* similar. The triangular kernel may also fail to smooth the data appropriately while the optcosine and cosine may othersmooth the data. In my opinion, the Gaussian and Epanechnikov kernels preform the best. Although similar, I would choose the Epanechnikov kernel over all other kernels.