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SIR Model

COVID 19

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# SIR Model: Differential Equations Model

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**SIR model Representation**

Mathematical models of disease spread splits the population into three basic categories according to disease status.

1. Susceptibles S(t): people who have not yet had the disease.
2. Infectives I(t): people who have contracted the disease and are capable of passing the disease to the susceptibles
3. Removed R(t): people who have had the disease and have recovered or those who have died

**Assumptions:**

1. Everyone is born susceptible and are capable of being infected
2. Removed individuals no longer contribute to the spread of the disease

**SIR Model:**

The model is governed by 3 differential equations

Susceptible Equation:

Infected Equation:

Removed Equation:

and

N: overall population

# Analytical Approach:

**Data Sources:** covid-19-india.csv and population\_india\_census2011.csv

1. Get the population figures by state using population\_india\_census2011.csv
2. Derive Susceptibles = Population – Infected and Removed = Recovered + Deceased by day for all states
3. Derive the dependent variables and
4. Independent variables are S(t) and I(t)
5. Estimate the value of a and b using curve fitting for Susceptibles Equation and Infected Equation (NLM function in R, also check similar function in Python)
6. Estimate R0 = a(0) \* S(0) / b(0)
7. Find the forecasts:

# References:

<https://www.maa.org/press/periodicals/loci/joma/the-sir-model-for-spread-of-disease-the-differential-equation-model>

<http://ceadserv1.nku.edu/longa/classes/mat375/mat375prep/SIR%20Model.html>

<https://www.youtube.com/watch?v=Qrp40ck3WpI>

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<https://theconversation.com/how-to-model-a-pandemic-134187>