Case Studies for Quasi-likelihood

Keunbaik Lee
Sungkyunkwan University

keunbaik@skku.edu

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GLM Example: Seizure Data

- Using only the responses at week 4.
- Consider three models: 1) linear model using $\log(\textit{seizure} + 0.5)$; 2) Poisson regression; 3) quasi-likelihood.

	Linear model	Poisson reg.	Quasi-like.
β_0	0.699 (0.550)	0.776* (0.285)	0.776 (0.449)
β_1	0.008 (0.017)	0.014 (0.009)	0.014 (0.014)
β_2	0.110* (0.016)	0.088* (0.004)	0.088* (0.007)
β_3	−0.457* (0.208)	−0.270* (0.102)	-0.270 (0.161)
Dispersion	NA	NA	2.484
AIC	146.45	342.79	NA

- The standard error estimates for the regression parameters for GLM are smaller than for quasi-likelihood.
- Note that AIC is no longer available for quasi-likelihood

```
> # Seizure Data
> setwd('d:/course/SKKU/Longitudinal_Data_Analysis/2016Fall/R-codes')
>
> seize<-read.table("seize.data",col.names=c
+ ("id","seizure","week","progabide","baseline8","age"))

> seize.lm <- glm(I(log(seizure+0.5))~age+baseline8+progabide,
+                 data=seize,subset=week==4,family=gaussian)    => linear model
> summary(seize.lm)

Call:
glm(formula = I(log(seizure + 0.5)) ~ age + baseline8 + progabide,
    family = gaussian, data = seize, subset = week == 4)

Deviance Residuals:
    Min       1Q   Median       3Q      Max
-1.9216  -0.3450   0.2560   0.5158   1.4711

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept)  0.698590   0.550308   1.269   0.2096
age          0.008016   0.016986   0.472   0.6389
baseline8    0.027426   0.003963   6.921 5.09e-09 ***
progabide   -0.457042   0.208729  -2.190   0.0328 *
---
Signif. codes:  0 '***' 0.001 '**â 0.01 '*' 0.05 '.' 0.1 ' ' 1

(Dispersion parameter for gaussian family taken to be 0.634476)

    Null deviance: 68.647  on 58  degrees of freedom
Residual deviance: 34.896  on 55  degrees of freedom
AIC: 146.45

Number of Fisher Scoring iterations: 2
```

```
> seize.glm <- glm(seizure~age+baseline8+progabide,
+                  data=seize,subset=week==4,family=poisson)  => loglinear model
> summary(seize.glm)

Call:
glm(formula = seizure ~ age + baseline8 + progabide, family = poisson,
    data = seize, subset = week == 4)

Deviance Residuals:
    Min       1Q   Median       3Q      Max
-3.1636  -1.0246  -0.1443   0.4865   3.8993

Coefficients:
             Estimate Std. Error z value Pr(>|z|)
(Intercept)  0.775574   0.284598   2.725  0.00643 **
age          0.014044   0.008580   1.637  0.10169
baseline8    0.022057   0.001088  20.267  < 2e-16 ***
progabide   -0.270482   0.101868  -2.655  0.00793 **
---
Signif. codes:  0 ‘***’ 0.001 ‘**â 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

(Dispersion parameter for poisson family taken to be 1)

    Null deviance: 476.25  on 58  degrees of freedom
Residual deviance: 147.02  on 55  degrees of freedom
AIC: 342.79

Number of Fisher Scoring iterations: 5

> seize.glm2 <- glm(seizure~age+baseline8+progabide,
+                  data=seize,subset=week==4,
+                  family=quasi(link=log,variance="mu"))    => quasi-likelihood
> summary(seize.glm2)

Call:
```

```
glm(formula = seizure ~ age + baseline8 + progabide, family = quasi(link = log,
    variance = "mu"), data = seize, subset = week == 4)

Deviance Residuals:
    Min       1Q   Median       3Q      Max
-3.1636  -1.0246  -0.1443   0.4865   3.8993

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept)  0.775574   0.448580   1.729   0.0894 .
age          0.014044   0.013524   1.038   0.3036
baseline8    0.022057   0.001715  12.858   <2e-16 ***
progabide   -0.270482   0.160563  -1.685   0.0977 .
---
Signif. codes:  0 ‘***’ 0.001 ‘**â 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

(Dispersion parameter for quasi family taken to be 2.484378)

    Null deviance: 476.25  on 58  degrees of freedom
Residual deviance: 147.02  on 55  degrees of freedom
AIC: NA

Number of Fisher Scoring iterations: 5
```