Parameter Estimation Using Gradient Descent

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Introduction

- Gradient Descent is an algorithm that minimizes functions.
- Given a function defined by a set of parameters, gradient descent starts with an initial set of parameter values and iteratively moves toward a set of parameter values that minimize the function.
- Gradient descent method is a way to find a local minimum of a function.

Problem Statement 1

- Collect the data from the local supermarket about Fat Content and Calories in Snack Foods (at least 25 products). Perform Gradient Descent to estimate parameters of the model(Cubic Fit).

Sample Data Set

- Sample Data Set is shown Below.

SR.NO	NAME	X(Calorie)kcal	Y(Fat)gm
1	MAGGIE	503	23.3
2	MAGGIE PASTA	402	14.4
3	BINGO CHIPS	529.97	29.55
4	PARLE CHIPS	501.72	22.58
5	LAYS	540.58	32.36
6	HALDIRAMS SALTED CHIPS	474.25	31.55
7	PRINGLES	550.34	34.09
8	UNCLE CHIPS	530.34	30.33
9	BALAJI	536.28	31.77
10	KURKURE	547.63	33.55
11	HALDIRAMS TAKATAK	542.79	32.45
12	BIKANO CHATEX	551.76	34.63
13	PARLE FULLTOSS	535.1	31.07

Figure : Fat Content and Calories in Snack Foods

Mathematical Model

- In Gradient Descent, We have to minimize the cost function which is given as below,

$$J(\theta_0, \theta_1) \quad = \quad min(\theta_0, \theta_1) \sum_{i=1}^{m} (h_\theta(x^{(i)}) - (y^{(i)}))^2$$

- Repeat until convergence (for every j)

$$\theta_j := \theta_j - \alpha \frac{\partial}{\partial \theta} J(\theta_0, \theta_1)$$

Results and Interpretation

Coefficients	Estimate(For α=.005)
Intercept	25.043527
(Calorie) Slop	1.071766
(Calorie^2) Slop	4.305266
(Calorie^3) Slop	7.335706

Result and Interpretation

- MSE=31.8722(Least Square)
- MSE=29.28346(RanSac)

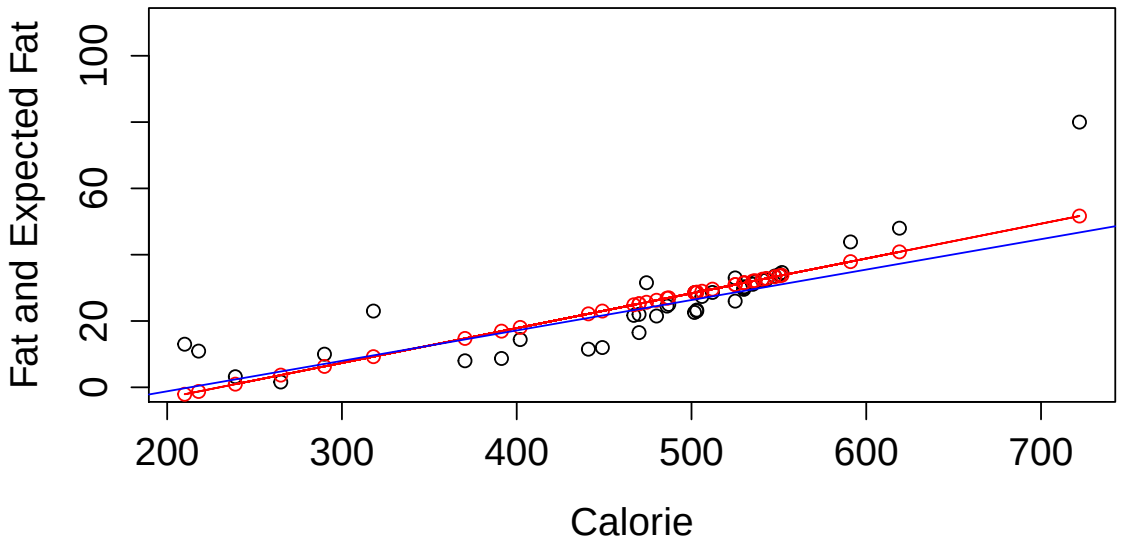

Figure : Graph of Least Square and RanSaC

Result and Interpretation

- MSE=0.005530845

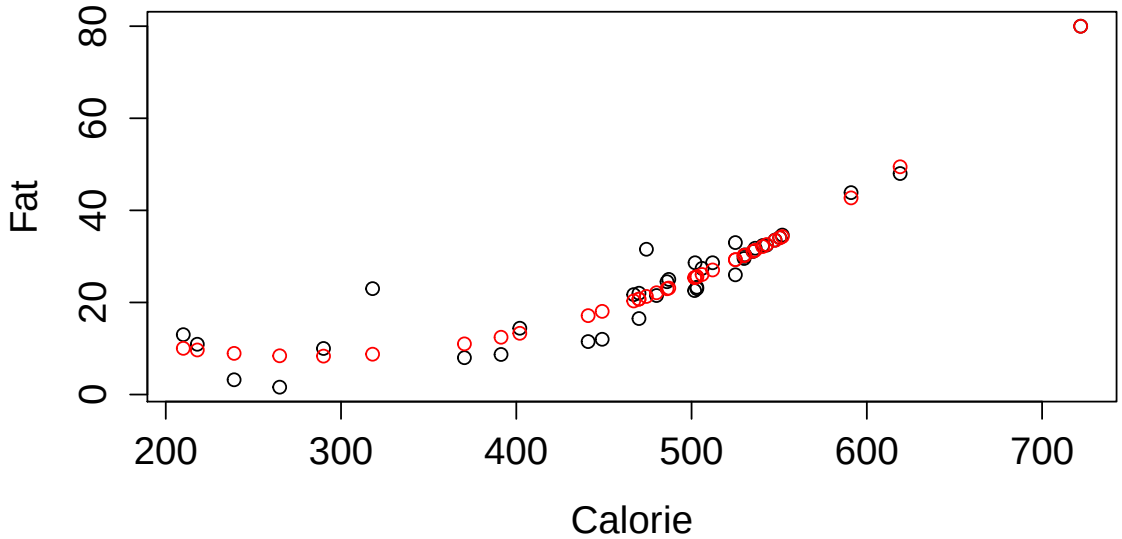

Figure : Graph of Cubic Fit

Result and Interpretation

- MSE=31.8722(When α=.005)

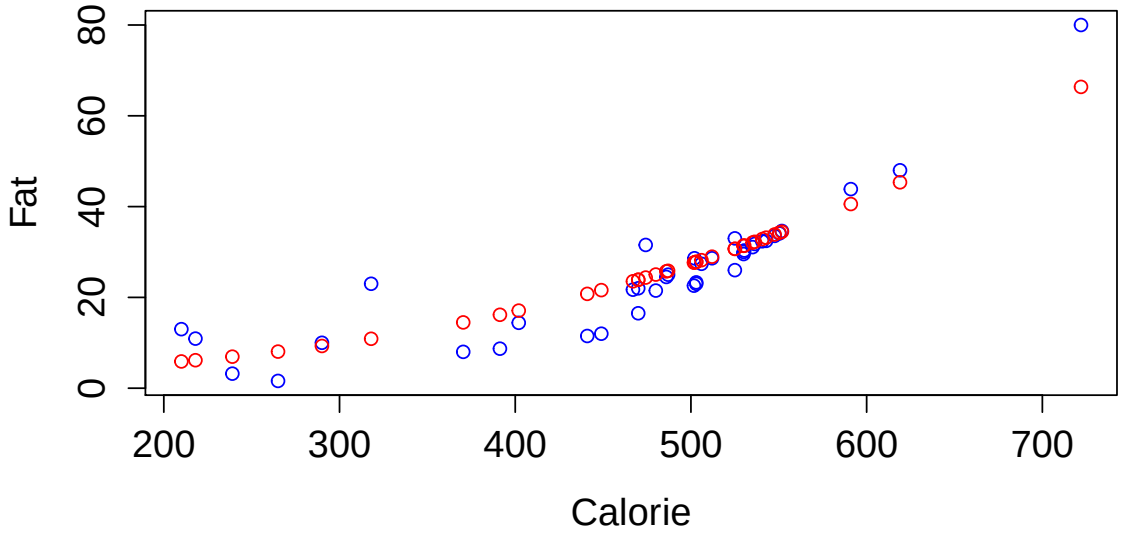

Figure : Graph of Gradient Descent

References


Nug,Andrew *Implementation of Gradient Descent Equation*, available at - http://class.coursera.org/ml-003/lecture/24


https://www.cs.cmu.edu/ ggordon/10725-F12/slides/05-gd-revisited.pdf