Lec21_2

2

```
library(dplyr)
```

```
##
## Attaching package: 'dplyr'
```

```
## The following objects are masked from 'package:stats':
##
##     filter, lag
```

```
## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union
```

```
library(mcprofile)
```

```
## Loading required package: ggplot2
```

a.

```
bird <- read.csv("bird.csv")
bird$Degradation <- factor(bird$Degradation, levels = levels(bird$Degradation[c(3, 1, 2)]))
bfit <- glm(Count ~ ., family = poisson(link = "log"), data = bird)
summary(bfit)$deviance # Residual devicance
```

```
## [1] 78.11879
```

```
summary(bfit)$df[2] # Residual degrees of freedom
```

```
## [1] 12
```

b.

```
bfit2 <- glm(Count ~ .*., family = poisson(link = "log"), data = bird) # Saturated model
anova(bfit, bfit2, test = "LR")
```

```
## Analysis of Deviance Table
##
## Model 1: Count ~ Guild + Degradation
## Model 2: Count ~ (Guild + Degradation) * (Guild + Degradation)
##   Resid. Df Resid. Dev Df Deviance  Pr(>Chi)
## 1        12     78.119
## 2         0      0.000 12   78.119 9.417e-12 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

LR test:

H0: all parameters of interaction terms are 0, Ha: at least one parameter of interaction terms are not 0

P-value = 9.417e-12

Reject H0 and conclude that ‘Guild’ and ‘Degradation’ are associated.

c.

```
# look at coefficients to see the position of each
coef(bfit2)
```

```
##                           (Intercept)                            GuildFruit
##                             2.0794415                             0.9162907
##                       GuildGround-Arth                       GuildLeaf-Arth
##                             1.1394343                             2.1546650
##                           GuildNectar                           GuildSeeds
##                             2.5257286                            -0.1335314
##                         GuildWood-Arth                       DegradationLow
##                            -1.3862944                             1.7917595
##                    DegradationModerate            GuildFruit:DegradationLow
##                             1.5841201                            -2.0149030
##       GuildGround-Arth:DegradationLow        GuildLeaf-Arth:DegradationLow
##                            -0.2657032                            -1.1506687
##            GuildNectar:DegradationLow            GuildSeeds:DegradationLow
##                            -1.1499056                            -0.7932306
##         GuildWood-Arth:DegradationLow       GuildFruit:DegradationModerate
##                             1.4271164                            -0.7086514
## GuildGround-Arth:DegradationModerate   GuildLeaf-Arth:DegradationModerate
##                            -0.7599447                            -0.8837527
##       GuildNectar:DegradationModerate       GuildSeeds:DegradationModerate
##                            -1.0131406                            -0.5342980
##    GuildWood-Arth:DegradationModerate
##                             1.3862944
```

```
# Baselines are 'Air-Arth' and 'High' for Guild and Degradation.
# Work on log scale, we can find coefficients of each ratio via simple algebra
# Make coefficient matrix regarding the position of each one in the model, each row represents one Guild cat
egory
k <- matrix(data = c(0, 0, 0, 0, 0, 0, 0, -1, 0, -1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
                     0, 0, 0, 0, 0, 0, 0, -1, 0, 0, -1, 0, 0, 0, 0, 0, 0, 0, 0, 0,
                     0, 0, 0, 0, 0, 0, 0, -1, 0, 0, 0, -1, 0, 0, 0, 0, 0, 0, 0, 0,
                     0, 0, 0, 0, 0, 0, 0, -1, 0, 0, 0, 0, -1, 0, 0, 0, 0, 0, 0, 0,
                     0, 0, 0, 0, 0, 0, 0, -1, 0, 0, 0, 0, 0, -1, 0, 0, 0, 0, 0, 0,
                     0, 0, 0, 0, 0, 0, 0, -1, 0, 0, 0, 0, 0, 0, -1, 0, 0, 0, 0, 0,
                     0, 0, 0, 0, 0, 0, 0, -1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0), nrow = 7, byrow = TR
UE)
pro.est <- mcprofile(bfit2, k)
table <- exp(confint(pro.est)) # Exponentiate to get counts

# Organize mcprofile output to make it more informative
table$estimate %>% unlist() -> i
table$confint %>% unlist() -> ii
op <- data.frame(High.vs.Low = i, lower = ii[1:7], upper = ii[8:14])
op <- `row.names<-`(op, c("GuildFruit", "GuildGround-Arth", "GuildLeaf-Arth", "GuildNectar", "GuildSeeds", "
GuildWood-Arth", "GuildAir-Arth"))
op
```

```
##                 High.vs.Low       lower     upper
## GuildFruit        1.2500000 0.508255218 3.1697137
## GuildGround-Arth  0.2173913 0.115220533 0.3802337
## GuildLeaf-Arth    0.5267176 0.350004116 0.7796614
## GuildNectar       0.5263158 0.375386011 0.7295668
## GuildSeeds        0.3684211 0.096884731 1.1200989
## GuildWood-Arth    0.0400000 0.002549161 0.1812151
## GuildAir-Arth     0.1666667 0.051264565 0.4194519
```

i.

The ratio under GuildWood-Arth is low.

ii.

This ratio measures adverse effect because it measures the multiplicative change in mean when switching from low to high degradation. Accordingly, when this ratios is far smaller than 1 the reduction effect in mean counts is severe.

d.

```r
# Similar to the last part
# By doing algebra on the log scale, ratio of mean ratios can be represented by coefficients
# Make coefficient matrix
krr <- matrix(c(0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, -1, 0, 0, 0, 0, 0, 0,
                0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, -1, 0, 0, 0, 0, 0, 0,
                0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, -1, 0, 0, 0, 0, 0, 0,
                0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, -1, 0, 0, 0, 0, 0, 0,
                0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, -1, 0, 0, 0, 0, 0, 0,
                0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, -1, 0, 0, 0, 0, 0, 0), nrow = 6, byrow = TRUE)
rr.est <- mcprofile(bfit2, krr)
table.rr <- exp(confint(rr.est))

table.rr$estimate %>% unlist() -> d
table.rr$confint %>% unlist() -> dd
op.rr <- data.frame(Ratio = d, lower = dd[1:6], upper = dd[7:12])
op.rr <- `rownames<-`(op.rr, c("Wood vs Fruit", "Wood vs Ground", "Wood vs Leaf", "Wood vs Nectar", "Wood vs Seeds", "Wood vs Air"))
op.rr
```

```
##                     Ratio       lower     upper
## Wood vs Fruit  0.03200000 0.002922659 0.1585807
## Wood vs Ground 0.18400000 0.017814509 0.8049141
## Wood vs Leaf   0.07594203 0.007523628 0.3112642
## Wood vs Nectar 0.07600000 0.007575377 0.3063901
## Wood vs Seeds  0.10857143 0.009298463 0.6572132
## Wood vs Air    0.24000000 0.021455071 1.3246449
```

ii.

All estimated odds ratios are smaller than 1, which says comparing to all others Wood-Arth guild group experiances higher abundance reduction in high vs low degradation. However Wood vs Air ratio has CI with upper limit bigger than 1, so in Wood guild the reduction effect can potentially be smaller than or same as in Air guild.