LogisticRegressionOlingFailure

STAT380

2023-10-05

# O-Ring Failure Data

## The context

The Space Shuttle Challenger crashed 73 seconds after liftoff on January 28th, 1986. The disaster claimed the lives of all seven astronauts on board. The details surrounding this disaster were very involved.

“The engineers who manufactured the large boosters that launched the rocket had data on the possible failures that could happen during cold temperatures. They tried to prevent the launch, but were ultimately ignored and disaster ensued.”

It was known that there is an association between the ORing seal failure and the low atmosphere temparature temperature.

The “fail” column in the data set below records how many O-rings experienced failures during that particular launch. The “temp” column lists the outside temperature at the time of launch.

### The data is available at: “<https://raw.githubusercontent.com/subhadippal2019/STAT380UAEU/main/oring1.csv>”

oring1<-read.csv(url("https://raw.githubusercontent.com/subhadippal2019/STAT380UAEU/main/oring1.csv"))  
summary(oring1)

## X temperature oringFail   
## Min. : 1.00 Min. :53.00 Min. :0.0000   
## 1st Qu.: 6.75 1st Qu.:67.00 1st Qu.:0.0000   
## Median :12.50 Median :70.00 Median :0.0000   
## Mean :12.50 Mean :69.92 Mean :0.2917   
## 3rd Qu.:18.25 3rd Qu.:75.25 3rd Qu.:1.0000   
## Max. :24.00 Max. :81.00 Max. :1.0000

## Fit the logistic regression model:

fit\_oring<-glm(oringFail~temperature, data=oring1, family="binomial")  
summary(fit\_oring)

##   
## Call:  
## glm(formula = oringFail ~ temperature, family = "binomial", data = oring1)  
##   
## Deviance Residuals:   
## Min 1Q Median 3Q Max   
## -1.2125 -0.8253 -0.4706 0.5907 2.0512   
##   
## Coefficients:  
## Estimate Std. Error z value Pr(>|z|)   
## (Intercept) 10.87535 5.70291 1.907 0.0565 .  
## temperature -0.17132 0.08344 -2.053 0.0400 \*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## (Dispersion parameter for binomial family taken to be 1)  
##   
## Null deviance: 28.975 on 23 degrees of freedom  
## Residual deviance: 23.030 on 22 degrees of freedom  
## AIC: 27.03  
##   
## Number of Fisher Scoring iterations: 4

### predict the probability of Failure at a given atmosphere temperature

#predict(fit\_oring)  
predict(fit\_oring,newdata = data.frame(temperature=31))

## 1   
## 5.564414

predict(fit\_oring,newdata = data.frame(temperature=31), type="response")

## 1   
## 0.9961828