

Logistic Regression

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1 Getting Set Up

1.1 Setting chunk options

1.2 Installing Packages

1.3 Reading the data

| ## | Age | Outcome | Sex | Family.name | Status |
|----------------------------|-----|---------|--------|-------------|--------|
| ## Breen_Edward_ | 13 | 1 | Male | Breen | Family |
| ## Breen_Margaret_Isabella | 1 | 1 | Female | Breen | Family |
| ## Breen_James_Frederick | 5 | 1 | Male | Breen | Family |
| ## Breen_John | 14 | 1 | Male | Breen | Family |
| ## Breen_Margaret_Bulger | 40 | 1 | Female | Breen | Family |
| ## Breen_Patrick | 51 | 1 | Male | Breen | Family |

```
## Breen_Patrick_Jr.      9      1  Male      Breen Family
## Breen_Peter            3      1  Male      Breen Family
## Breen_Simon_Preston    8      1  Male      Breen Family
## Donner_Elitha_Cumi     13     1 Female    G_Donner Family
```

```
##           Age Outcome    Sex fem
## Breen_Edward_      13      1  Male  0
## Breen_Margaret_Isabella  1      1 Female  1
## Breen_James_Frederick   5      1  Male  0
## Breen_John           14      1  Male  0
## Breen_Margaret_Bulger   40     1 Female  1
## Breen_Patrick         51      1  Male  0
## Breen_Patrick_Jr.       9      1  Male  0
## Breen_Peter           3      1  Male  0
## Breen_Simon_Preston     8      1  Male  0
## Donner_Elitha_Cumi     13     1 Female  1
```

2 Fitting a logistic regression

```
##
## Call:
## glm(formula = Outcome ~ Age + fem, family = binomial(link = "logit"),
##      data = donner.na)
##
## Deviance Residuals:
##      Min       1Q   Median       3Q      Max
## -1.8828  -1.0383   0.6511   1.0261   1.7386
##
## Coefficients:
##              Estimate Std. Error z value Pr(>|z|)
## (Intercept)  0.55382    0.41788   1.325  0.1851
## Age         -0.03561    0.01525  -2.336  0.0195 *
## fem          1.06798    0.48229   2.214  0.0268 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##      Null deviance: 120.86  on 87  degrees of freedom
## Residual deviance: 108.87  on 85  degrees of freedom
## AIC: 114.87
##
## Number of Fisher Scoring iterations: 4
```

2.1 Odds ratios

```
## (Intercept)      Age      fem
##  1.7398953  0.9650211  2.9094868

##           2.5 %    97.5 %
## (Intercept) 0.7748972 4.0431170
```

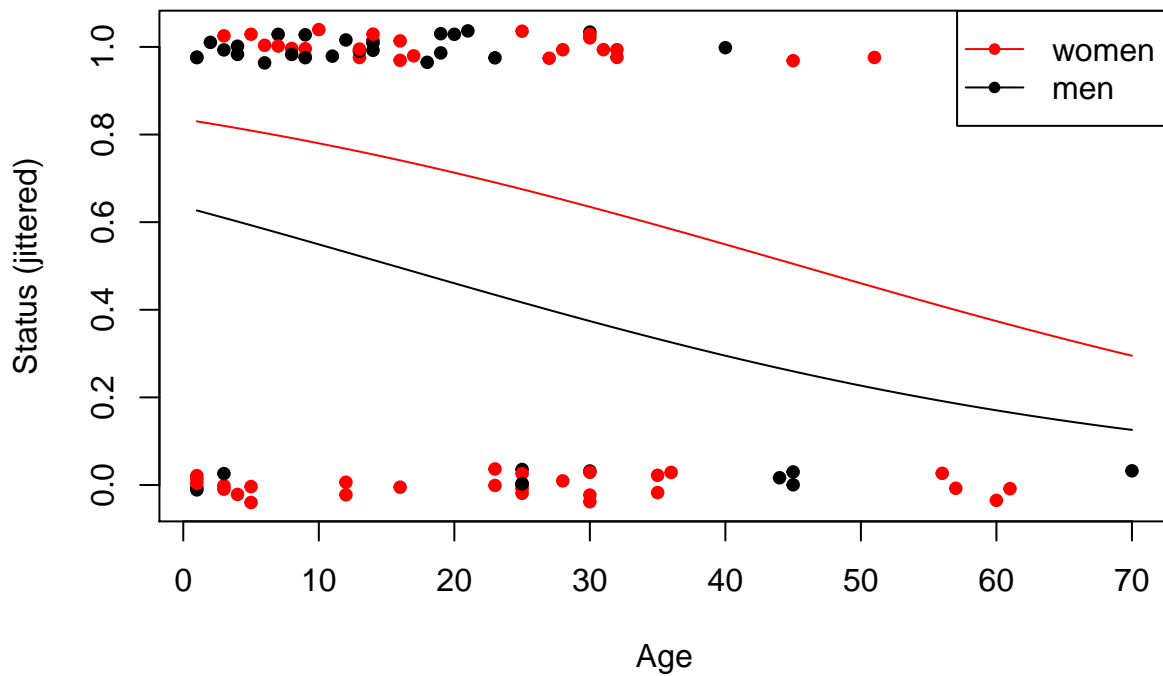
```
## Age      0.9348223 0.9930661
## fem      1.1543365 7.7529827

##          OR      2.5 %    97.5 %
## (Intercept) 1.7398953 0.7748972 4.0431170
## Age         0.9650211 0.9348223 0.9930661
## fem         2.9094868 1.1543365 7.7529827
```

2.2 Odd ratio for Survival with 10 year increase

```
##   OR.Age      2.5 %    97.5 %
## 0.7004356 0.5096720 0.9327850
```

2.3 Plotting the logit curve



2.4 Predicted probabilities of survival

```
##   fem   Age   greP
## 1    1 20.22727 0.711279
```

```
##   fem   Age   greP
## 1    0 20.22727 0.4585025
```

```
##      fem      Age      greP
## 1    0 20.22727 0.4585025
## 2    1 20.22727 0.7112790
```

2.5 Interaction model

```
##
## Call:
## glm(formula = Outcome ~ Age * fem, family = binomial(link = "logit"),
##      data = donner.na)
##
## Deviance Residuals:
##      Min       1Q   Median       3Q      Max
## -1.9888  -1.0532   0.5961   1.0727   1.6317
##
## Coefficients:
##              Estimate Std. Error z value Pr(>|z|)
## (Intercept)  0.39779    0.48139   0.826   0.409
## Age         -0.02789    0.01911  -1.460   0.144
## fem          1.47859    0.82469   1.793   0.073 .
## Age:fem     -0.01977    0.03166  -0.624   0.532
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##      Null deviance: 120.86  on 87  degrees of freedom
## Residual deviance: 108.47  on 84  degrees of freedom
## AIC: 116.47
##
## Number of Fisher Scoring iterations: 4
```

3 Model Selection

3.1 Fitting the models

3.2 Akaike Weights

```
##
## Model selection based on AICc:
##
##              K   AICc Delta_AICc AICcWt Cum.Wt      LL
## Age+Sex       3 115.15      0.00   0.56  0.56 -54.43
## Age+Sex+Age:Sex 4 116.95      1.80   0.23  0.79 -54.23
## Age          2 118.16      3.01   0.13  0.92 -57.01
## Sex          2 119.02      3.87   0.08  1.00 -57.44
```

4 Model Averaging

```
##
```

```
## Multimodel inference on "Age" based on AICc
##
## AICc table used to obtain model-averaged estimate:
##
##      K   AICc Delta_AICc AICcWt Estimate   SE
## Age    2 118.16      3.01   0.18   -0.04 0.01
## Age+Sex 3 115.15      0.00   0.82   -0.04 0.02
##
## Model-averaged estimate: -0.04
## Unconditional SE: 0.02
## 95% Unconditional confidence interval: -0.07, -0.01
```

```
##
## Multimodel inference on "fem" based on AICc
##
## AICc table used to obtain model-averaged estimate:
##
##      K   AICc Delta_AICc AICcWt Estimate   SE
## Sex    2 119.02      3.87   0.13    1.11 0.46
## Age+Sex 3 115.15      0.00   0.87    1.07 0.48
##
## Model-averaged estimate: 1.07
## Unconditional SE: 0.48
## 95% Unconditional confidence interval: 0.13, 2.01
```

5 Odds Ratio with interaction model

