

## Supplement for Lecture 27: Logistic Regression

### Load Data

```
#Load and Preview Data
data(Putts1)
head(Putts1)

#Inspect Data
COMPLETE
```

### Plot of Raw Data

```
plot(Putts1$Length,Putts1$Made,pch=16)
abline(lm(Made~Length,data=Putts1),lty=4,lwd=2,col="red")
```

### Plot of Summarized Data

```
COMPLETE

Putts.Summary=data.frame(Length=3:7,Prob=COMPLETE)

COMPLETE
```

### Logistic Regression Model

```
putt.mod = COMPLETE
summary(putt.mod)
```

### Visualization of Logistic Regression Model

```
COMPLETE
COMPLETE

plot(jitter(Made,amount=0.1)~Length,data=Putts1,pch=16)
curve(exp(b0+b1*x)/(1+exp(b0+b1*x)),col="red",add=TRUE)

plot(Prob~Length,data=Putts.Summary,pch=16,ylim=c(0,1),xlim=c(0,14))
curve(exp(b0+b1*x)/(1+exp(b0+b1*x)),col="red",lwd=2,add=TRUE)
abline(h=c(0,1),lwd=2,col="blue",lty=4)
abline(h=0.5,lwd=2,col="orange",lty=2)
```

## Comparing Sample Proportions to Estimated Probabilities

```
prop=COMPLETE
prob=COMPLETE

OUT = data.frame(Length=3:7,Proportion = prop, Probability=prob)
OUT
```

## Odds

```
#Calculate using Formula
OUT$Odds = COMPLETE

#Calculate using Predict Function
COMPLETE

#Plot log(odds) vs Length
plot(x=OUT$Length,y=log(OUT$Odds),pch=16)
abline(a=b0,b=b1,col="red")
```

## Odds Ratios

```
#Compare 3ft Putts to 7ft Putts
exp(b0+b1*3)/exp(b0+b1*7)

#Compare 7ft Putts to 3ft Putts (Reciprocal)
exp(b0+b1*7)/exp(b0+b1*3)
```

Interpretation: The odds of making a 3ft putt is 9.63 times the odds of making a 7ft putt. This is equivalent to saying the odds of making a 7ft putt is 0.10 times the odds of making a 3ft putt. Typically, statisticians prefer interpreting odds  $>1$  which requires putting the group with the higher chance of success in the numerator.

## Relationship to Slope of Line

```
#Compare 4ft Putts to 3ft Putts
COMPLETE

#Compare 7ft Putts to 6ft Putts
COMPLETE

#Calculate Slope From Odds Ratio
COMPLETE

#Notice the difference here
COMPLETE
```

Notice: For every one unit increase in X, the odds of success increases by a factor of  $e^{b1}$

```
#Empirical Logit Plot
COMPLETE
```