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# Prediction on Covid-19 in India

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## ABSTRACT

***The outbreak of Coronavirus disease 2019 (COVID-19), caused by severe acute respiratory syndrome (SARS) coronavirus 2 (SARS-CoV-2), has thus far killed over 300,000 people and infected over 4,000,000 worldwide, resulting in catastrophe for humans. The paper talks about the modelling of new corona virus spread based on Reproduction Rate, Total Number of Active Patients and Daily New Confirmed Patients. The model determines a rough estimate on the number of new cases based on the daily rate and previous week average of active patients. This prediction model is required in order to better prepare ourselves for medical-actions. The prediction of various parameters (number of positive cases, number of recovered cases, etc.) obtained by the proposed method is accurate within a certain range.***

***Keywords***— *COVID-19, Coronavirus, India, Reproduction Rate, Daily New Confirmed Patients, Model*

## 1. INTRODUCTION

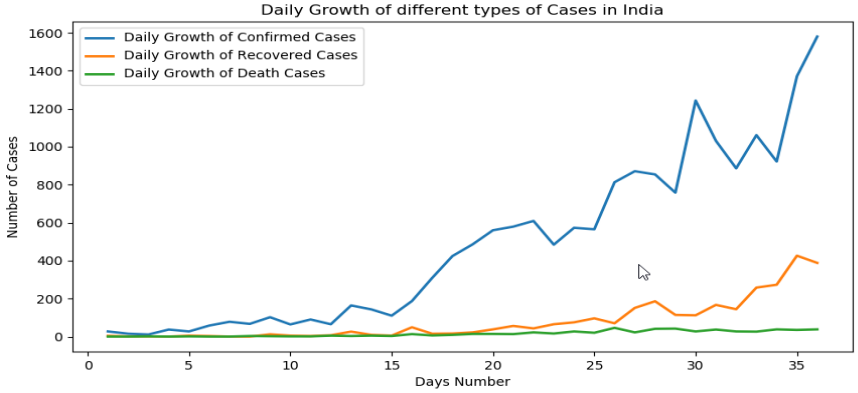
Coronavirus disease 2019 (COVID-19) has presented an unprecedented challenge before the world. As of March 30, 2020, there have been about 0.8 million confirmed cases of COVID-2019 and about 40,000 reported deaths globally. About one-third of the world population is currently under lockdown to arrest the spread of this highly infectious disease. COVID-19 is caused by the novel coronavirus SARS-CoV-2, for which there is no specific medication or vaccine approved by medical authorities yet.

On 31 December 2019, a cluster of pneumonia cases of unknown aetiology was reported in Wuhan, Hubei Province, China. On 9 January 2020, China CDC reported a novel coronavirus as the causative agent of this outbreak, coronavirus disease 2019 (COVID-19). The first case of the COVID-19 pandemic in India was reported on 30 January 2020, originating from China. As of 16 May 2020, the Ministry of Health and Family Welfare have confirmed a total of 85,940 cases, 30,153 recoveries (including 1 migration) and 2,752 deaths in the country. The model is derived from the evolution of the following parameters New Patients (Nd), Total Number of Active Patients (Sd), Reproduction Rate (Rd) and the calculation has been used based on Polynomial Regression which depends on the Reproduction Rate and Average number of patients per week.

## 2. MODEL

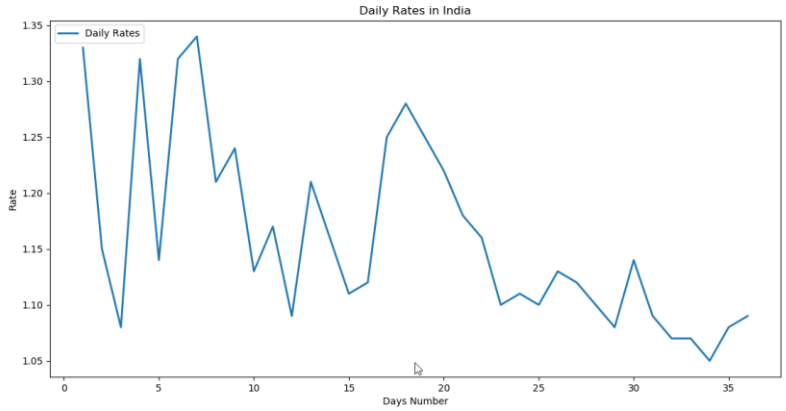
The model has been prepared based on the factual data provided by https://www.covid19india.org. We data has the following parameters i.e. daily new confirmed cases, daily recovered cases and daily deceased. Based on the parameter we are calculate the rate of reproduction (Rd) of COVID-19.

Active Cases = New Confirmed – Daily Recovered Cases – New Deceased




Rate (Rd) = Current Active Cases/Previous Active




Based on the analysis, the varies rate from [1.05 to 1.4] for total population. Based on the figure mentioned below.

```
"C:\Program Files\Python\Python37\python.exe" C:/Abhineet/Development/Python/C
18-Mar-20 ---- New patients :  37  ---- Rate :  1.32  ---- Active :  153 ---
19-Mar-20 ---- New patients :  27  ---- Rate :  1.14  ---- Active :  174 ---
20-Mar-20 ---- New patients :  58  ---- Rate :  1.32  ---- Active :  229 ---
21-Mar-20 ---- New patients :  78  ---- Rate :  1.34  ---- Active :  307 ---
22-Mar-20 ---- New patients :  67  ---- Rate :  1.21  ---- Active :  371 ---
23-Mar-20 ---- New patients :  102  ---- Rate :  1.24  ---- Active :  459 --
24-Mar-20 ---- New patients :  64  ---- Rate :  1.13  ---- Active :  517 ---
25-Mar-20 ---- New patients :  90  ---- Rate :  1.17  ---- Active :  603 ---
26-Mar-20 ---- New patients :  65  ---- Rate :  1.09  ---- Active :  656 ---
27-Mar-20 ---- New patients :  164  ---- Rate :  1.21  ---- Active :  791 --
28-Mar-20 ---- New patients :  143  ---- Rate :  1.16  ---- Active :  920 --
29-Mar-20 ---- New patients :  110  ---- Rate :  1.11  ---- Active :  1022 -
30-Mar-20 ---- New patients :  187  ---- Rate :  1.12  ---- Active :  1147 -
31-Mar-20 ---- New patients :  309  ---- Rate :  1.25  ---- Active :  1435 -
01-Apr-20 ---- New patients :  424  ---- Rate :  1.28  ---- Active :  1834 -
02-Apr-20 ---- New patients :  486  ---- Rate :  1.25  ---- Active :  2284 -
03-Apr-20 ---- New patients :  560  ---- Rate :  1.22  ---- Active :  2792 -
04-Apr-20 ---- New patients :  579  ---- Rate :  1.18  ---- Active :  3302 -
05-Apr-20 ---- New patients :  609  ---- Rate :  1.16  ---- Active :  3846 -
06-Apr-20 ---- New patients :  484  ---- Rate :  1.1  ---- Active :  4249 --
07-Apr-20 ---- New patients :  573  ---- Rate :  1.11  ---- Active :  4720 -
08-Apr-20 ---- New patients :  565  ---- Rate :  1.1  ---- Active :  5169 --
09-Apr-20 ---- New patients :  813  ---- Rate :  1.13  ---- Active :  5866 -
10-Apr-20 ---- New patients :  871  ---- Rate :  1.12  ---- Active :  6564 -
11-Apr-20 ---- New patients :  854  ---- Rate :  1.1  ---- Active :  7191 --
12-Apr-20 ---- New patients :  758  ---- Rate :  1.08  ---- Active :  7793 -
13-Apr-20 ---- New patients :  1243  ---- Rate :  1.14  ---- Active :  8897
14-Apr-20 ---- New patients :  1031  ---- Rate :  1.09  ---- Active :  9724
15-Apr-20 ---- New patients :  886  ---- Rate :  1.07  ---- Active :  10439
16-Apr-20 ---- New patients :  1061  ---- Rate :  1.07  ---- Active :  11216
17-Apr-20 ---- New patients :  922  ---- Rate :  1.05  ---- Active :  11827
18-Apr-20 ---- New patients :  1371  ---- Rate :  1.08  ---- Active :  12737
19-Apr-20 ---- New patients :  1580  ---- Rate :  1.09  ---- Active :  13891
```

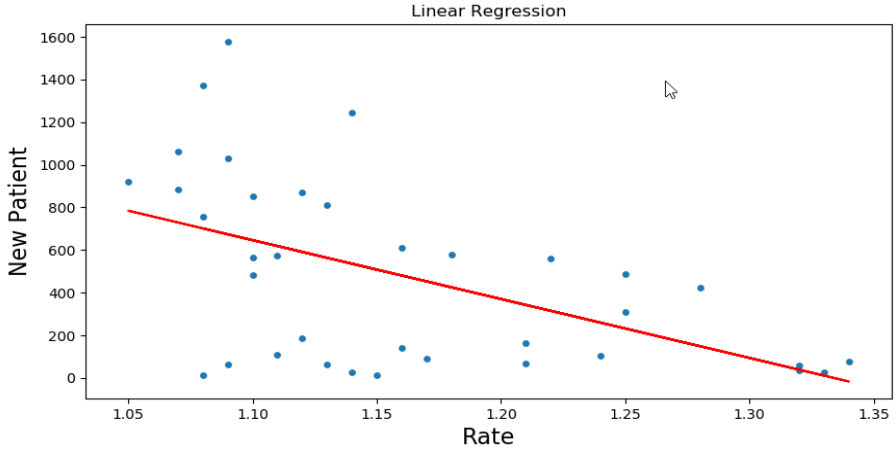
Taking polynomial regression, able to calculate the new number of patients based on rate. That is, New Confirmed Cases (Nd) is proportional to Rate, and New Confirmed Case (Nd) is proportional to Number of Days

Based on the analysis, the rate has been decreasing from x1 coefficient and based on number of days the new confirmed cased has increased.

New Confirmed Patient = Rate *(Patient Per Rate Average) + X2*(Per Week Average)

## 3. RESULTS

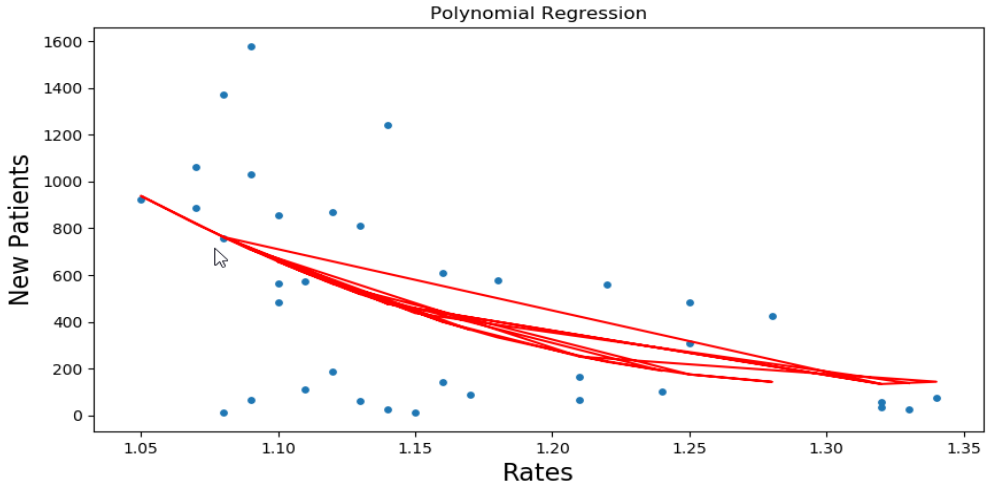
Using Linear regression to fit model for (rates and new patients) but the it does not look good for predicting other values.




RMSE = 369.97432773569165

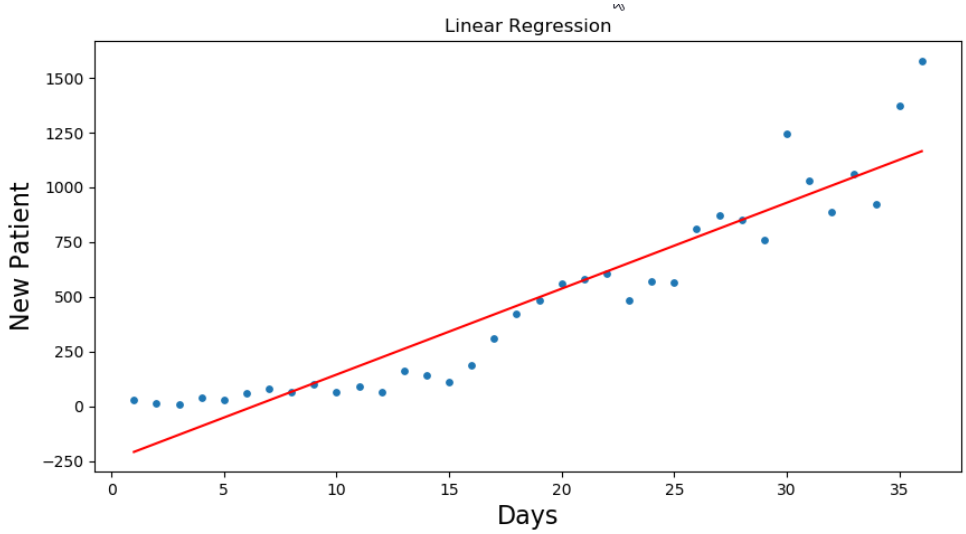
 

Using polynomial with degree 2 regression to fit model for (rates and new patients).



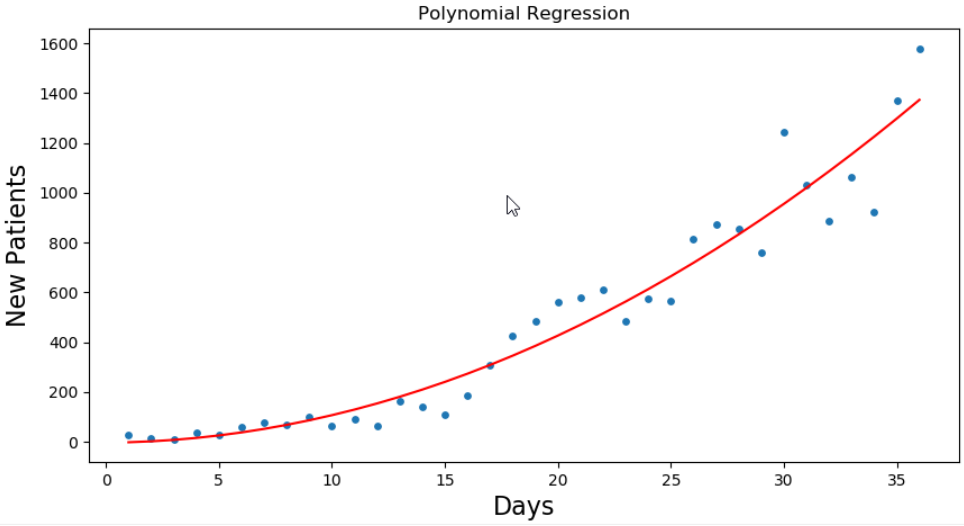

RMSE = 362.97432773569165
Median for Rate = 1.135

Applying Linear Regression and Polynomial Regression for Number of Days and New Patients. This linear regression does not fit the graph.




RMSE = 148.2061997016689

Taking the polynomial regression to fit model for number of days and new patients. The graph looks like fitting the data points.




RMSE = 108.62244413981982

Based on the inference, model assumes that rate is directly proportional to rate and number of days.
Hence,

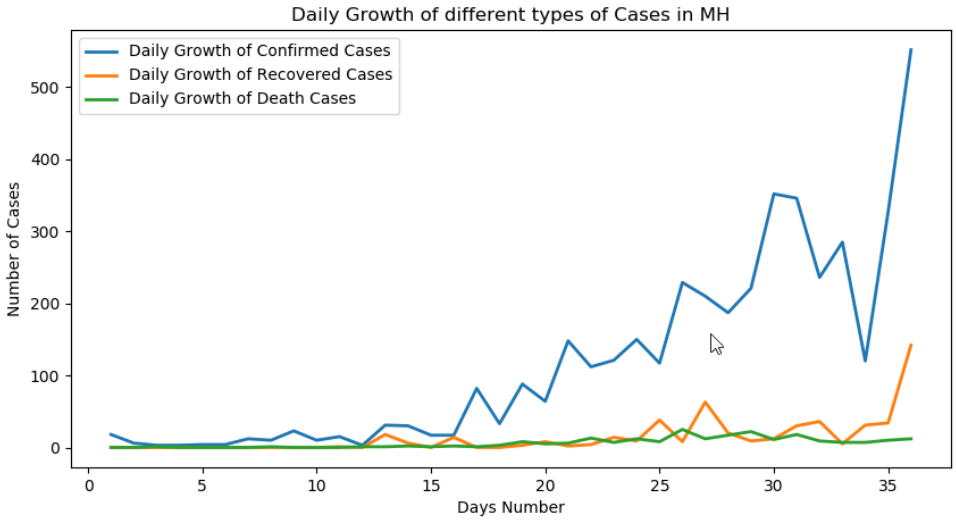
New Confirmed Patient (Nd) = Rate *(Patient Per Rate Average) + X2*(Per Week Average)

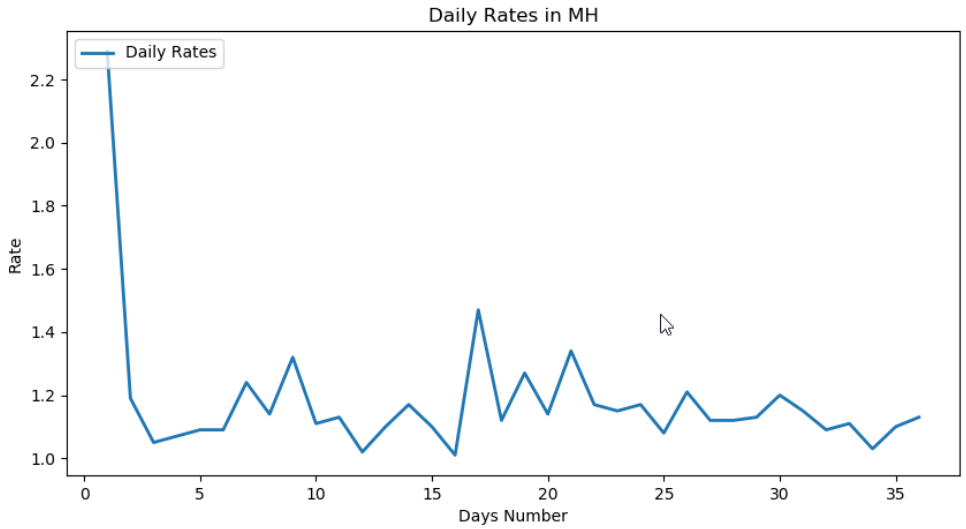
 

**3.1 Data Results**

| Week | Rate | Patient Per Rate Average | Per Week Average |
|---|---|---|---|
| Week1 | 1.24 | 318.8207035 | 20.37492101 |
| Week2 | 1.172857 | 384.5127289 | 30.35263796 |
| Week3 | 1.201429 | 318.9254749 | 350.3993039 |
| Week4 | 1.117143 | 581.0792043 | 669.1446976 |
| Week5 | 1.08375 | 750.0791524 | 1125.69607 |

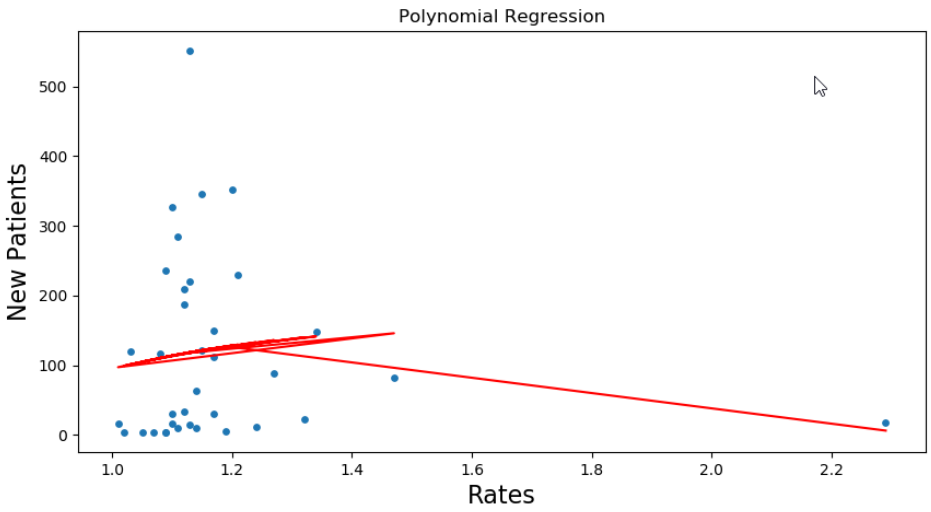
**Running Model for Maharashtra State**



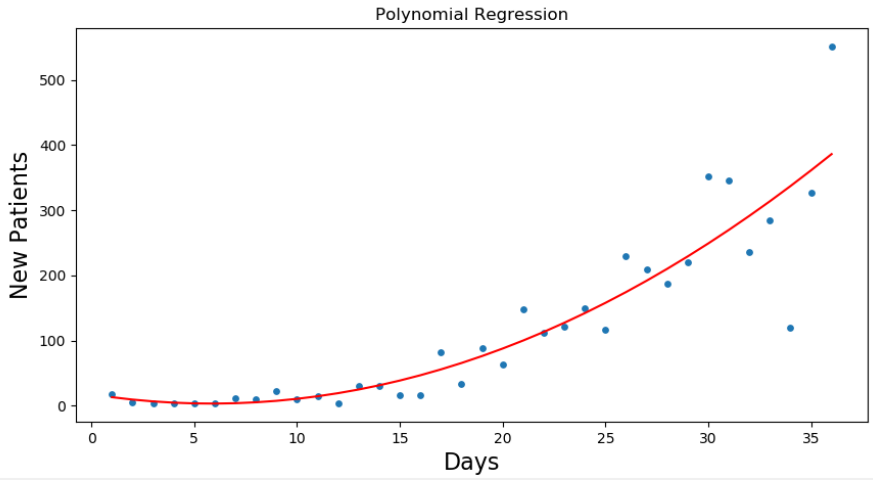

**Polynomial Regression**

- Rates (Rd) vs New Patients (Nd)



- Days vs New Patients (Nd)




### 3.2 Data Results

| Week | Rate | Patient Per Rate Average | Per Week Average |
|---|---|---|---|
| Week1 | 1.288571 | 100.7138539 | 6.472150169 |
| Week2 | 1.141429 | 118.9384994 | 5.351267676 |
| Week3 | 1.207143 | 124.5853236 | 67.34030625 |
| Week4 | 1.145714 | 120.7817067 | 159.6117201 |
| Week5 | 1.1175 | 116.3580393 | 304.7467855 |

New Confirmed Patient (Nd) = Rate *(Patient Per Rate Average) + X2*(Per Week Average)

## 4. SUMMARY

If we analyse the data based on the model discussed above, the rate is declining but the numbers are still high based on the week average. The curve of corona virus will be flattened when the rate of reproduction (rd) will become less than 1 and the week average also becomes constant over time.

## 5. REFERENCES

[1] https://people.sutd.edu.sg/jianxi luo/public html/COVID19PredictionPaper.pdf
[2] https://www.researchgate.net/publication/340362418_Modeling_and_Predictions_for_COVID_19_Spread_in_India
[3] https://www.researchgate.net/publication/340314461_Predictions_for_COVID-19_outbreak_in_India_using_Epidemiological_models