Tesla battery survey polynomial prediction

2024-03-31

From https://electrek.co/2018/04/14/tesla-battery-degradation-data/

"Battery degradation is one of the biggest concerns for electric car owners and potential buyers, but data from Tesla battery packs have been very reassuring so far. A group of Tesla owners on the Dutch-Belgium Tesla Forum are gathering data from over 350 Tesla vehicles across the world and frequently updating it in a public Google file.' '

- Here we will use the Tesla battery survey to explore the nature of the predictive accuracy of various polynomials, The file `tesla_battery_Survey.csv` contains battery and mileages information on variety on Tesla. We will try to predict `Remaining.battery.capacity` using `Your.mileage.km`.

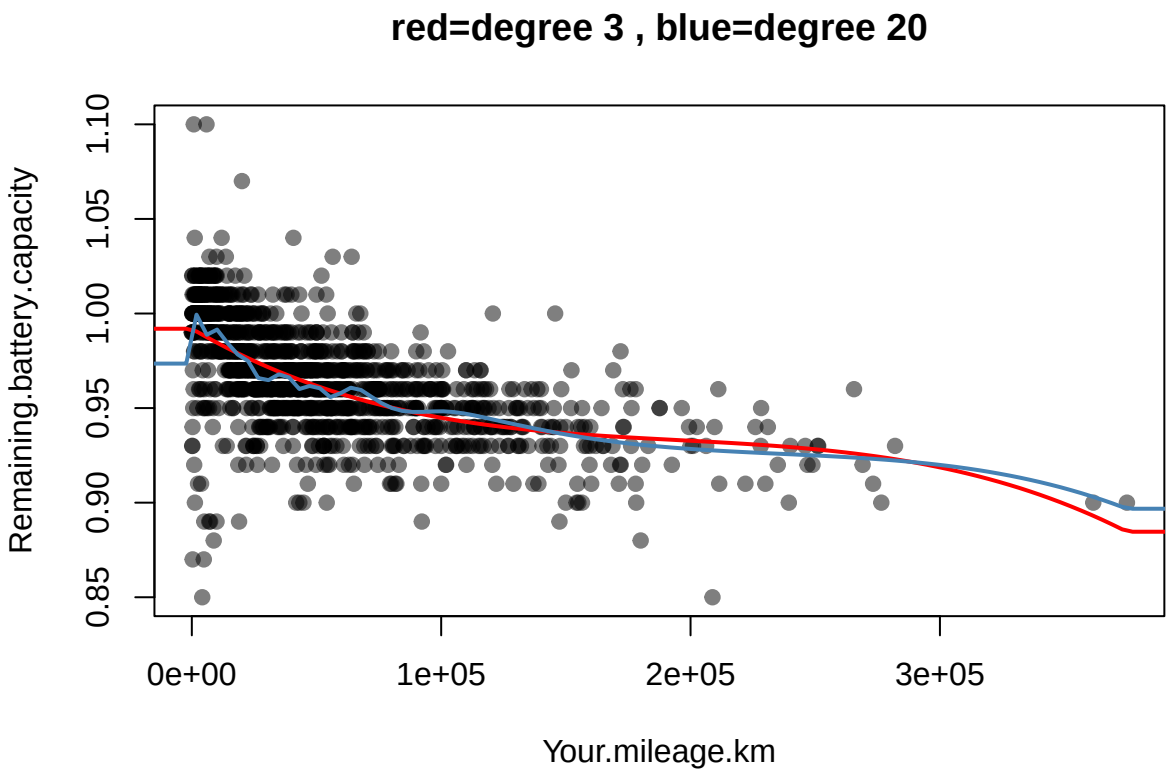
We now generate the scatter plot of the data (with shading) and overlay the fitted polynomials with degrees 3 and 20 to the data.

```
library(splines)
tesla_data = read.csv("tesla_battery_Survey.csv")
tesla_data$x = tesla_data$Your.mileage.km
tesla_data$y = tesla_data$Remaining.battery.capacity


muhat3  <- getmuhat(tesla_data, 3)
muhat12 <- getmuhat(tesla_data, 20)

xlim <- extendrange(tesla_data$x)

plot(tesla_data[,c('Your.mileage.km', 'Remaining.battery.capacity')],
     pch=19, col= adjustcolor("black", 0.5))
curve(muhat3, from = xlim[1], to = xlim[2],
      add = TRUE, col="red", lwd=2)
curve(muhat12, from = xlim[1], to = xlim[2],
      add = TRUE, col="steelblue", lwd=2)
title(main="red=degree 3 , blue=degree 20")
```



Since we only have 350 Tesla Vehicles as our population, which is quite small. We will generate $m = 25$ samples of size $n = 600$. Fit polynomials of degree 3 and 20 to every sample.

```
m=25
n= 600
samps    <- lapply(1:m, FUN= function(i){getSampleComp(tesla_data, n)})
Ssamples <- lapply(samps, FUN= function(Si){getXYSample("x", "y", Si, tesla_data)})
Tsamples <- lapply(samps, FUN= function(Si){getXYSample("x", "y", !Si, tesla_data)})

muhats3 <- lapply(Ssamples, getmuhat, complexity = 3)
muhats20 <- lapply(Ssamples, getmuhat, complexity = 20)
```

We now plot all the fitted polynomials with degree 3 and 20 on two different figures. Overlay the two fitted polynomials of degree 3 and 20 based on the whole population.

```
par(mfrow=c(1,2))

xvals <- seq(xlim[1], xlim[2], length.out = 200)
plot(tesla_data[,c('Your.mileage.km', 'Remaining.battery.capacity')],
     pch=19, type='n',
     xlab="Your.mileage.km", ylab="Remaining.battery.capacity",
     main= " muhats (degree = 3) & mubar")


for (i in 1:m) {
  curveFn <- muhats3[[i]]
```

```
  curve(curveFn, from = xlim[1], to = xlim[2], add=TRUE, col=adjustcolor("blue", 0.2), lwd=3, lty=(1))
}

curve(muhat3,  from = xlim[1], to = xlim[2],
      add=TRUE, col="firebrick", lwd=3)

points(tesla_data[,c('Your.mileage.km', 'Remaining.battery.capacity')],
     pch=19, col= adjustcolor("black", 0.5))


plot(tesla_data[,c('Your.mileage.km', 'Remaining.battery.capacity')],
     pch=19, type='n',
     xlab="x", ylab="predictions",
     main= " muhats (degree = 20) & mubar")

for (i in 1:m) {
  curveFn <- muhats20[[i]]
  curve(curveFn, xlim[1], xlim[2], add=TRUE, col=adjustcolor("blue", 0.2), lwd=3, lty=1)
}

curve(muhat12, xlim[1], xlim[2], add=TRUE, col="firebrick", lwd=3)

points(tesla_data[,c('Your.mileage.km', 'Remaining.battery.capacity')],
     pch=19, col= adjustcolor("black", 0.5))
```