Data Analytics - Assignment II (First Part)

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Mars Orbit

Problem Statement:
(i) For each fixed value of x (offset of the average Sun) and y (angle of the line with respect to the reference Aries), write down an expression for the projection of Mars position on the ecliptic plane and the distance of this projection to the centre, in terms of a paired observation.
(ii) Then using the loss function log (arithmetic mean) - log (geometric mean), find the best fit value of x and y.

Data Preprocessing

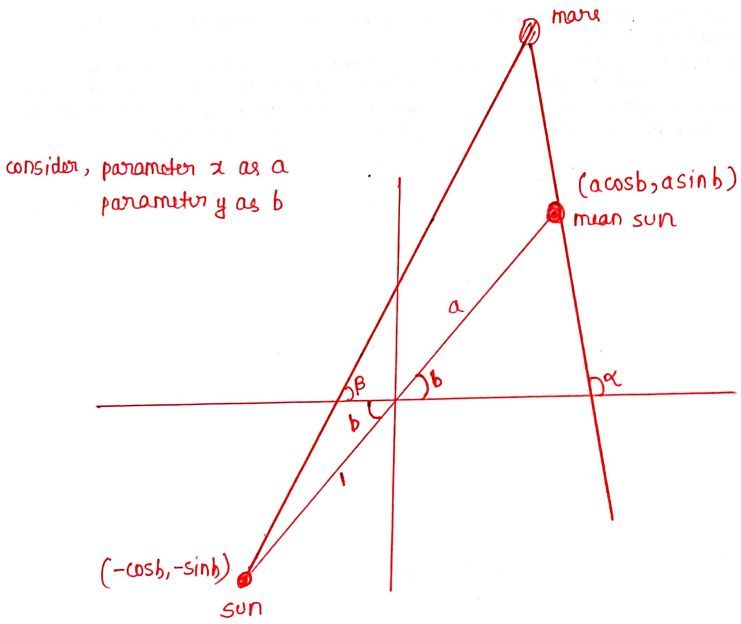
Longitude = (s*30 + Degree + Minute/60 + Second/3600)* $\frac{\pi}{180}$ (in radian)

Here, s is Zodiac index

Assumption

Parameters are a amd b (instead of x and y)
a : offset of the average Sun
b : angle of the line with respect to the reference Aries

Approach



line 1 : Line passing through average sun and mars.
line 2 : Line passing through sun and mars.

Equation of Line 1 :

$(y - asinb) = tan(\alpha)(x - acosb)$

Equation of Line 2 :

$(y + sinb) = tan(\beta)(x + cosb)$

Solving Equation (1) and (2), we will get coordinate of mars.

$x = \frac{(-1-a)sin(b)+(a*tan(\alpha)+tan(\beta))cos(b)}{tan(\alpha)-tan(\beta)}$

$y = asin(b) + tan(\alpha)(x - acos(b))$

$radius = \sqrt{x^2 + y^2}$

Steps ::

1) Convert longitude into radians.
2) Initialise parameter and then minimize loss by using *scipy* package *minimize* function. This will return optimized value of parameters. loss on radius is computed as follows:

$$\text{loss} = \log(\text{Arithmetic Mean}) - \log(\text{Geometric Mean})$$

Results

I had assumed parameter x as a and parameter y as b.
Parameters
a = 0.96
b= -0.5 radian (328 degree)
Total Loss = 0.00177
Radius = 10.75