

Logistic Regression Analysis of HIV Data (p.49 and p.205)

Binary Logistic Regression: y, n versus x

Link Function: Logit

Response Information

Variable	Value	Count
y	Event	7
	Non-event	24
n	Total	31

Logistic Regression Table

Predictor	Coef	SE Coef	Z	P	Odds Ratio	95% CI	
Constant	-1.70475	0.543557	-3.14	0.002			
x	2.11021	1.06243	1.99	0.047	8.25	1.03	66.19

Log-Likelihood = -14.527

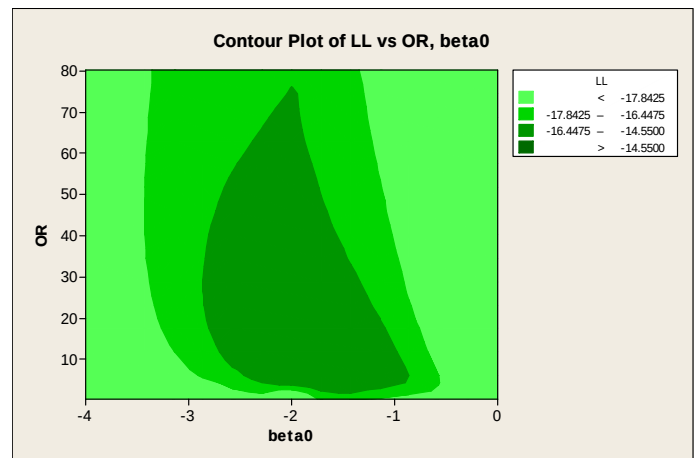
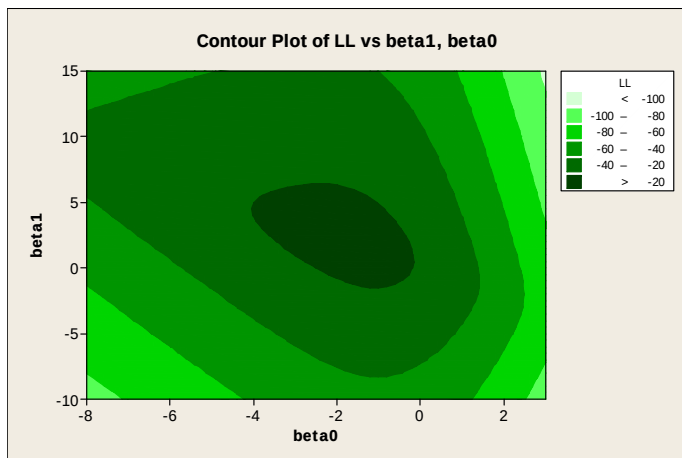
Test that all slopes are zero: G = 4.063, DF = 1, P-Value = 0.044

Measures of Association:

(Between the Response Variable and Predicted Probabilities)

Pairs	Number	Percent	Summary Measures	
Concordant	66	39.3	Somers' D	0.35
Discordant	8	4.8	Goodman-Kruskal Gamma	0.78
Ties	94	56.0	Kendall's Tau-a	0.12
Total	168	100.0		

Log-Likelihood Contour (see text p.205 for plot at left)



```
proc iml;

    start LL(beta);
        b0=beta[1]; theta=beta[2]; b1=log(theta);
        tomax=7*b0+3*b1-5*log(1+exp(b0+b1))-26*log(1+exp(b0));
        return(-tomax);
    finish LL;

    con={-20 -20,20 20};
```

```

x={-1 10}; optn={0,2};

call nlpcg(rc,betahat,"LL",x,optn,con);

b0=betahat[1]; theta=betahat[2]; b1=log(theta);
quit;

```

Optimization Start
Parameter Estimates

N Parameter	Estimate	Gradient Objective Function	Lower Bound Constraint	Upper Bound Constraint
1 X1	-1.000000	3.923826	-20.000000	20.000000
2 X2	10.000000	0.093135	-20.000000	20.000000

Value of Objective Function = 15.952250959

Conjugate-Gradient Optimization

Automatic Restart Update (Powell, 1977; Beale, 1972)

Gradient Computed by Finite Differences

Parameter Estimates	2
Lower Bounds	2
Upper Bounds	2

Optimization Start

Active Constraints	0	Objective Function	15.952250959
Max Abs Gradient Element	3.9238257408		

Iter	Restarts	Function Calls	Active Constraints	Objective Function	Objective Function Change	Max Abs Gradient Element	Step Size	Slope of Search Direction
1	0	3	0	14.54536	1.4069	0.1324	0.200	-15.405
2	1	6	0	14.53205	0.0133	0.2020	100.0	-0.0003
3	2	8	0	14.52751	0.00454	0.00849	0.223	-0.0399
4	2	11	0	14.52751	1.514E-6	0.00486	56.251	-54E-9
5	3	14	0	14.52746	0.000049	0.000020	3.896	-253E-7

Optimization Results

Iterations	5	Function Calls	15
Gradient Calls	14	Active Constraints	0
Objective Function	14.527456908	Max Abs Gradient Element	0.0000195249
Slope of Search Direction	-0.000025255		

GCONV convergence criterion satisfied.

Optimization Results

Parameter Estimates

N Parameter	Estimate	Gradient Objective Function
1 X1	-1.704731	-0.000019525
2 X2	8.249314	-0.000009550

Value of Objective Function = 14.527456908

```

aa <- read.csv(file="f://aaa Teaching/1a STAT336 AdvBiostats/I Spring 2010/C Logistic/PLL.csv",header=T)
theta <- aa[,2]
PLL <- aa[,4]
xrange <- range(-2,211)
yrange <- range(PLL)
xx <- seq(-2,90,length=1000)
yy <- rep(-16.4475,1000)
xxx <- seq(-2,200,length=1000)
yyy <- rep(-17.8425,1000)

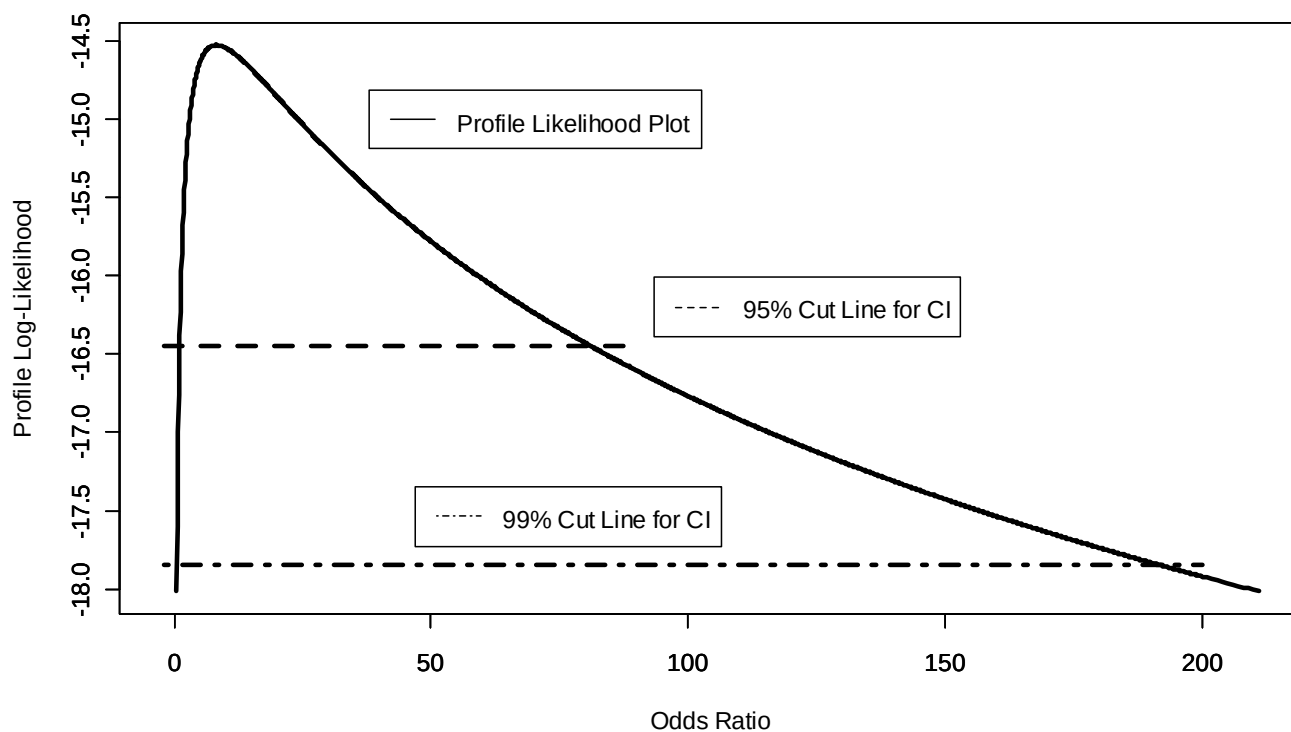
plot(theta,PLL,type="l",ylab="Profile Log-Likelihood",xlab="Odds Ratio",lwd=3,xlim=xrange,ylim=yrange)
legend(locator(1),legend=c("Profile Likelihood Plot"),lty=c(1))

par(new=T)
plot(xx,yy,type="l",ylab="",xlab="",lwd=3,lty=2,xlim=xrange,ylim=yrange)
legend(locator(1),legend=c("95% Cut Line for CI"),lty=c(2))

par(new=T)
plot(xxx,yyy,type="l",ylab="",xlab="",lwd=3,lty=4,xlim=xrange,ylim=yrange)
legend(locator(1),legend=c("99% Cut Line for CI"),lty=c(4))
title("Profile Neg-Log-Likelihood Plot for Theta")

```

Profile Neg-Log-Likelihood Plot for Theta



SAS Program for PNLL Curve

```
proc iml;

  start LL(beta);
    b0=beta[1]; theta=beta[2]; b1=log(theta);
    tomax=7*b0+3*b1-5*log(1+exp(b0+b1))-26*log(1+exp(b0));
    return(-tomax);
  finish LL;
  con={-20 -20, 20 20};
  beta0={-1 10};

  start PNLL(b0) global(theta);
    b1=log(theta);
    tomax=7*b0+3*b1-5*log(1+exp(b0+b1))-26*log(1+exp(b0));
    return(-tomax);
  finish PNLL;
  beta0p={-1};
  conp={-99, 99};

  opt={0,0};
  call nlpcg(rc,betahat,"LL",beta0,opt,con);
  b0=betahat[1]; theta=betahat[2]; b1=log(theta);
  *print "intercept:" b0 "slope:" b1 "Odds Ratio:" theta;

  ans={0 0 0};
  do theta=2000 to 12000 by 1;
    call nlpcg(rc,beta0hat,"PNLL",beta0p,opt,conp);
    PNLLmin=PNLL(beta0hat);
    temp=beta0hat||theta||PNLLmin;
    ans=ans//temp;
  end;
  len=nrow(ans); ans=ans[2:len,];
  print ans;
quit;
```