4_Detailed_Report

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Dataset

Raw Dataset

Removed `track_hist`, `url`, `artists_ids`, `track_id`, `chart_start`, `chart_end`, and `new_id`.

```
   hitness danceability energy key loudness mode speechiness acousticness
1:    1260        0.841  0.728   7   -3.370    1      0.0484       0.0847
2:    2560        0.336  0.627   7   -7.463    1      0.0384       0.1640
3:    1490        0.589  0.472   8   -8.749    1      0.0502       0.6140
4:    1140        0.754  0.424   2   -8.463    1      0.0363       0.6430
5:    1000        0.683  0.375   0  -13.056    1      0.0303       0.5790
6:    1070        0.240  0.598   7   -8.435    1      0.0369       0.7660
   instrumentalness liveness valence   tempo duration_ms time_signature
1:                0   0.1490   0.430 130.049      243837              4
2:                0   0.0708   0.350 150.273      241107              4
3:                0   0.5050   0.898  67.196      126267              4
4:                0   0.0652   0.806 119.705      130973              4
5:                0   0.0760   0.888 140.467      135533              4
6:                0   0.1170   0.776 201.629      151933              3
   popularity sentiment
1:  17532.333    0.9938
2:   2772.143    0.9805
3:    410.000    0.9868
4:    281.000    0.8442
5:   1169.000    0.9966
6:   1144.000    0.9973
```

Classified Dataset

Classified songs as hit songs by using a `hitness` threshold of 250, converted duration from milliseconds to minutes, and log scaled popularity and tempo. This dataset was used for all the models.

```
   hitness danceability energy key loudness mode speechiness acousticness
1:    TRUE        0.841  0.728   7   -3.370    1      0.0484       0.0847
2:    TRUE        0.336  0.627   7   -7.463    1      0.0384       0.1640
3:    TRUE        0.589  0.472   8   -8.749    1      0.0502       0.6140
4:    TRUE        0.754  0.424   2   -8.463    1      0.0363       0.6430
5:    TRUE        0.683  0.375   0  -13.056    1      0.0303       0.5790
6:    TRUE        0.240  0.598   7   -8.435    1      0.0369       0.7660
```

```
   instrumentalness liveness valence time_signature sentiment duration_min
1:                0   0.1490   0.430              4    0.9938     4.063950
2:                0   0.0708   0.350              4    0.9805     4.018450
3:                0   0.5050   0.898              4    0.9868     2.104450
4:                0   0.0652   0.806              4    0.8442     2.182883
5:                0   0.0760   0.888              4    0.9966     2.258883
6:                0   0.1170   0.776              3    0.9973     2.532217
   log_tempo log_popularity
1:  4.867911       9.771802
2:  5.012454       7.927376
3:  4.207614       6.016157
4:  4.785030       5.638355
5:  4.944973       7.063904
6:  5.306429       7.042286
```

Log Scaling Popularity

```
pdf
  2
```

```
pdf
  2
```

Log Scaling Tempo

```
pdf
  2
```

Number of Rows / Feature Vectors

```
[1] 4441
```

Summary of Raw Data (Continuous Hitness Values and Unscaled)

```
    hitness        danceability        energy            key        
 Min.   :  20.0   Min.   :0.0671   Min.   :0.0326   Min.   : 0.000  
 1st Qu.:  40.0   1st Qu.:0.5290   1st Qu.:0.5700   1st Qu.: 2.000  
 Median : 220.0   Median :0.6300   Median :0.7090   Median : 5.000  
 Mean   : 419.5   Mean   :0.6251   Mean   :0.6822   Mean   : 5.208  
 3rd Qu.: 480.0   3rd Qu.:0.7290   3rd Qu.:0.8180   3rd Qu.: 8.000  
 Max.   :4250.0   Max.   :0.9860   Max.   :0.9960   Max.   :11.000  
    loudness            mode         speechiness      acousticness      
 Min.   :-29.224   Min.   :0.0000   Min.   :0.0225   Min.   :0.0000033  
 1st Qu.: -7.054   1st Qu.:0.0000   1st Qu.:0.0368   1st Qu.:0.0183000  
 Median : -5.616   Median :1.0000   Median :0.0563   Median :0.0736000  
 Mean   : -5.964   Mean   :0.6715   Mean   :0.1062   Mean   :0.1718459  
 3rd Qu.: -4.403   3rd Qu.:1.0000   3rd Qu.:0.1280   3rd Qu.:0.2410000  
 Max.   :  0.175   Max.   :1.0000   Max.   :0.9510   Max.   :0.9930000  
 instrumentalness       liveness         valence           tempo        
 Min.   :0.0000000   Min.   :0.0193   Min.   :0.0349   Min.   : 48.72  
 1st Qu.:0.0000000   1st Qu.:0.0979   1st Qu.:0.3190   1st Qu.:100.01  
```

```
 Median :0.0000000   Median :0.1310   Median :0.4780   Median :124.08
 Mean   :0.0112172   Mean   :0.1892   Mean   :0.4861   Mean   :123.97
 3rd Qu.:0.0000131   3rd Qu.:0.2460   3rd Qu.:0.6510   3rd Qu.:143.89
 Max.   :0.9550000   Max.   :0.9790   Max.   :0.9760   Max.   :213.74
  duration_ms     time_signature    popularity       sentiment
 Min.   : 46253   Min.   :1.000   Min.   :     1   Min.   :-1.0000
 1st Qu.:197759   1st Qu.:4.000   1st Qu.:  2938   1st Qu.:-0.7613
 Median :219840   Median :4.000   Median :  7716   Median : 0.9636
 Mean   :224905   Mean   :3.973   Mean   : 13929   Mean   : 0.3771
 3rd Qu.:245867   3rd Qu.:4.000   3rd Qu.: 16468   3rd Qu.: 0.9949
 Max.   :688453   Max.   :5.000   Max.   :115282   Max.   : 1.0000
```

Summary of Classified and Cleaned Data (Factorized and Scaled)

```
 hitness          danceability        energy            key
 Mode :logical   Min.   :0.0671   Min.   :0.0326   Min.   : 0.000
 FALSE:2378      1st Qu.:0.5290   1st Qu.:0.5700   1st Qu.: 2.000
 TRUE :2063      Median :0.6300   Median :0.7090   Median : 5.000
                 Mean   :0.6251   Mean   :0.6822   Mean   : 5.208
                 3rd Qu.:0.7290   3rd Qu.:0.8180   3rd Qu.: 8.000
                 Max.   :0.9860   Max.   :0.9960   Max.   :11.000
    loudness            mode         speechiness      acousticness
 Min.   :-29.224   Min.   :0.0000   Min.   :0.0225   Min.   :0.0000033
 1st Qu.: -7.054   1st Qu.:0.0000   1st Qu.:0.0368   1st Qu.:0.0183000
 Median : -5.616   Median :1.0000   Median :0.0563   Median :0.0736000
 Mean   : -5.964   Mean   :0.6715   Mean   :0.1062   Mean   :0.1718459
 3rd Qu.: -4.403   3rd Qu.:1.0000   3rd Qu.:0.1280   3rd Qu.:0.2410000
 Max.   :  0.175   Max.   :1.0000   Max.   :0.9510   Max.   :0.9930000
 instrumentalness       liveness         valence       time_signature
 Min.   :0.0000000   Min.   :0.0193   Min.   :0.0349   Min.   :1.000
 1st Qu.:0.0000000   1st Qu.:0.0979   1st Qu.:0.3190   1st Qu.:4.000
 Median :0.0000000   Median :0.1310   Median :0.4780   Median :4.000
 Mean   :0.0112172   Mean   :0.1892   Mean   :0.4861   Mean   :3.973
 3rd Qu.:0.0000131   3rd Qu.:0.2460   3rd Qu.:0.6510   3rd Qu.:4.000
 Max.   :0.9550000   Max.   :0.9790   Max.   :0.9760   Max.   :5.000
   sentiment        duration_min       log_tempo     log_popularity
 Min.   :-1.0000   Min.   : 0.7709   Min.   :3.886   Min.   : 0.000
 1st Qu.:-0.7613   1st Qu.: 3.2960   1st Qu.:4.605   1st Qu.: 7.985
 Median : 0.9636   Median : 3.6640   Median :4.821   Median : 8.951
 Mean   : 0.3771   Mean   : 3.7484   Mean   :4.791   Mean   : 8.708
 3rd Qu.: 0.9949   3rd Qu.: 4.0978   3rd Qu.:4.969   3rd Qu.: 9.709
 Max.   : 1.0000   Max.   :11.4742   Max.   :5.365   Max.   :11.655
```

Linear Model (OLS)

Accuracy

```
[1] 0.6147615
```

Summary (Coefficients, F-Statistics, P-Value)

```
Call:
```

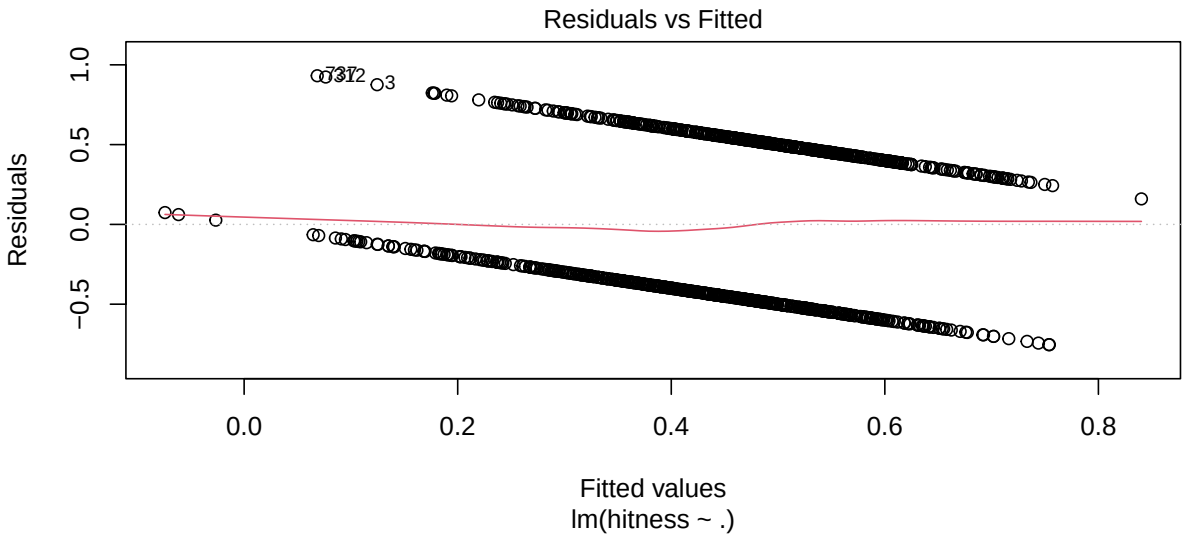
```
lm(formula = hitness ~ ., data = dataset.5.train)

Residuals:
    Min      1Q  Median      3Q     Max
-0.7541 -0.4439 -0.2277  0.4886  0.9315

Coefficients:
                  Estimate Std. Error t value Pr(>|t|)
(Intercept)      -0.267899   0.401848  -0.667   0.5051
danceability      0.255939   0.118198   2.165   0.0306 *
energy           -0.206569   0.150078  -1.376   0.1690
key               0.001504   0.004107   0.366   0.7143
loudness          0.014674   0.009391   1.563   0.1184
mode              0.072420   0.032524   2.227   0.0262 *
speechiness      -0.594191   0.145641  -4.080 4.83e-05 ***
acousticness     -0.159829   0.085221  -1.875   0.0610 .
instrumentalness -0.008887   0.132692  -0.067   0.9466
liveness          0.010336   0.106168   0.097   0.9225
valence           0.261433   0.079235   3.299   0.0010 ***
time_signature    0.054399   0.052688   1.032   0.3021
sentiment         0.024539   0.018323   1.339   0.1808
duration_min      0.006825   0.018677   0.365   0.7149
log_tempo         0.005976   0.060501   0.099   0.9213
log_popularity    0.047394   0.009625   4.924 9.77e-07 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.4844 on 1095 degrees of freedom
Multiple R-squared:  0.06718,   Adjusted R-squared:  0.0544
F-statistic: 5.257 on 15 and 1095 DF,  p-value: 2.906e-10
```

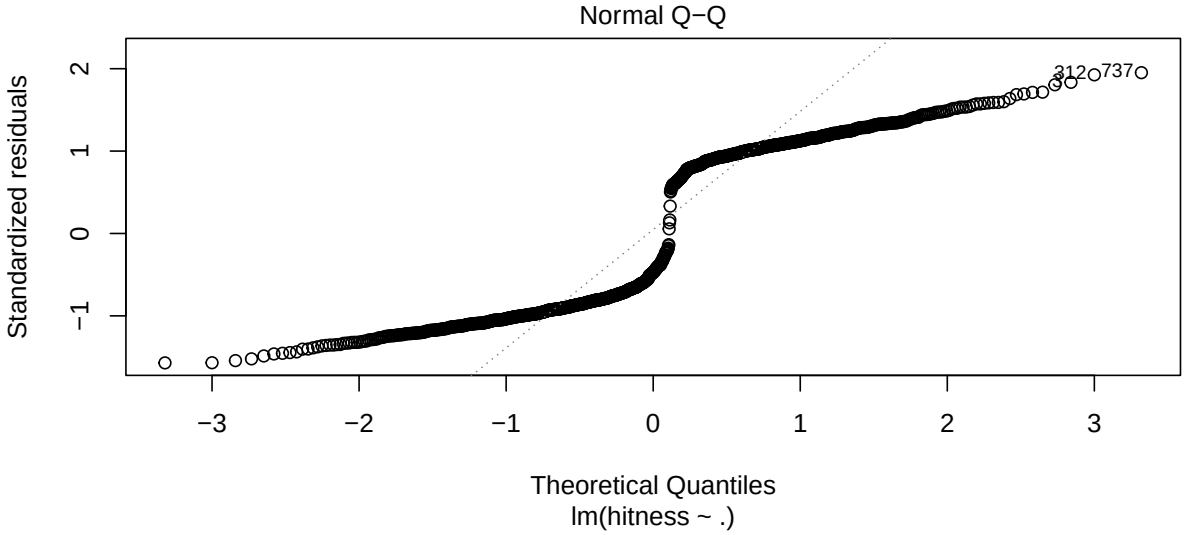
Anova Table

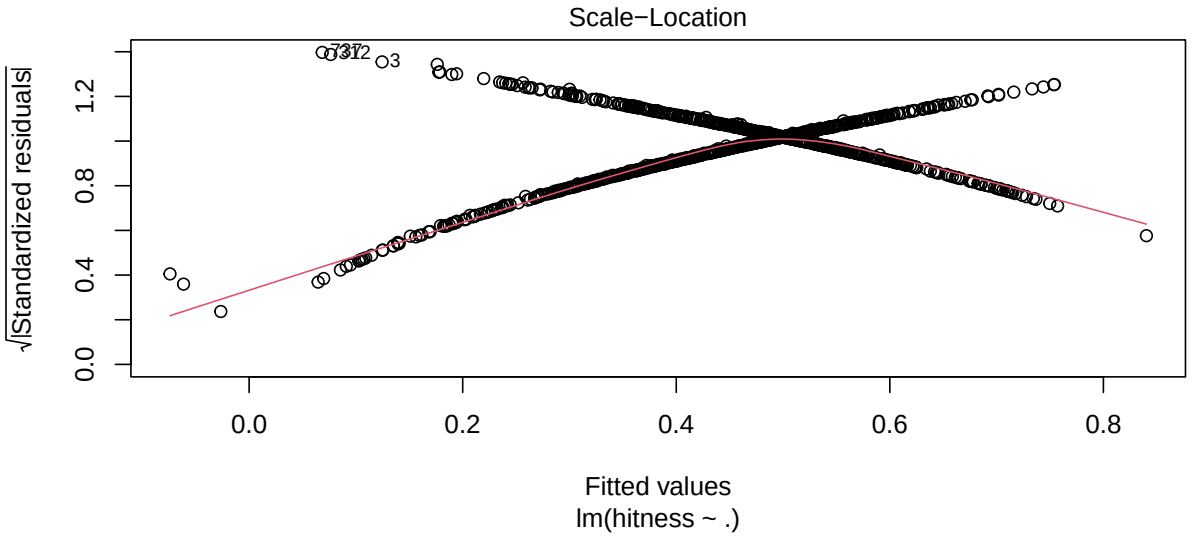
```
Anova Table (Type II tests)

Response: hitness
                  Sum Sq   Df F value    Pr(>F)
danceability       1.100    1  4.6887 0.0305772 *
energy             0.445    1  1.8945 0.1689745
key                0.031    1  0.1341 0.7142746
loudness           0.573    1  2.4417 0.1184400
mode               1.163    1  4.9581 0.0261717 *
speechiness        3.906    1 16.6450 4.834e-05 ***
acousticness       0.825    1  3.5174 0.0609935 .
instrumentalness   0.001    1  0.0045 0.9466111
liveness           0.002    1  0.0095 0.9224612
valence            2.555    1 10.8864 0.0009999 ***
time_signature     0.250    1  1.0660 0.3020847
sentiment          0.421    1  1.7936 0.1807658
duration_min       0.031    1  0.1335 0.7148837
log_tempo          0.002    1  0.0098 0.9213401
log_popularity     5.690    1 24.2477 9.774e-07 ***
Residuals        256.949 1095
```

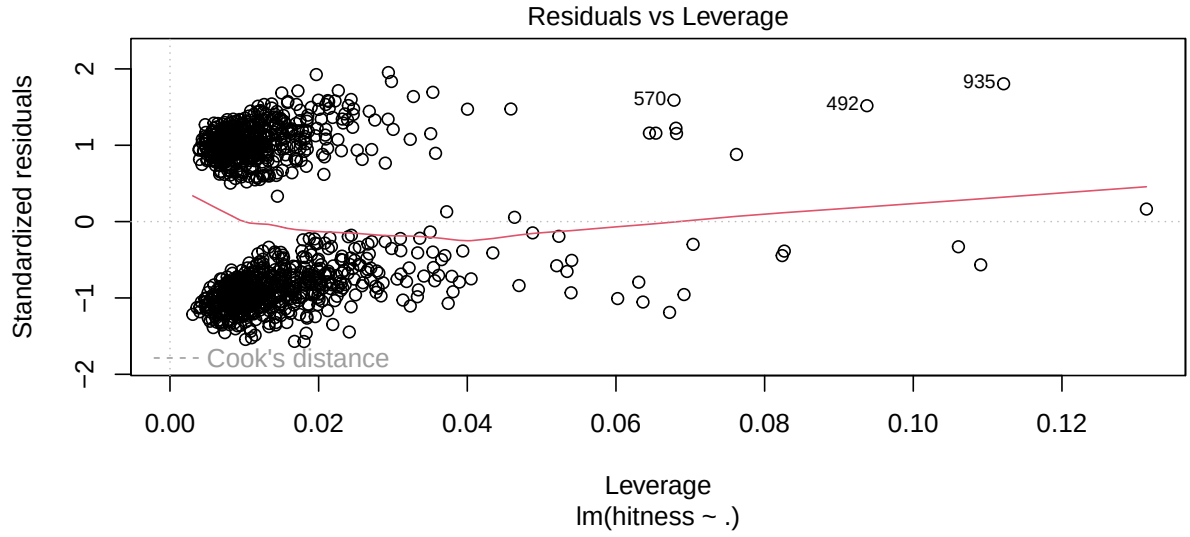
```
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Plots (Residuals vs Fitted, Normal Q-Q, Scale-Location, Residuals vs Leverage)









Logistic Regression

Accuracy

```
[1] 0.6147615
```

Summary (Coefficients, F-Statistics, P-Value)

```
Call:
glm(formula = hitness ~ ., family = binomial(logit), data = dataset.5.train)

Deviance Residuals:
```

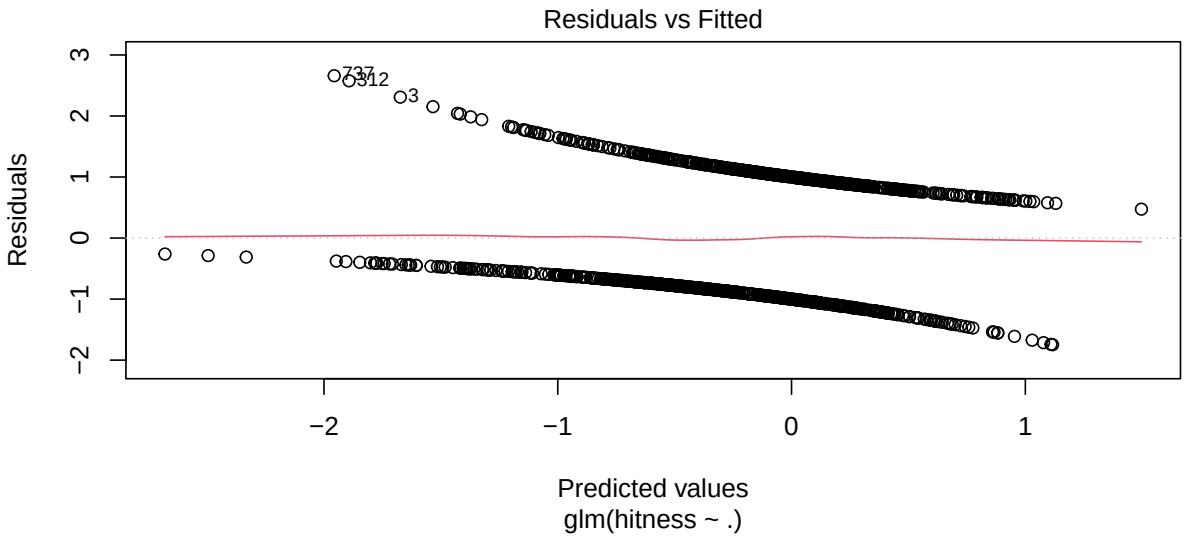
```
    Min       1Q   Median       3Q      Max
-1.6732  -1.0744  -0.7175   1.1577   2.0438

Coefficients:
                 Estimate Std. Error z value Pr(>|z|)
(Intercept)      -3.55078    1.82792  -1.943  0.05207 .
danceability      1.13329    0.51531   2.199  0.02786 *
energy           -0.89314    0.64928  -1.376  0.16895
key               0.00711    0.01763   0.403  0.68673
loudness          0.06605    0.04091   1.614  0.10642
mode              0.31925    0.14052   2.272  0.02309 *
speechiness      -2.64060    0.65349  -4.041 5.33e-05 ***
acousticness     -0.69608    0.37267  -1.868  0.06179 .
instrumentalness -0.03816    0.57944  -0.066  0.94749
liveness          0.04974    0.45602   0.109  0.91315
valence           1.12038    0.34228   3.273  0.00106 **
time_signature    0.27198    0.25577   1.063  0.28760
sentiment         0.10601    0.07879   1.346  0.17846
duration_min      0.02899    0.08147   0.356  0.72193
log_tempo         0.02621    0.26211   0.100  0.92035
log_popularity    0.21452    0.04452   4.819 1.45e-06 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

(Dispersion parameter for binomial family taken to be 1)

    Null deviance: 1531.0  on 1110  degrees of freedom
Residual deviance: 1452.5  on 1095  degrees of freedom
AIC: 1484.5

Number of Fisher Scoring iterations: 4
```

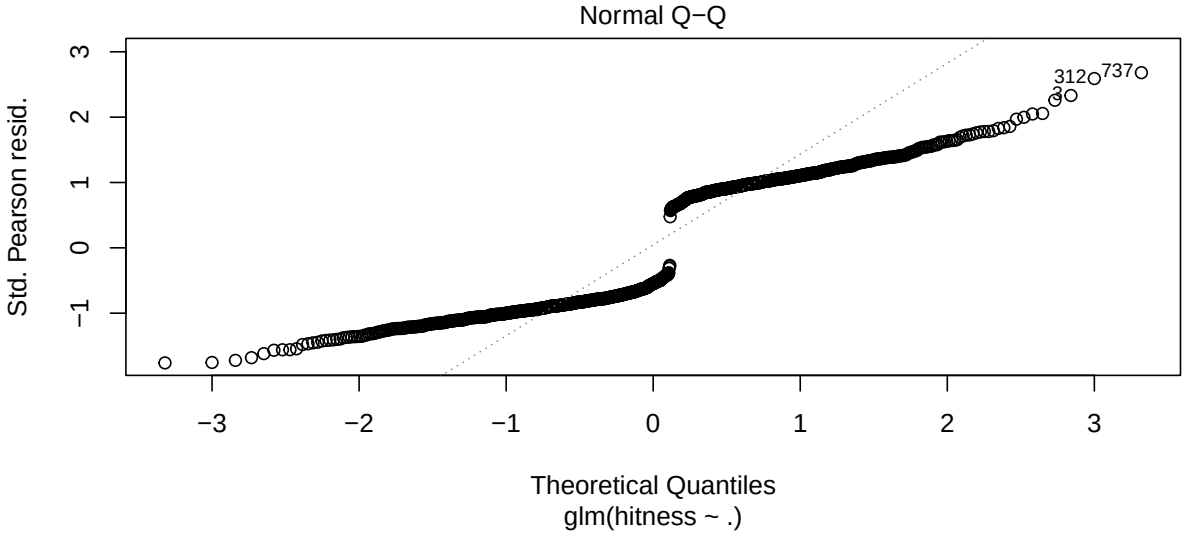
Anova Table

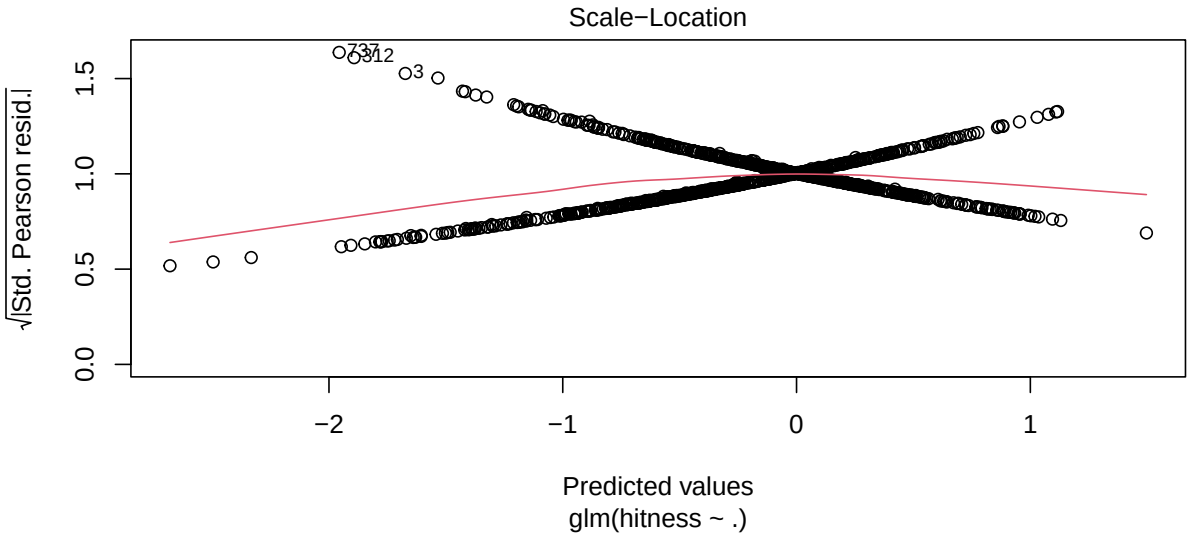
```
Analysis of Deviance Table (Type II tests)

Response: hitness
                 LR Chisq Df Pr(>Chisq)
danceability       4.8781  1   0.027200 *
energy             1.8988  1   0.168216
key                0.1627  1   0.686715
loudness           2.6252  1   0.105179
mode               5.2005  1   0.022580 *
speechiness       17.1550  1  3.445e-05 ***
acousticness       3.5173  1   0.060732 .
instrumentalness   0.0043  1   0.947450
liveness           0.0119  1   0.913173
valence           10.8266  1   0.001001 **
time_signature     1.1870  1   0.275943
sentiment          1.8156  1   0.177843
duration_min       0.1262  1   0.722365
log_tempo          0.0100  1   0.920341
log_popularity    24.9659  1  5.835e-07 ***
```

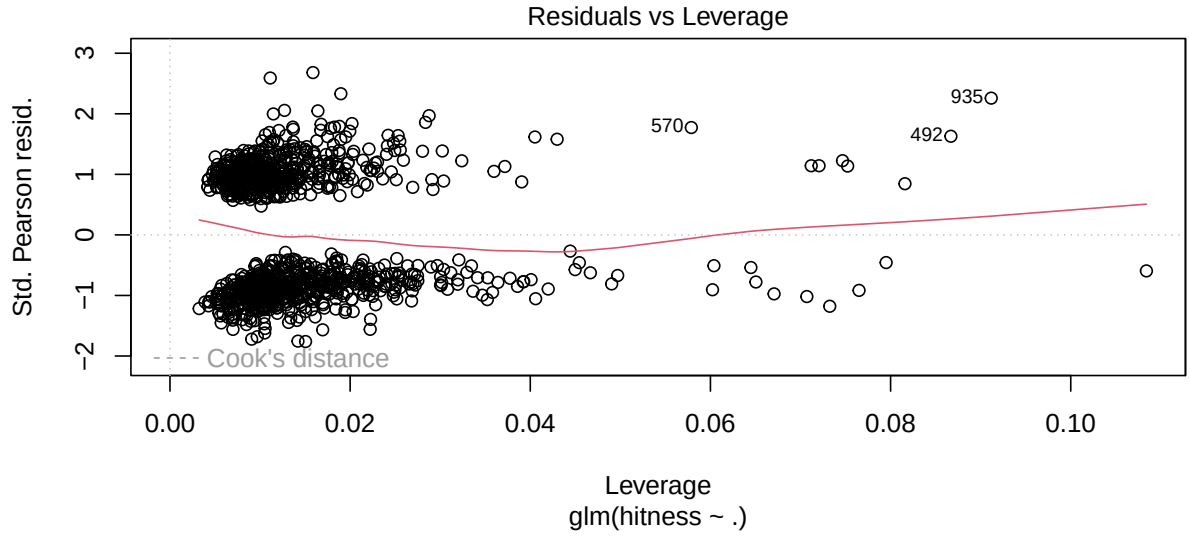
```
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Plots (Residuals vs Fitted, Normal Q-Q, Scale-Location, Residuals vs Leverage)







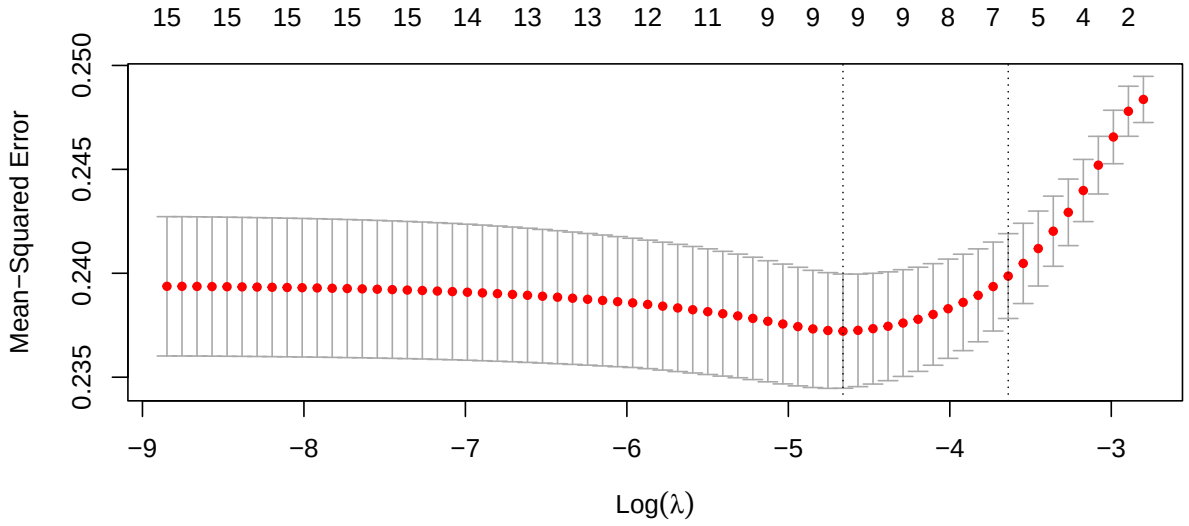


Logistic LASSO Regression

Accuracy

```
[1] 0.6138614
```

LASSO Log Selection (1SE)



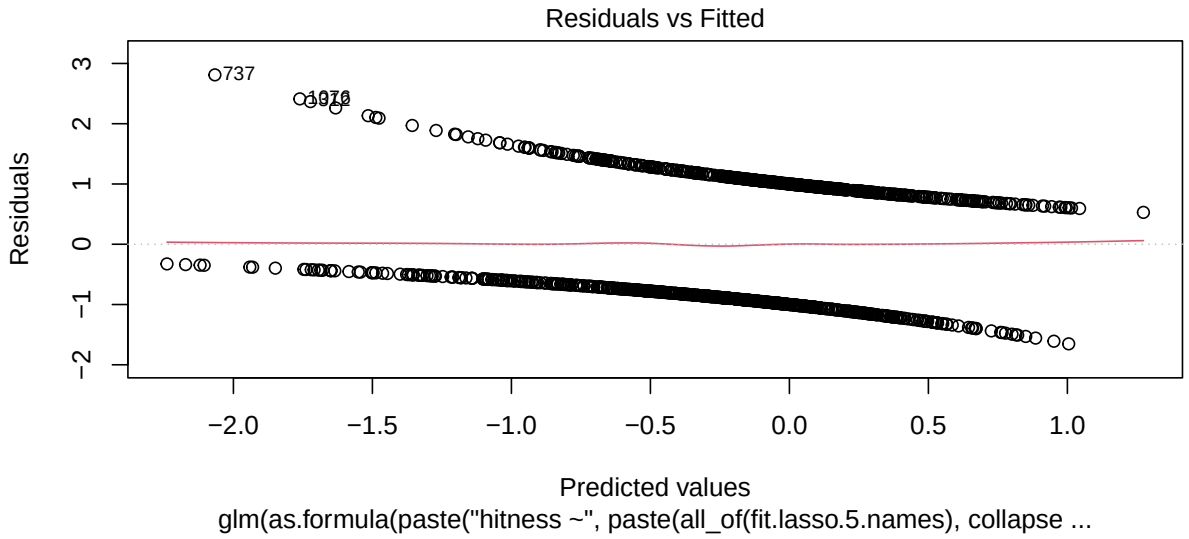
Summary (Coefficients, F-Statistics, P-Value)

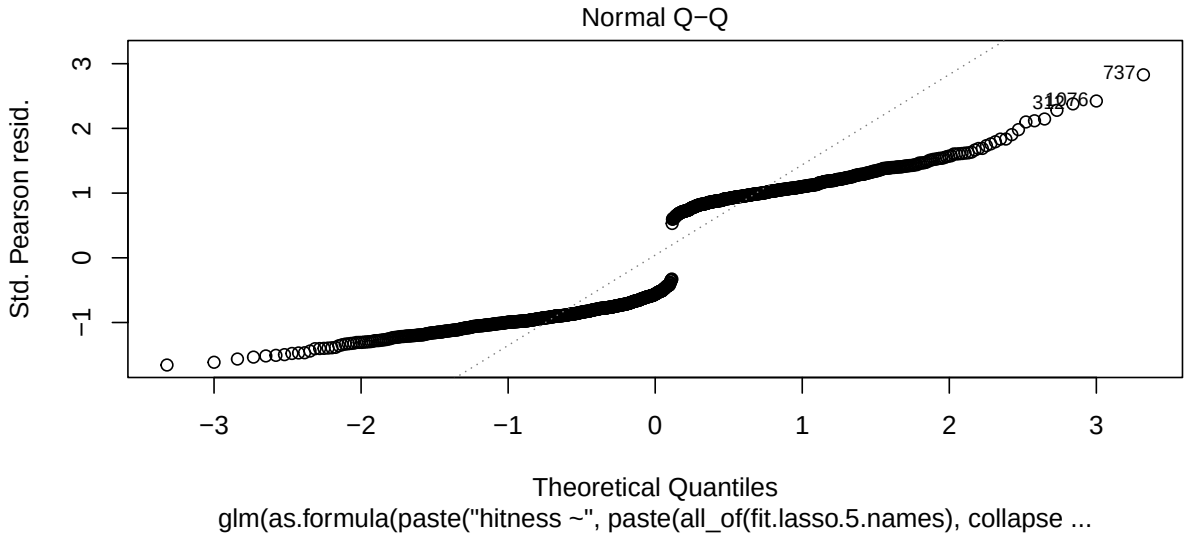
```
Call:
glm(formula = as.formula(paste("hitness ~", paste(all_of(fit.lasso.5.names),
    collapse = " + "))), family = binomial(logit), data = dataset.5.train)

Deviance Residuals:
    Min       1Q   Median       3Q      Max
-1.6227  -1.0858  -0.7318   1.1605   2.0909

Coefficients:
              Estimate Std. Error z value Pr(>|z|)
(Intercept)    -2.98807    0.52705  -5.669 1.43e-08 ***
danceability    1.23571    0.47788   2.586  0.00972 **
loudness        0.03274    0.03079   1.064  0.28753
mode            0.31169    0.13756   2.266  0.02346 *
speechiness    -2.77018    0.64117  -4.320 1.56e-05 ***
acousticness   -0.50296    0.33217  -1.514  0.12999
valence         0.97959    0.31172   3.143  0.00167 **
log_popularity  0.21701    0.04395   4.938 7.90e-07 ***
---
Signif. codes:  0 ’***’ 0.001 ’**’ 0.01 ’*’ 0.05 ’.’ 0.1 ’ ’ 1

(Dispersion parameter for binomial family taken to be 1)

    Null deviance: 1531.0  on 1110  degrees of freedom
Residual deviance: 1457.3  on 1103  degrees of freedom
AIC: 1473.3

Number of Fisher Scoring iterations: 4
```

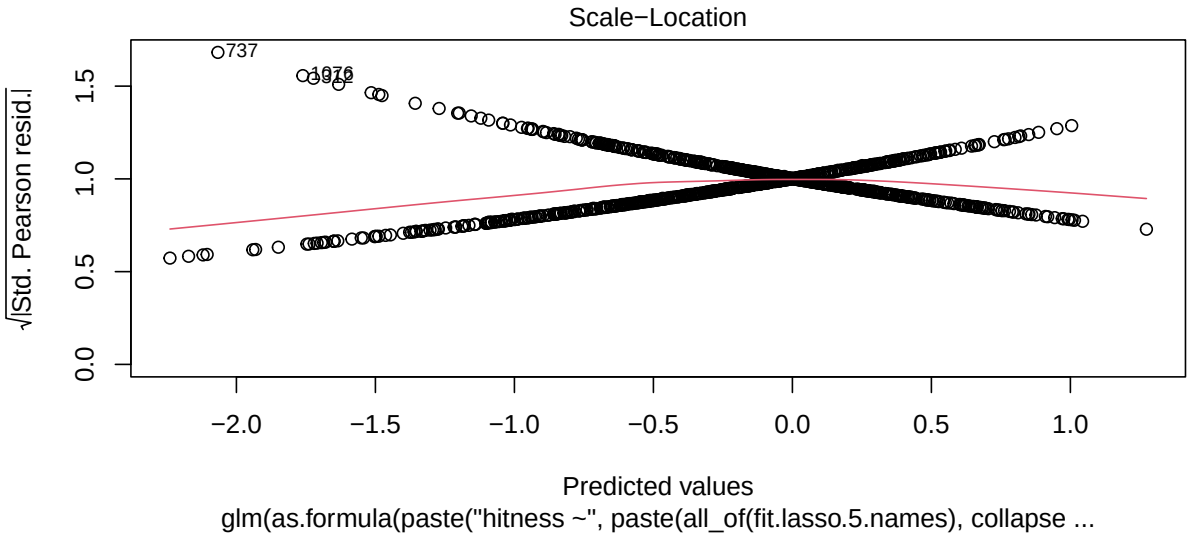
Anova Table

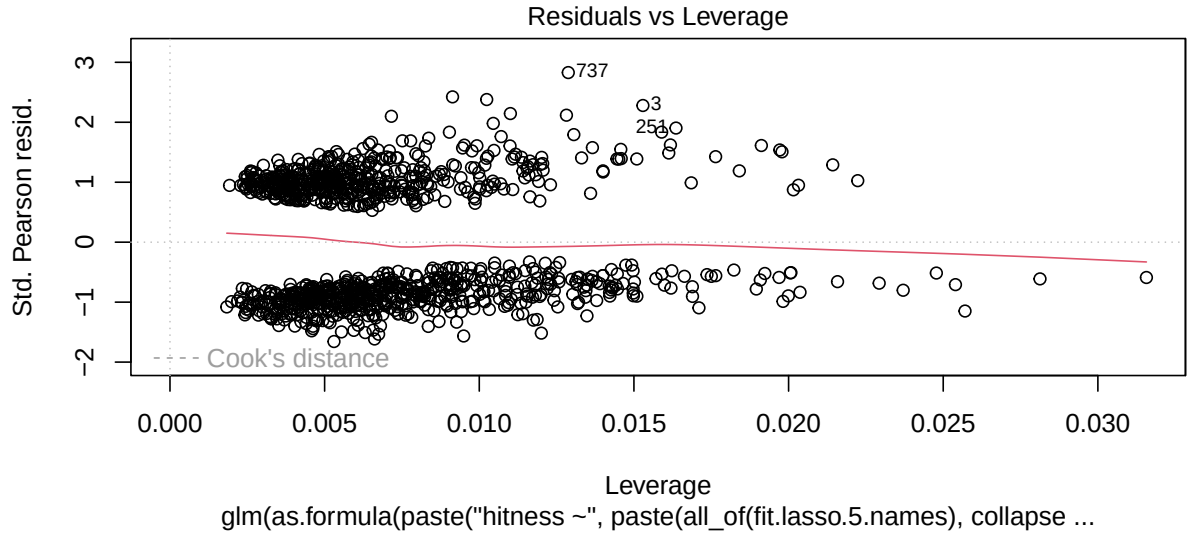
```
Analysis of Deviance Table (Type II tests)

Response: hitness
               LR Chisq Df Pr(>Chisq)
danceability     6.7522  1   0.009363 **
loudness         1.1385  1   0.285976
mode             5.1728  1   0.022943 *
speechiness     19.7425  1  8.861e-06 ***
acousticness     2.3131  1   0.128286
valence          9.9641  1   0.001596 **
log_popularity  26.2782  1  2.956e-07 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Plots (Residuals vs Fitted, Normal Q-Q, Scale-Location, Residuals vs Leverage)






Scale−Location
√|Std. Pearson resid.|
737
1976
0.0
0.5
1.0
1.5
−2.0
−1.5
−1.0
−0.5
0.0
0.5
1.0
Predicted values
glm(as.formula(paste("hitness ~", paste(all_of(fit.lasso.5.names), collapse ...


Residuals vs Leverage
Std. Pearson resid.
737
3
251
Cook's distance
−2
−1
0
1
2
3
0.000
0.005
0.010
0.015
0.020
0.025
0.030
Leverage
glm(as.formula(paste("hitness ~", paste(all_of(fit.lasso.5.names), collapse ...