

# SIR Model for Fake News Spreading through Whatsapp

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## Abstract:

Whatsapp is an instant messaging social media platform which allows authors to send and receive message, pictures and videos. The app has about nine hundred million monthly active authors in the world, who stock approximately six hundred million facts in keeping with day. This work applies powerful and analytical modeling approach to estimate the spread of Fake news on Whatsapp. The study introduces a framework to compare misinformation dynamics on Whatsapp based on the topical age group as well as a framework for the prediction of topic occurrence.

*Keyword: SIR Model, Mobile messenger, Differential Equation, Epidemic Threshold.*

## 1. Introduction

Social networks are masses of community who share a commonality. People are either connected to each other by clubs or by professional circles called networking groups. With the flying success of the internet and establishment of social media, social networking has come to symbolize the podium by using which people have interaction, collaboration, and inter communication. For example, Facebook, Twitter, LinkedIn are viewed as most likely social networks whereas Whatsapp, Viber, Snapchat are viewed as social media platforms.

Instant messaging is a sort of on-line chat which offers actual-time textual content transmission over the net. Due to the fact that the advent of smart phone and the successive access of cell apps, small price or open chat and social messaging apps have demonstrated themselves as a reasonably-priced alternative to operator-based text messaging through SMS. Whatsapp is predominately free prominent mobile messenger with currently more than 900 million monthly active users and gives simple, comfortable, reliable messaging and calling, available on smart phones all over the world, which makes it extraordinarily popular. Jan Koum and Brian Acton are the founders of this popular messenger who had previously spent twenty years mixed at Yahoo. Later on Whatsapp is accompanied by using Facebook in 2014, but continues to serve as a separate app with a focus on sending and receiving an array of media: text messages, pictures, videos, documents, and location, as well as voice calls that works like a bullet and reliable all over in the world. More than one million individuals in over one hundred eighty countries use app to stay in contact with companions, whenever and wherever.

Fake news in India is a growing problem. The practice of the use of social media platforms like Whatsapp to popularize fictitious information is leading in a dangerous direction. There are two main aspects urging the fake news surge. Firstly, the trend of declining smart phone prices over the last couple of years. And, secondly the fall in internet data prices. Therefore, the problem of fake news is not going to leave soon, and knowing the truth is not going to be easy. We heard fake news at the time of demonetization of currency notes in India during Nov. 2017. Lots of fake news, videos and photos on the conflicts of Hinds and Muslims are

shared through Whatsapp. The SIR models the flows of people between three states: susceptible (S), infected (I), and recovered (R). The first SIR model, was proposed by Kermack at el.(1927). Information transmission is a moving growth guided by using the interplay among the susceptible and the infective. The conduct of SIR models are extremely laid low with the manner in which conveyance between infected and susceptible entities are modeled. The ranges of epidemiological models which are broadly used are the so-called homogeneous models. A homogeneous model assumes that every character has identical touch to others within the population and that the rate of infection is largely determined by the density of the infected population.

## Nomenclature

S: represents the number of feasible authors those are relevant for spreading of fake news.

I: represents the wide variety of authors in the age group 19-24 who are highly active for posting the fake information

R: represents the range of authors in the age group 40-60 who are inactive to spread the fake information.

$\alpha$  is transfer rate,  $\beta$  is recovery rate and  $k$  the possibilities of contagion from individuals.

M: Million

## 1.1. Literature Review

Nikhil et al. (2017) calculated that Whatsapp customers in India use the video calling feature for a complete of 50 million minutes per day, the highest aggregate usage inside the global, in keeping with the enterprise. Manish et al. (2017) told about Whatsapp users in India, that about 200 million people are actively using this app in India. Anatoly Khorozov et al. (2016) revealed that Whatsapp messenger site has become most favorite app and is being widely used by 63% people in India and this percentage is growing day by day. Prashant Naidu et al. (2015) presented a data in which he showed that watspp users in India are approximately 44% in the age group of 20-29 years and this growth is going like a bullet. Krishnan et al. reported that India is one of the biggest markets for several social media and communication companies - it has 160 million of Whatsapp's monthly active users and fake news are being speeded through

this messenger like a wild fire, further he told two major factors driving fake news. Mukherjee et al. (2017) explained that Whatsapp’s underlying encryption makes it difficult to tackle the challenge of fake news, as Whatsapp operators have no way of seeing what kind of information is being spread on their networks, unless it is reported to them directly by users. Zoey et al. (2017) reported that due to end-to-end encryption in Whatsapp, government is unable to stop and punish people spreading fake news. Alan et al. (2017) Whatsapp engineer termed this messaging app as “Complex” due to encryption mechanism because it does not store any information on the server. Iyoha et al. (2015) differentiated between social media and social network and told that Whatsapp now further exist on the web via www.web.Whatsapp.com (Chrome browser only) and can now access it on the personal computer.

1.2. Structure of SIR model



Fig. 1 – Structure of SIR model

2. Differential equations and Stability Analysis of the model:

$$\alpha \qquad \beta$$

$$\frac{dS}{dt} = -\alpha(k)SI \qquad (1)$$

$$\frac{dI}{dt} = \alpha(k)SI - \beta I \qquad (2)$$

$$\frac{dR}{dt} = \beta I - \mu R \qquad (3)$$

Jacobian matrix for the model is given by the following equation:

$$J = \begin{bmatrix} -\alpha k I & -\alpha k S & 0 \\ \alpha k I & \alpha S - \beta & 0 \\ 0 & \beta & -\mu \end{bmatrix}$$

Now

$$\begin{aligned}
 \text{Det}(J - \lambda I) &= \begin{vmatrix} -\beta I - \lambda & -\beta S & 0 \\ \beta I & \beta S - \alpha - \lambda & 0 \\ 0 & \alpha & -\mu - \lambda \end{vmatrix} \\
 &= \begin{vmatrix} -47.3556 - \lambda & 107.736 & 0 \\ 47.3556 & 107.036 - \lambda & 0 \\ 0 & 0.7 & -0.0001 - \lambda \end{vmatrix}
 \end{aligned}$$

Therefore the sign of all Eigen values are that is negative, so the given model is stable, otherwise the model is unstable. Its eigen values are (-0.0001, 135.0016 and -75.3315) so if  $\lambda_1 < 0$ ,  $\lambda_2 < 0$  and  $\lambda_3 > 0$ ; The observation is that the condition of stability exists for the model.

3. Numerical simulation of SIR Model

Table-1	
Parameters	Values
S(0)	134M
I(0)	58.9
R(0)	13.4
$\alpha$	1.34 estimated
$\beta$	0.7estimated
$K$	0.6 estimated
$\mu$	0.0001 Approx.

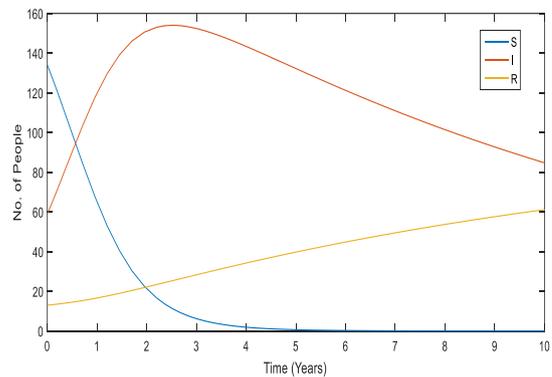


Fig. 2 - SIR model for fake news on WhatsApp (Social media)

4. Conclusion

An epidemiological SIR model to describe dynamics of spreading of fake news through social media platform named Whatsapp. The rate of growth of misinformation through the social media platform is increasing every year by the age group 19-24 very rapidly that is also shown in the graph whereas the recovery rate is comparatively low in the age group 40-60 resp. At the first step, we have a deterministic model based on differential equations. It is concluded that the fake news spreading on Whatsapp is increasing day to day. Mathematics result of the model is representing the situation is stable. Society needs to think to stop the fake news spreading and explain the demerits of such news. We will advise readers to not believe all the news on this app, because some of the news may fake.

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