Data Analytics – Covid 19 Modelling
Assignment – 5 Report

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We have implemented the SEIRV model to predict the COVID19 cases in this assignment. The parameters [$\beta, S_0, E_0, I_0, R_0, CIR_0$] are used for the analysis.
The method for this is used as follows: -

$$\Delta S(t) = -\beta(t)S(t)\frac{I(t)}{N} - \varepsilon\Delta V(t) + \Delta W(t)$$
$$\Delta E(t) = \beta(t)S(t)\frac{I(t)}{N} - \alpha E(t)$$
$$\Delta I(t) = \alpha E(t) - \gamma I(t),$$
$$\Delta R(t) = \gamma I(t) + \varepsilon\Delta V(t) - \Delta W(t).$$

We use the following parameters Alpha-1 = 5.8 days (mean incubation period), Gamma-1 = 5 days (mean recovery period) and Epsilon = 0.66 (vaccine efficacy) and N = 70 million (total population).

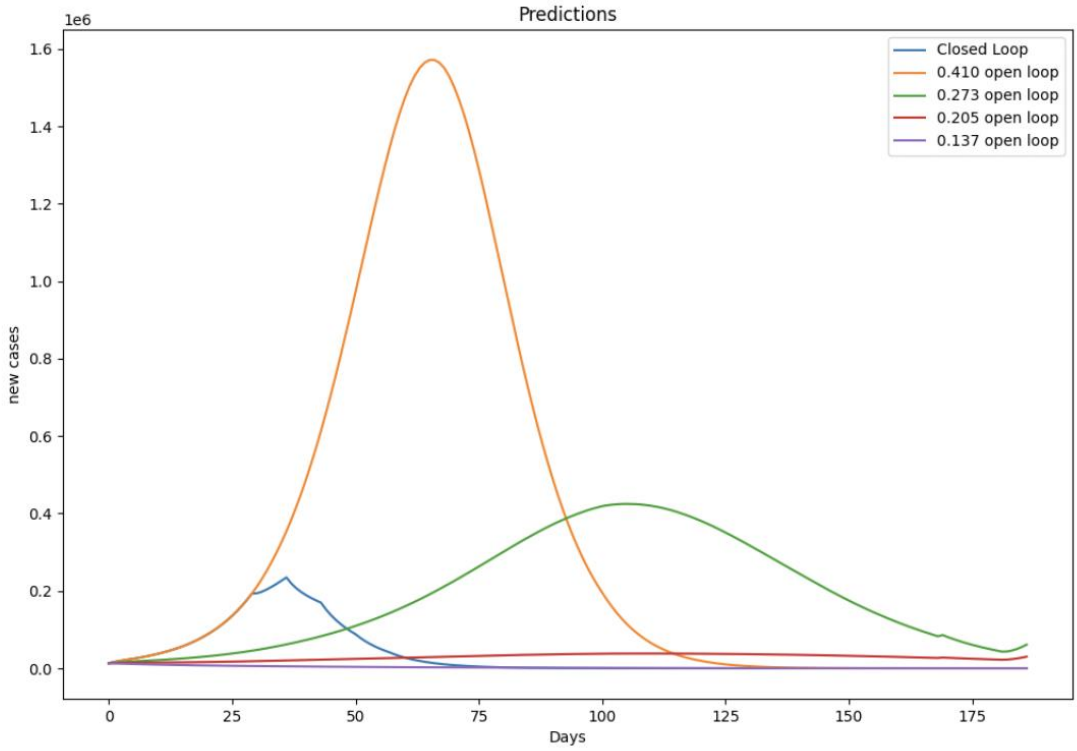
OBSERVATIONS: -

The optimal parameters obtained after the gradient descent operations are shown below: -

1. Beta = 0.3163900503354733
2. S = 68999990.6390055
3. E = 76990.6390050335
4. I = 76990.6390050335
5. R = 14000009.360995019
6. CIR = 13.936

```
iter: 5600,      loss: 0.035920766752961235
iter: 5800,      loss: 0.03585849685389621
iter: 6000,      loss: 0.03581360833576709
iter: 6200,      loss: 0.03578449490869301
iter: 6400,      loss: 0.03576973169443848
final loss : 0.0358
(0.3163900503354733, 68999990.6390055, 76990.6390050335, 76990.6390050335, 14000009.360995019, 13.936099496645248)
vedu@vedu:~/Downloads/DA assignment$
```

For the first plot open loop with no modifications in BETA gives us a gaussian like curve showing pretty relevant results comparing with the data. As BETA value reduces the curve dies out as the contact rate lessens which means lower infection rate. Closed loop method gives not smooth plot as beta changes there rapidly. The plot for daily cases from 16th March 2021 onwards can be shown below: -



For the 2nd plot we can see that the orange curve goes down pretty faster as it has higher contact rate which means more susceptible people moves to exposed state and hence lower number of susceptible people. Other values of BETA shows similar characteristics.