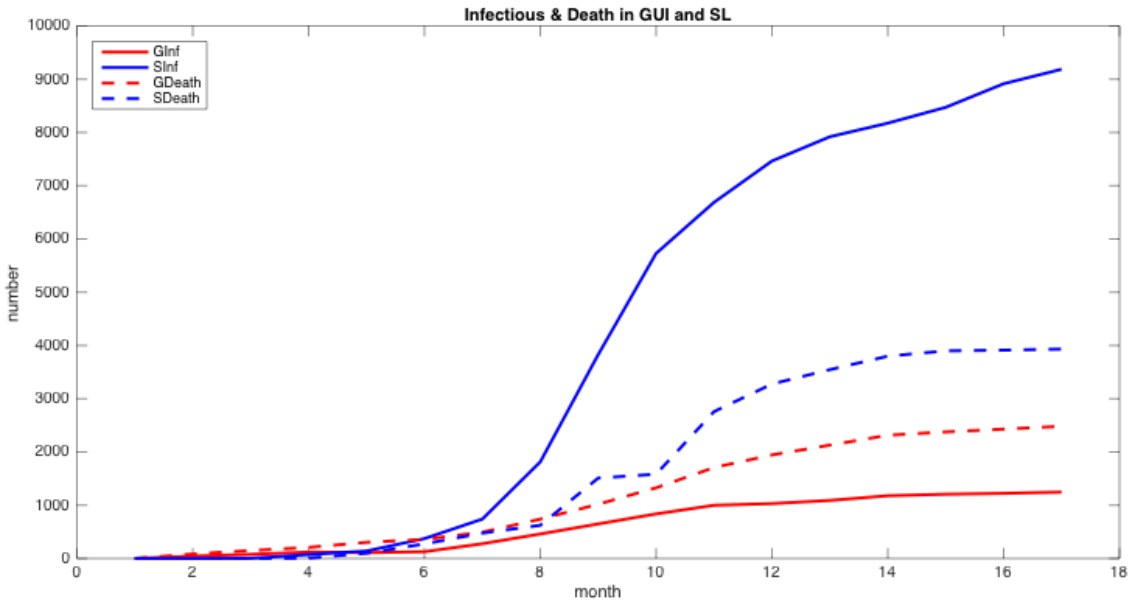
Model Report 04/30/2016 (By Baihan Lin)



Note:

$\beta =$ The per-capita contact rate between any two individuals.

$\gamma =$ The per-capita rate of recovery once infectious.

$k =$ Exposure InfectionRate

Want:

SL high transmission, low fatality → β: GUI < SL

GUI low transmission, high fatality → γ: GUI > SL

Models:

1. Simple SIR Model
   A) With **only 1 least square** based on Infectious cases
   B) With **2 least square** based on Infectious cases and death cases
2. SEIR Model
3. SEIR with import and mortality rate
4. Try to search for minimum least square for $\beta, \gamma, k,$ S_0, I_0 .
5. Try to plot different population size.
6. Try to use a set effective population size

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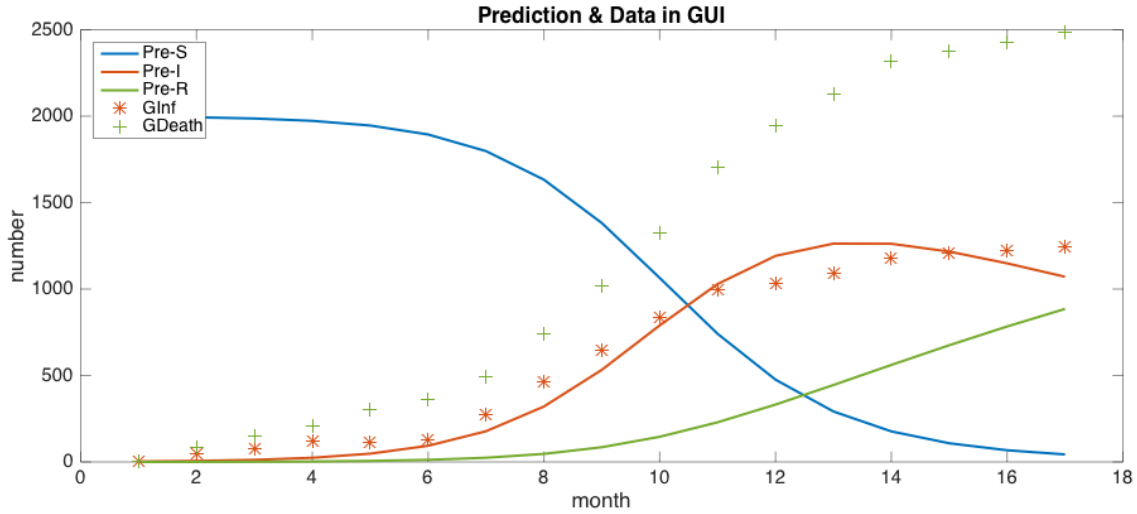
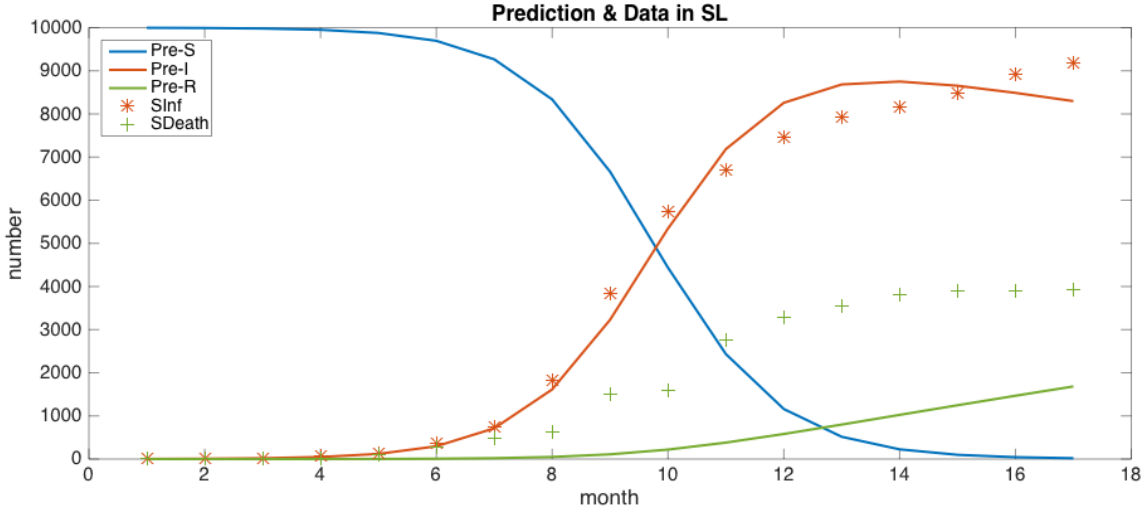
Models:

1. Simple SIR Model
   A) With **only 1 least square** based on Infectious cases



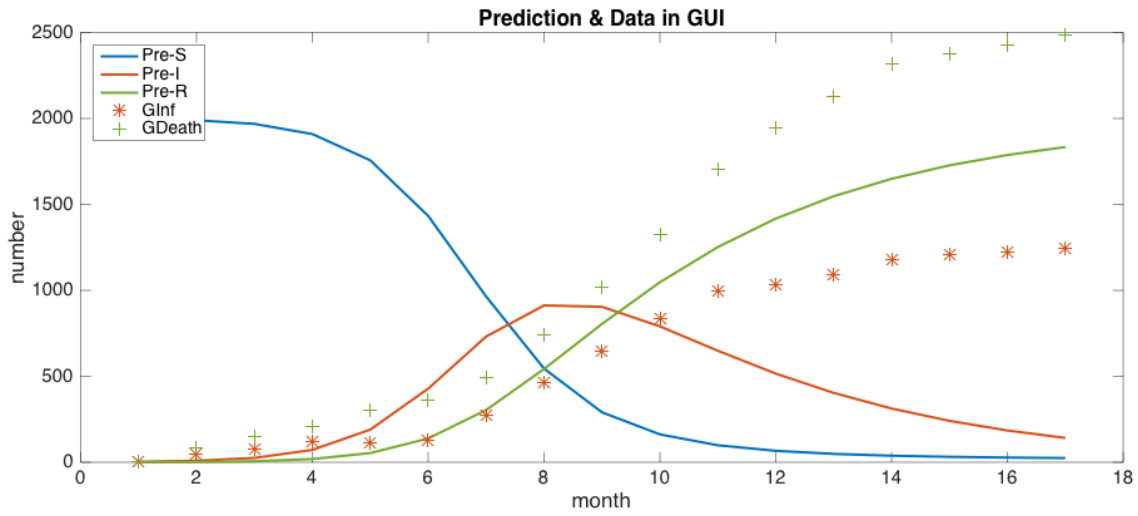
$\beta = 0.7916$ $\gamma = 0.0916$ $R_0 = 8.6389$



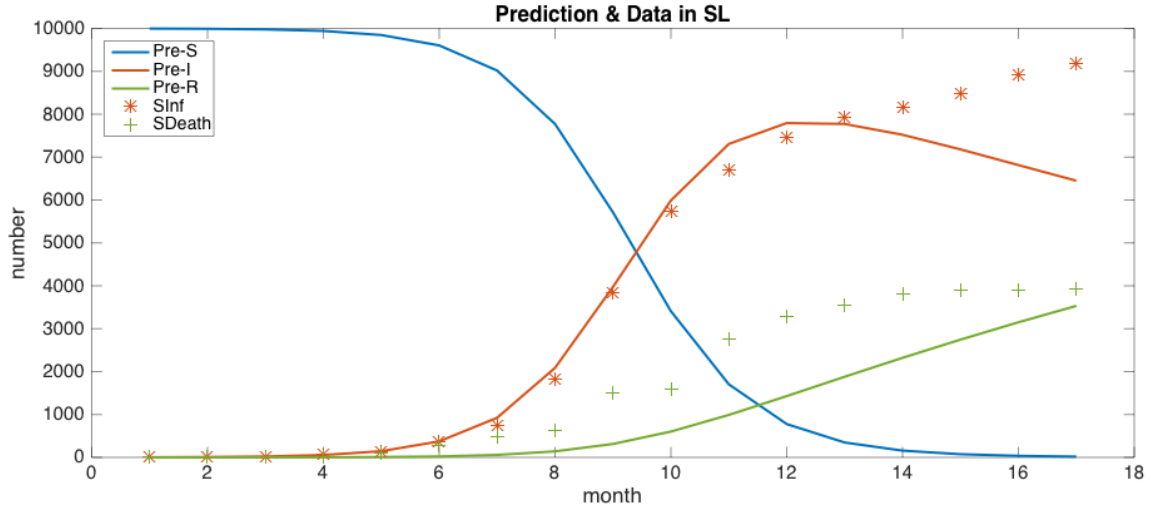
$\beta = 0.9505$ $\gamma = 0.0257$ $R_0 = 37.0355$

Conclusion: Support
Remark: Good at capturing Not good at fitting recovered or death cases

B) With **2 least square** based on Infectious cases and death cases



$\beta = 1.3618$ $\gamma = 0.2845$ $R_0 = 4.7874$



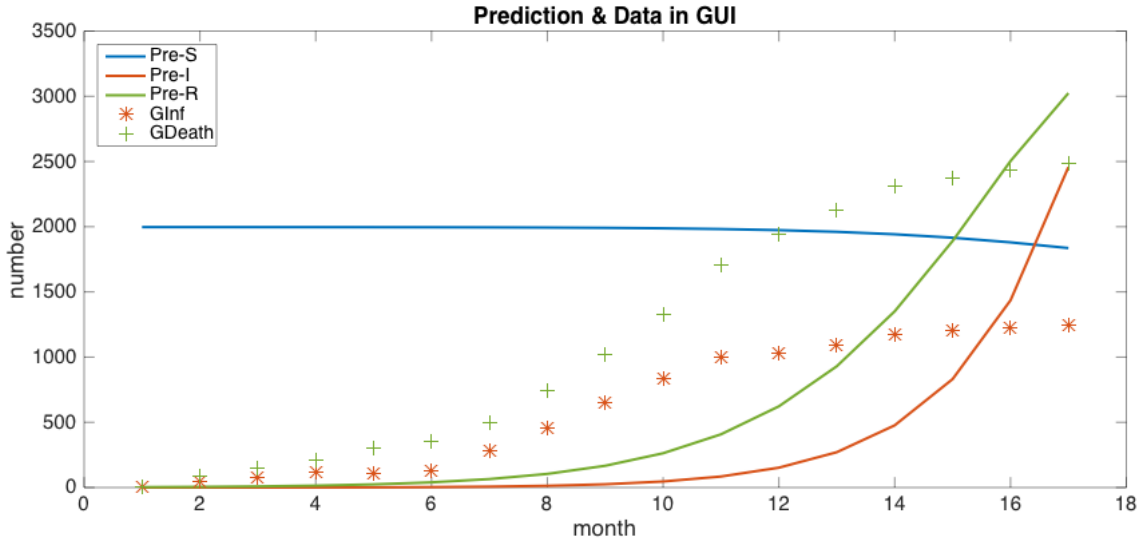
$\beta = 1.0309$ $\gamma = 0.0577$ $R_0 = 17.8686$

Conclusion: Support

Remark: Not good at predicting GUI, perhaps we need SEIR

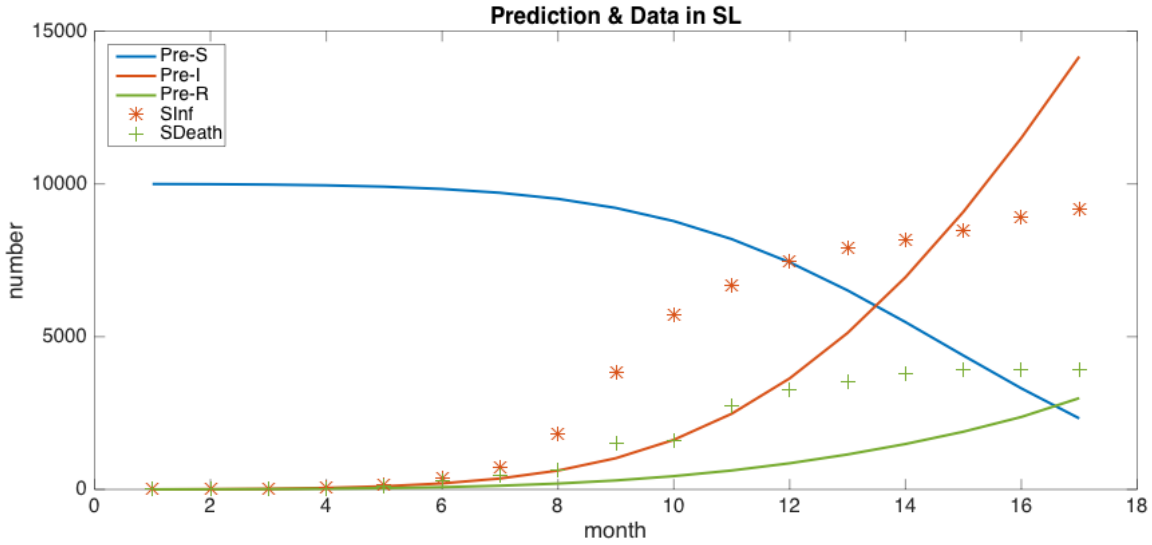
2. SEIR Model

```
y0 = [1997 0 3 0]
```



$\beta =$ 0.0170 $\gamma =$ -0.5382 $k =$ -0.5138

```
y0 = [9997 0 3 0]
```



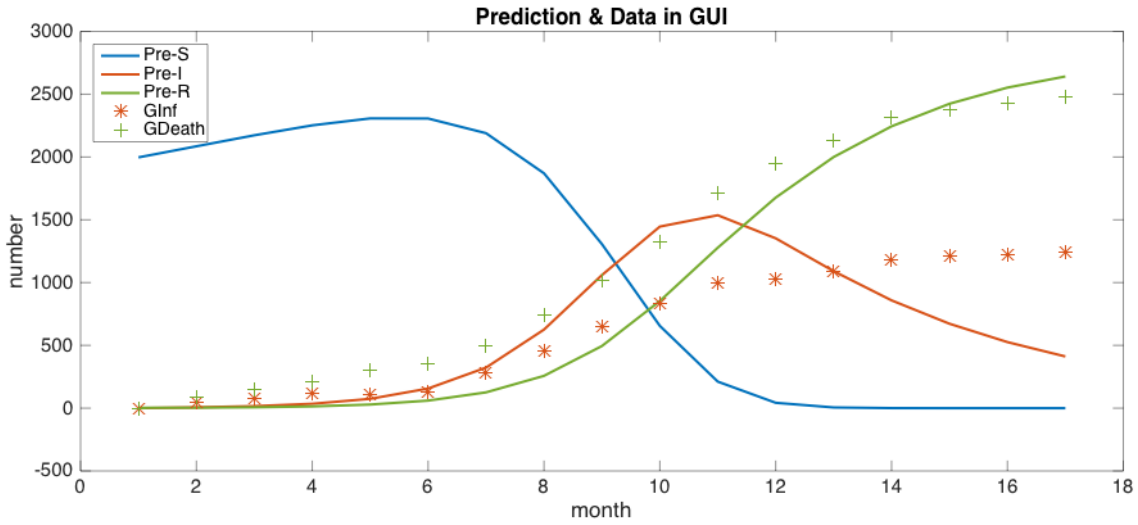
$\beta =$ 1..3240 $\gamma =$ 0.8605 $k =$ -0.1309

Conclusion: Fail to Support
Remark: Not good at predicting, Doesn' t make sense to have negative parameters

Issue: Initial Condition is crucial!!! But the initial condition here doesn't work well.

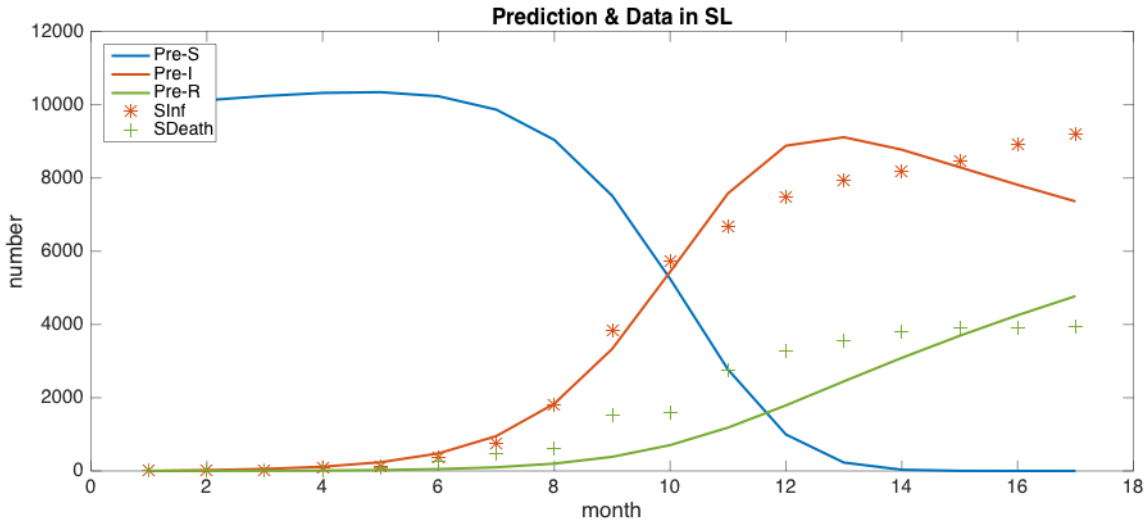
3. SEIR with import and mortality rate

```
y0 = [1997 0 3 0]
```



$\beta = 0.0011083, \gamma = 0.018268,\ k = 0.29200,\ \lambda = -0.034560, \mu = -0.046957,$
$R_0 = -0.033881$

```
y0 = [9997 0 3 0]
```



$\beta = 0.0007016,\ \gamma = 0.0097733, k = 0.074564, \lambda = 0.27091, \mu = -0.01467,$
$R_0 = 3.2936$

Conclusion: Support

Remark: Fit better, but negative mortality doesn' t make sense.

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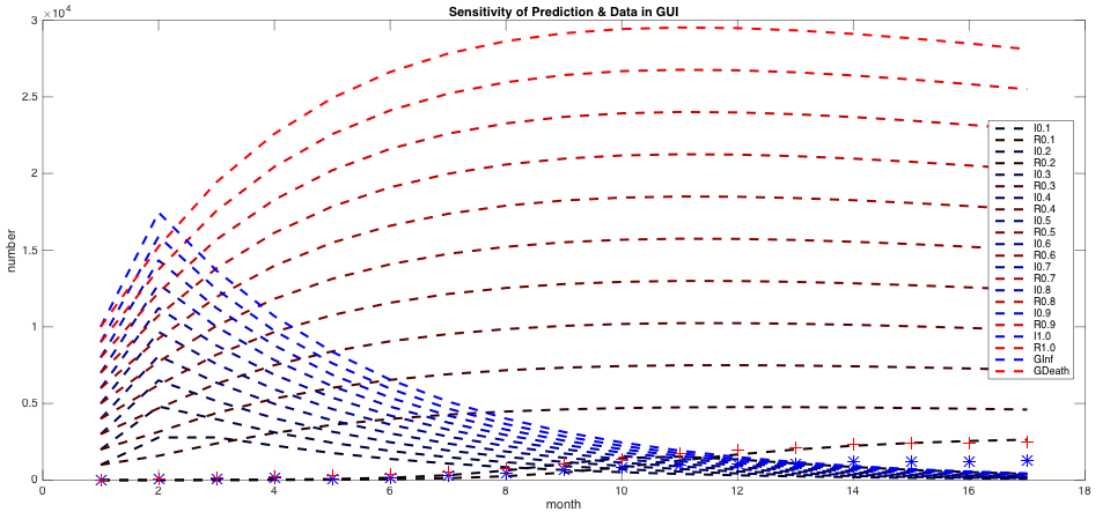
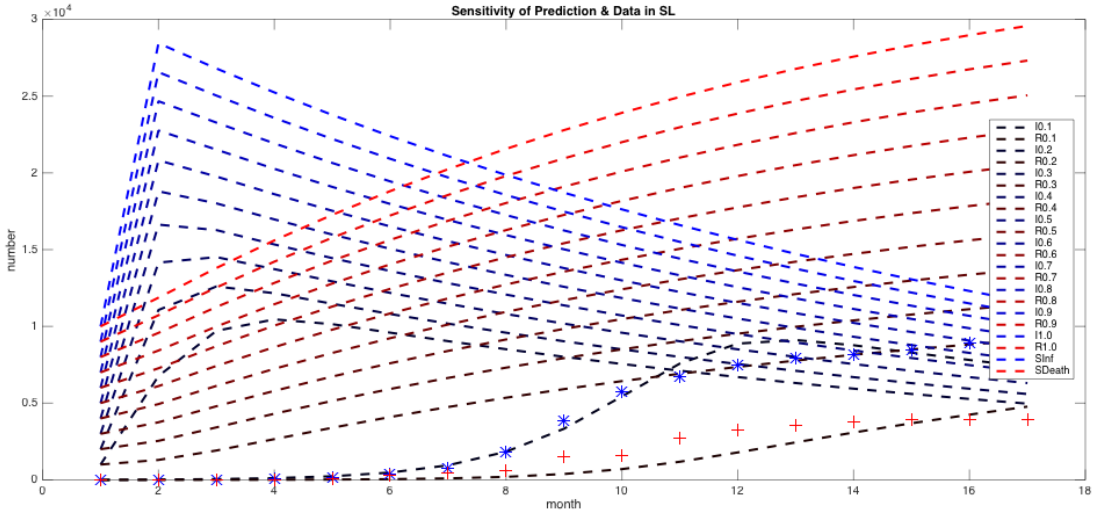
4. Try to search for minimum least square for $\beta, \gamma, k, S_0, I_0$.
   This takes 5 dimension Monte Carlos. My Matlab fails.

5. Another way is to plot different population size.





6. Or I use a set effective population size.