Homework 10 - MAT3008

박준영

1 How to Build

2 Method

주어진 nonlinear model

$$x' = \frac{a_{11}x + a_{12}y + a_{13}}{a_{31}x + a_{32}y + 1} \tag{1}$$

$$y' = \frac{a_{21}x + a_{22}y + a_{23}}{a_{31}x + a_{32}y + 1} \tag{2}$$

에 대하여 각 매개변수로 편미분 한 값은 다음과 같다.

$$\frac{\partial x'}{\partial a_{11}} = \frac{1}{a_{31}x + a_{32}y + 1}x,\ \frac{\partial x'}{\partial a_{12}} = \frac{1}{a_{31}x + a_{32}y + 1}y,\ \frac{\partial x'}{\partial a_{13}} = \frac{1}{a_{31}x + a_{32}y + 1}$$

$$\frac{\partial x'}{\partial a_{31}} = -\frac{x'}{a_{31}x + a_{32}y + 1}x,\ \frac{\partial x'}{\partial a_{32}} = -\frac{x'}{a_{31}x + a_{32}y + 1}y$$

$$\frac{\partial y'}{\partial a_{21}} = \frac{1}{a_{31}x + a_{32}y + 1}x,\ \frac{\partial y'}{\partial a_{22}} = \frac{1}{a_{31}x + a_{32}y + 1}y,\ \frac{\partial y'}{\partial a_{23}} = \frac{1}{a_{31}x + a_{32}y + 1}$$

$$\frac{\partial y'}{\partial a_{31}} = -\frac{y'}{a_{31}x + a_{32}y + 1}x,\ \frac{\partial y'}{\partial a_{32}} = -\frac{y'}{a_{31}x + a_{32}y + 1}y$$

위 사실을 바탕으로 주어진 데이터셋에 대하여 모든 a를 1로 초기화하여 Levenberg–Marquardt method를 적용한 결과 다음의 데이터를 얻을 수 있었다.

$$a_{11} = -5.991367,\ a_{12} = 9.514857,\ a_{13} = 707.230408$$
$$a_{21} = 2.000000,\ a_{22} = 2.000000,\ a_{23} = 2.000000$$
$$a_{31} = -4.717877,\ a_{32} = 11.088751$$