

Logistic Regression

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This is logistic regression. I am going to use 'Newton-Raphson Method' (here equivalent to Fisher's Scoring method) to solve regression coefficient estimate Beta.

```
data=read.csv("https://stats.idre.ucla.edu/stat/data/binary.csv")
sigmoid=function(p){
  exp(p)/(1+exp(p))
}
y=data$admit
n=nrow(data)
x=cbind(1,data$gre,data$gpa)
Ba=solve(t(x)%*%x)%*%t(x)%*%(y)
ua=x%*%Ba
itr=function(Ba){
  u=r=as.vector(array(NA,n))
  for(i in 1:n){
    u[i]=sigmoid(t(Ba)%*%x[i,])
    r[i]=u[i]*(1-u[i])
  }
  S=diag(r)
  list(u=u,Sa=S)
}
ic=0
eps=1
while(ic<1000 && eps>0.000001){
  BOLD=(solve(t(x)%*%itr(Ba)$Sa)%*%t(x)%*%((itr(Ba)$Sa)%*%x%*%Ba)+y-itr(Ba)$u)
  BNEW=(solve(t(x)%*%itr(BOLD)$Sa)%*%t(x)%*%(((itr(BOLD)$Sa))%*%x%*%BOLD)+y-itr(BOLD)$u)
  eps=(t(BNEW)%*%BNEW)-(t(BOLD)%*%BOLD)
  BOLD=BNEW
  ic=ic+1
}
```

The regression coefficient estimate is

BNEW

```
##           [,1]
## [1,] -4.914127153
## [2,]  0.002669534
## [3,]  0.748844402
```