Growth Analysis of Social, Mobile and Mobile Social Users through Internet

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Abstract—**Evaluating the growth of information transmission on online social network is a composite effort because of immense number of users and their friendship. This scope to outspread records rapidly has brought about excessive expectations for telling people about something and viral campaigns in online social networks. In this work, an SIR model is formulated on social networks which include growth of internet users', social users', mobile users' and mobile social users'. This model is reduced to a system of three ordinary differential equations for Social Networks. The work shows the study for parametric values estimated according to literature. Numerical results showed the unstable dynamic behavior of the social network.**

Keywords—*SIR Model, Social Network, Differential Equation, Mathematical Modeling.*

I. INTRODUCTION

It has been observed that most of the associations commence, develop and finish on social media. People now don't want be in possession of handclasp and confronting each other. Social media sites are growing every day. Social networking has become one of the basic needs of every second individual. Everyone is given to using internet services either on laptops or on mobiles. As mobiles are handy therefore the mobile social usage is increasing day by day. Social network is a network that everyone is expanding with their friends, colleagues, and partners. Social networking is a good source of expanding your ideas, finding people of your interest and killing time. Year-on-year growth is getting stronger, particularly in the use of mobile social media. Internet users are the persons who accesses internet through any mode like mobile, laptops and other electronic gadgets. Internet is defined as a fastest communicating network that provides to get involved in imitation of a variety concerning verbal exchange features and consists of email, news, entertainment and many more features. Most of the generation in world's population is using mobile phones. The actual growth is in favor of adopting smart phones with many devices sold every second. The number of users is penetrating into social media through mobiles every single day. This growth is going like a bullet. The most common social media used by population on mobile is Whatsapp. It is the world's fastest growing platform. Social media is the shared online communication platform where ideas committed in imitation of community-based input, interaction, content-sharing and collaboration.

Everything is associated with pros and cons, and social media is also not left behind. Main advantages of social media are: It allows you to stay linked to friends and families in today's busy paced world; one can connect with old friends in just a simple search. One can share their memories at any point of time. Not only sharing memories but one can also be part of other friends' memories too by seeing their pictures online. It also allows one to get latest news about what is happening around the world. Any type of information spreads as wildfire among million of people over social media sites. Important matters kind of recalls, reminders, storm facts is communicated quickly. Unfortunately, so many fake things are also being speeded without even thinking about damaging the cause of society and which creates panic between societies. One over the most important dangers over using social networking web sites are the youngsters are getting addicted towards these social media sites. They are spending most of their sites only which is somewhere degrading their overall academic and physical development.

II. STANDARD EPIDEMIC SIR MODELS FOR SOCIAL NETWORK

SIR is the standard epidemic model which was firstly invented in 1927 by Kermack et.al and has played a major role in mathematical epidemiology. $S(t)$ represents the number of feasible authors, who might have a hobby in an issue at any time t, $I(t)$ represent wide range of authors who write down posts on any issue throughout identical duration and $R(t)$ represents range of recovered authors whose posts not affecting others on a subject. Where infection rate (α) suggests the rate of feasible authors from susceptible class to infected class whereas recovery rate (β) suggests the rate of recovered authors from infected class i.e., infective authors get better in the course of a unit time. Due to the fact that contamination takes place via a touch between susceptible and infective, the number of authors who become infected from susceptible is described as product

$$\alpha S(t)I(t).$$

III. DIFFERENTIAL EQUATIONS OF SIR MODEL

$$\frac{dS}{dt} = -\alpha SI \;..........(1)$$

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

$$\frac{dR}{dt} = \beta I \;..........(3)$$

IV. REVIEW OF LITERATURE

Thakare et.al (2016) explained the improved SIR model for epidemic control in a social network which gives the better realistic simulation results by considering crowding or protection effect. The efficiency of the model can be analyzed in social sub-networks with some potential immunization strategies. Woo et.al (2016) presented the SIR model of matter transmission within internet forums. The model was estimated on outsized data from the web forum of a major retail corporation. The suitable outcomes proved that the SIR model is an attainable version to explain the circulation mode of issue. The studies confirmed that a contagion fashion amplifies utility regions to subject matter conversation on the web. Wang et.al (2015) applied and studied SIR model on fake news spreading by taking the influence of social network(homogenous and inhomogeneous)medium into consideration. They found that the impact of the network medium on homogeneous networks is larger than on inhomogeneous networks. They performed numerical simulations which showed that fake news spreading accelerates with an increase of the infected persons and the network medium. Cannarella et.al (2014) applied a modified epidemiological model to outline the acceptance and disused progress of online social networks by active users. They validated proposed infectious recovery SIR model (irSIR model) on the available public data from MySpace and then that apply irSIR model in conformity with ask query data because of "Facebook," who confirmed the instance regarding a disused phase. Extrapolating the superior in shape model between the after predicts rapid decline in Facebook recreation into the next little years. Marek et.al (2013) presented an analysis on whether the spreading phenomena, as includes the thoroughness over ideas is influenced with the aid of the structure regarding the social network. They carried out distillation simulations the use of the SIR model on a sizeable quantity of real-world or artificially generated community datasets. This work concluded the two main outcomes which are tremendous effect on the simulated SIR spreading and identify significant differences among the networks. Sotoodeh et.al (2013) proposed a general compartmental information diffusion model and extracted some of the parameters which are beneficial to analyze the model. To acceptance of deterministic manner to stochastic one, Markovian property has been used to find out transition probability. Then, the

probability obtained has been applied to get the mean value of population per each group. Wei et.al (2013) proposed a general compartmental information diffusion model and extracted some of the parameters which are beneficial to analyze the model. To acceptance of deterministic manner to stochastic one, Markovian property has been used to find out transition probability. Then, the probability obtained has been applied to get the mean value of population per each group. Westland (2010) proposed a model for social networks, and shows the management of the model. Cha et al (2012) showed that the two factors can give an explanation for the patters located on actual data and helps us to understand how these aspects affect world network's capability to spread news swiftly and broadly. Yakushev A. et al (2014) presented their approach for data mining from social media which is based on combination big data and cloud computing paradigms.

V. STABILITY ANALYSES FOR MATHEMATICAL MODEL

Jacobian matrix of the governing equation of the system is given as:

$$J = \begin{bmatrix} -\alpha I & -\alpha S & 0 \\ \alpha I & \alpha S - \beta & 0 \\ 0 & \beta & 0 \end{bmatrix} \cdot \begin{bmatrix} S \\ I \\ R \end{bmatrix} .....(4)$$

$$DET(J - \lambda I) = \begin{vmatrix} -\alpha I - \lambda & -\alpha S & 0 \\ \alpha I & \alpha S - \beta - \lambda & 0 \\ 0 & \beta & -\lambda \end{vmatrix} = 0....(5)$$

$$\Rightarrow (-\lambda)\left[\lambda = -(\alpha I - \alpha S + \beta) \pm \sqrt{(\alpha I - \alpha S + \beta)^2 - 4\alpha\beta I}\right] = 0..(6)$$

$i.e.\ \lambda_1 \le 0, \lambda_2 \le 0 \quad and \ \lambda_3 \le 0; \ if \ -(\alpha I - \alpha S + \beta) \ge \sqrt{(\alpha I - \alpha S + \beta)^2 - 4\alpha\beta I} ...(7)$

Since all the Eigen values are negative then the given model is stable, otherwise the model is unstable [10]

VI Numerical Simulation of Social Media User Growth, Internet User Growth, Mobile User Growth, Mobile Social Media User Growth:

S. No	Parameters	Parameters estimations (estimated)			
		(1)Social media user	(2)Internet user growth	(3)Mobile user growth	(4)Mobile social media user growth
1	$S(0)$ represents the number of feasible authors	0.9	0.9	0.9	0.9
2	$I(0)$ represents the range of authors who write down posts on any issue	0.1	0.1	0.1	0.1
3	$R(0)$ represents the range of recovered authors whose posts not affecting	0.05	0.05	0.05	0.03
4	(α) represents how many feasible authors could be infected	0.087 [Ben cooper (2015)]	0.076 [Ben cooper (2015)]	0.034 [Ben cooper (2015)]	0.023 [Ben cooper (2015)]
5	Recovery rate (δ) shows how many infective authors according to infective get better	0.02	0.02	0.015	0.01

Eigen values of **(1) Social media user** are 0, 0.0458; 0.0038. Since all the Eigen values for the above growth are positive; Eqs (4)-(7) shows that SIR model for social media is in unstable condition.
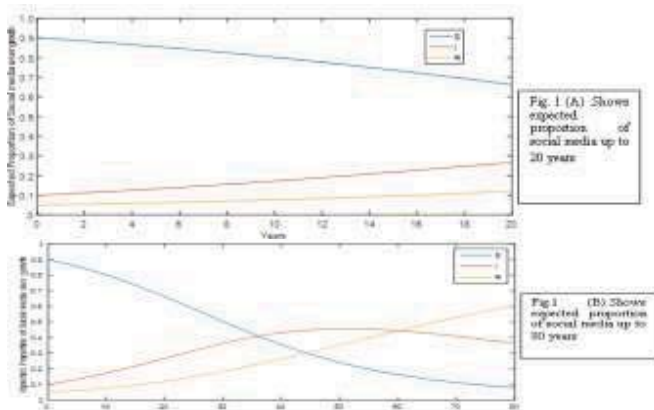

Fig 1(A to B) shows the growth analysis of Social media users which indicate the range of authors who write down posts on any issue (I) is increasing up to 50 years but it is decreasing after 50 years of analysis.

Now, its eigen values **(2)Internet user growth** are 0, 0.0367, 0.0041 Since all the Eigen values for the above growth are positive; Eqs (4)-(7) shows that SIR model for social media is in unstable condition.
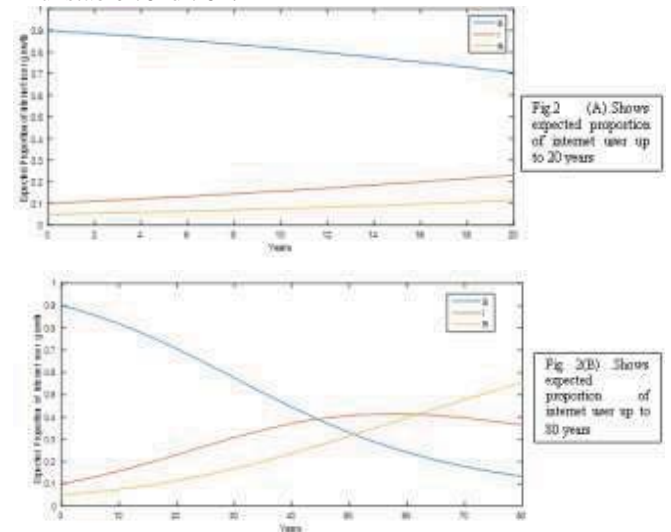

Fig 2(A to B) shows the growth analysis of Internet user growth which indicate the range of authors who write down posts on any issue (I) is increasing up to 50 years but it is decreasing very slowly after 50 years of analysis.

Now, real part of eigen values **(3)Mobile user growth** are 0.0000 + 0.0000i; 0.0061 + 0.0037i; 0.0061 - 0.0037i Since all the Eigen values for the above growth are positive; Eqs (4)-(7) shows that SIR model for social media is in unstable condition.
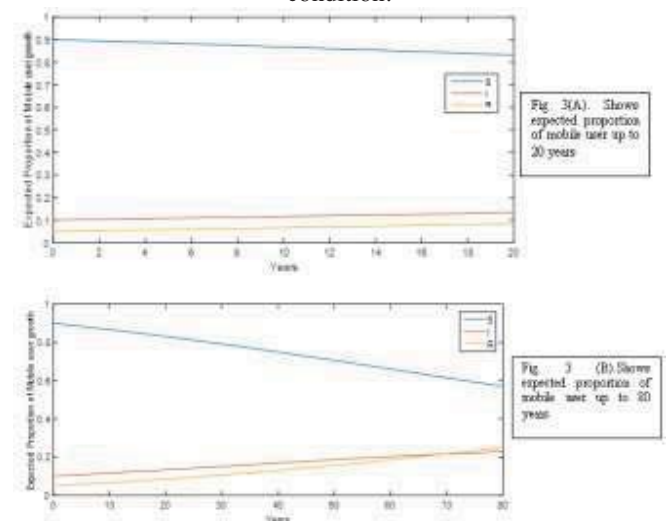

Fig 3(A to B) shows the growth analysis of Internet user growth which indicate the range of authors who write down posts on any issue (I) is increasing yearly.

Now, real part of eigen values **(4) Mobile social media user growth** are 0.0000 + 0.0000i, 0.0043 + 0.0021i, 0.0043 - 0.0021i. Since all the Eigen values for the above growth are

positive; Eqs (4)-(7) shows that SIR model for social media is in unstable condition.
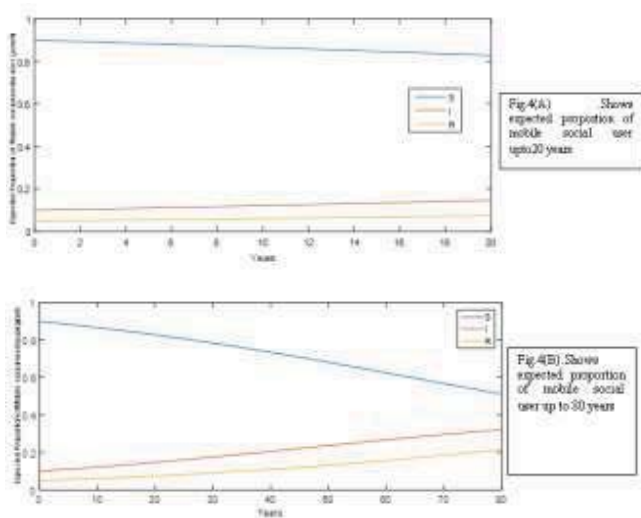

Fig 4 (A to B) shows the growth analysis of Internet user growth which indicate the range of authors who write down posts on any issue (I) is increasing yearly.

In these graphs, S represents the number of possible authors with the blue color, I represent the range of authors who write down posts on any issue with green and R represents the range of recovered authors whose posts not affecting. Numerical Simulations has been carried out for estimated proportion for 20 years, 80 years using MATLAB. In a social network users dynamicity is a major feature where can impact of users behaviors. The graph shows that the number of possible authors is decreasing with respect to time and the range of range of recovered authors whose posts not affecting to others on a subject is increasing with to respect to time.

VI. CONCLUSIONS AND FUTURE WORK

In the study an approach of analyzing data of social networks for social media users, internet users, mobile users and mobile social users has been presented. Social media incorporate the number of individual information and might be used as an added records supply for evaluation of social strategies in actual genuine world. A model has been described for the analysis of Social media user growth, internet user growth, mobile user growth and mobile social media user growth for prediction. Prediction is based on factors which are estimated on the online data sources. SIR model has been applied for the prediction of quantity of people that have same level of interests on any unique topic. We studied the behavior of social users with the help of epidemiology SIR model and observed that these networks are not being used a positive way.

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