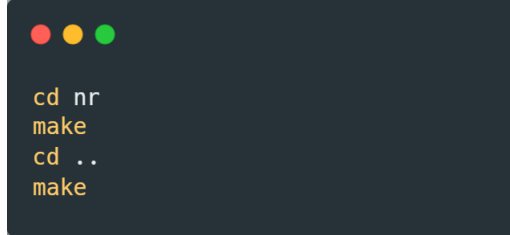


# Homework 10 - MAT3008

박준영

## 1 How to Build



```
cd nr
make
cd ..
make
```

## 2 Method

주어진 nonlinear model

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

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

에 대하여 각 매개변수로 편미분 한 값은 다음과 같다.

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

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

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

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

위 사실을 바탕으로 주어진 데이터셋에 대하여 모든  $a$ 를 1로 초기화하여 Levenberg-Marquardt method를 적용한 결과 다음의 데이터를 얻을 수 있었다.

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