**Date:** 29 October, 2015

**Experiment No. 13**

**Aim:** To obtain the fitted counts of response variable and test if Poisson regression fits well or not.

**Experiment:**  A student conducted an experiment of looking at the impact of popping temperature, amount of oil and popping time on the number of inedible Kernels. The data obtained is as follows:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| X1 | 7 | 5 | 7 | 7 | 6 | 6 | 5 | 6 | 5 | 6 | 5 | 7 | 6 | 6 | 6 |
| X2 | 4 | 3 | 3 | 2 | 4 | 3 | 3 | 2 | 4 | 2 | 2 | 3 | 3 | 3 | 4 |
| X3 | 90 | 105 | 105 | 90 | 105 | 90 | 75 | 105 | 90 | 75 | 90 | 75 | 90 | 90 | 75 |
| Yi | 3 | 5 | 7 | 9 | 10 | 8 | 6 | 14 | 11 | 9 | 5 | 11 | 6 | 11 | 12 |

A Poisson regression is fitted to the data and the estimates of the parameters are obtained as

= 2.2195; = 0.02174; = 0.0224 and = 0.000276

Obtain the fitted counts of inedible kernels and test if Poisson regression fits well to the given data or not.

**Theory:**

If  is a vector of independent variables, then the model takes the form

where  and. Sometimes this is written more compactly as

where x is now an (n + 1)-dimensional vector consisting of n independent variables concatenated to a vector of ones.

Thus, when given a Poisson regression model θ and an input vector x, the predicted mean of the associated Poisson distribution is given by

[fitted count].

If Yi are independent observations with corresponding values xi of the predictor variables, then θ can be estimated by maximum likelihood.

**H0:** Poisson Regression fits well to the data.

**H1:** Poisson Regression doesn’t fit well to the data

The null hypothesis is tested using the following test statistic:

D = 2) – (yi – λi)} ~ χ2 (n-k)

which under the null hypothesis follows a chi-square distribution with n-k degrees of freedom;

where yi is the ith observed value

λi is the ith fitted value

k is the number of parameters estimated

n is the number of observations

Reject the null hypothesis if the value of the test statistic is greater than χ20.05;n-k where χ20.05;n-k is the upper 0.05 of chi-square distribution with n-k degrees of freedom.

**Algorithm:**

1. Open the file “in13.txt” to read the data and “out13.txt” to write the results using pointers.
2. We input the values of X1, X2, X3 and Y from the input file.
3. We then fit the Poisson regression using these values and the given estimates of the parameters.
4. Then we compute the test statistic.
5. Results are expected in the file “out13.txt”.

**Additional:**

Using excel command, we find the critical value chiinv(0.05,11) to be 19.67514.

**Results:**

The value of the test statistic comes out to be 29.873304 and the expected values of response variable are shown in the output file attached alongside.

**Conclusion:**

The value of test statistic is more than the critical value and hence, the null hypothesis is rejected at 5% level of significance. Therefore, Poisson regression doesn’t fit well to the given data.