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WEIGHTED LEAST SQUARE FITTING THROUGH MATRIX FORM USING SCILAB PROGRAMMING

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ABSTRACT:

Weighted least square method plays important role for data sets. It is more efficient as compared to others and makes a good use of small data sets. It having the ability to handle the regression situations where the data points of varying quality. The study has been done manually as well as by the Scilab software (computational software). It has been found that programing done by the software gives the same result as done by manually. Both results are same. ***C(1) = 16.662021*** *and* ***C(2) = - 53.95678****for weight* ***115****also* ***C(1) = 17.290078****and* ***C(2) = - 41.897501****for weight* ***145.****The weighted least squaremethod is a frequently used and most popular method of fitting curve for a given data.*

KEYWORDS: *Scilab software 5.5.2, Weighted least square.*

INTRODUCTION:

The method of weighted least squares is a frequently used and most popular method of fitting curve for a given data.The problems of Least squares can be divided into categories one is linear ordinary least squares and other is non-linear least squares. First happens in statistical regression analysis and has a close outcome, but the second is usually solved by iterative refinement.For each iteration the system is approximated by a linear one so the core calculation looks likes similar in both cases.

The method of **weighted least squares** used when the ordinary least squares assumption of constant variance in the errors is violated. It also includes ordinary least squares as the special case where all the weights w_i = 1 excepted one weight.Using SPSS the data analysed which revealsa strong positive relationship between the number of fire outbreak and the loss of properties [1].For the geophysical observations the data representation and numerical model output was discussed for a best fit straight line in the geosciences and other fields [2]. The form of many equationshave been discussed and proposed by the authors which provide the comprehensive study [3-6].Using alternative method for the estimation of varianceconsidered weighted estimation method which evaluated for the shape parameter of the log-logistic and Weibull distributions via a simulation study and it shows better performance than the maximum likelihood, least-squares [7].In regression model heteroscedasticity (non-constant variance) is present so least square estimates lose the efficiency property sothis in types cases the weightedleast square estimates (WLSE) or alternative methods could be used [8-11].

ADVANTAGES: Weighted least square method plays important role for data sets. It is more efficient as compared to others and makes a good use of small data sets. It having the ability to handle the regression situations where the data points of varying quality.

DISADVANTAGES: The weights which are estimated from small nos. of replicated datas or observations then the result becomes very bad and the effects are very difficult to access for it. So this method can be opted only when the estimates are of fairly precised.

In the problem we took the points (10,110) and (19,175) corresponding weights are 115 and 145 respectively. These point are more reliable than other points in the problem. Here we solve Linear Weighted least square approximation for general straight line equation y= c(1)x + c(2).

The line fitted to the data points (0,1), (1,9), (2,17), (3,18), (4,21), (5,30), (6,45), (7,71), (8,88), (9,98), (10,110), (11,115), (12,122), (13,130), (14,139),(15,144), (16,155), (17,162), (18,175), (19,188), (20,200), (21,221), (22,235), (23,250) and (24,270).

x	y	w	wx	wx^2	wy	wxy
0	1	1	0	0	1	0
1	9	1	1	1	9	1
2	17	1	2	4	17	34
3	18	1	3	9	18	54
4	21	1	4	16	21	84
5	30	1	5	25	30	150
6	45	1	6	36	45	270
7	71	1	7	49	71	497
8	88	1	8	64	88	704
9	98	1	9	81	98	882

10	110	115	1150	11500	12650	126500
11	115	1	11	121	115	1265
12	122	1	12	144	122	1464
13	130	1	13	169	130	1690
14	139	1	14	196	139	1946
15	144	1	15	225	144	2160
16	155	1	16	256	155	2480
17	162	1	17	289	162	2754
18	175	1	18	324	175	3150
19	188	1	19	361	188	3572
20	200	1	20	400	200	4000
21	221	1	21	441	221	4641
22	235	1	22	484	235	5170
23	250	1	23	529	250	5750
24	270	1	24	576	270	6480
Sum x=300	Sum y=3014	Sum w=139	Sum wx=1440	Sum wx^2=16300	Sum wy=15554	Sum wxy=175698

The calculation will be done through the equations

C(1)$\Sigma w_i x_i^2$ + C(2) $\Sigma w_i x_i = \Sigma w_i x_i y_i$……………(1)

C(1) $\Sigma w_i x_i$ + C(2) $\Sigma w_i = \sum w_i y_i$ …………….(2)

Putting the values from the table we can find the values of C(1) and C(2) which are

C(1) = 16.662021

C(2) = - 53.95678

These values are for points (10,110) with weight 115.

So the linear least square approximation is given byy **= 16.662021 x - 53.95678**

Similarly for the points (19,175) with corresponding weights 145

C(1) = 17.290078

C(2) = - 41.897501

And **y = 17.290078x - 41.897501**

Next we solve the approximation using Scilab Software (5.5.2)

SCILAB CODES:

```
clc
funcprot(0);
x=[0:24]';
y=[1;9;17;18;21;30;45;71;88;98;110;115;122;130;139;144;155;162;175;188;200;221;235;250;270];
w=[1;1;1;1;1;1;1;1;1;1;1;1;1;115;1;1;1;1;1;1;1;1;1;1;1]; // for figure 1
w=[1;1;1;1;1;1;1;1;1;1;1;1;1;1;1;1;1;1;1;145;1;1;1;1;1]; // for figure 2
a=sum(w.*(x.*x));
b=sum(w.*x);
c=sum(w.*(x.*y));
d=sum(w.*y);
e=sum(w);
A=[a,b;b,e];
B=[c;d];
C=A\B;//inv(A)*B;
y1=C(1)*x+C(2)
plot(x,y,'o--')
disp(C(1))
disp(C(2))
plot(x,y1,'--ro')
xlabel('x','fontsize',5)
ylabel('y','fontsize',5)
legend('simple plot','weighted plot',2)
title('Plot of x & y','fontsize',5)
```

OUTPUTS:

For figure (1)

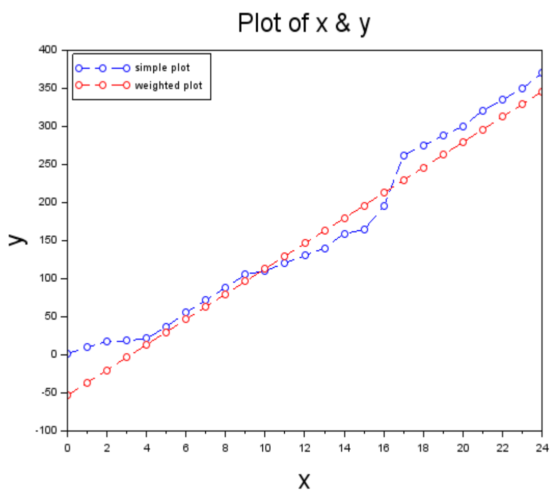
C(1) = 16.662021

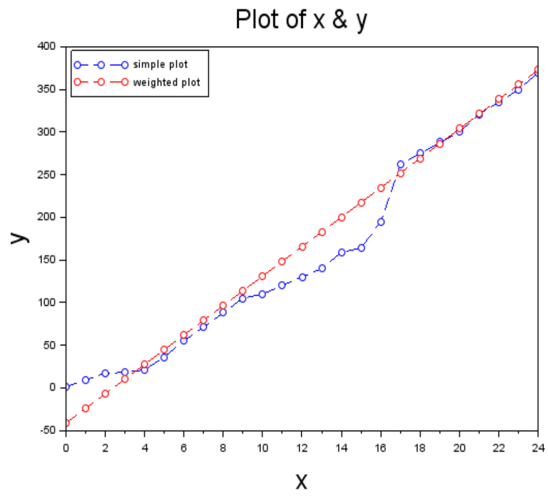
C(2) = - 53.95678

For figure (2)

C(1) = 17.290078

C(2) = - 41.897501





[Figure 1.The value of weight y(11) is 115] [Figure 2.The value of weight y(20) is 145]

RESULTS AND CONCLUSION:

It has been observed that the regression estimates have not changed much from the ordinary least squares method.In figures graph is plotted between x & y, blue curve is for weighted least square and red is for withoutweighted least square. When we solve manually the values of constants are found to be same as that solved by the Scilab software. **C(1) = 16.662021** and **C(2) = - 53.95678**for weight **115**also **C(1) = 17.290078**and **C(2) = - 41.897501**for weight **145**. The weighted least squaremethod is a frequently used and most popular method of fitting curve for a given data.So the weighted least square method having importance for data sets, which is more efficient as compared to others. We know that the weighted points are more reliable than other points it can also be seen from the figures for both weighted.

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