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# **Journal of Media and Communication Studies**

**Table of Contents: Volume 10 Number 10 November 2018**

## **ARTICLES**

**Perception of medical awareness of media analyzed by multilayer perceptron**

K. Ravichandran, S. Arulchelvan and K. PeriyaKannan

**Forecasting, forewarning weather and disasters in the social web: A network study**

Mahalakshmi Selvaraj and Sunitha Kuppuswamy

*Full Length Research Paper*

# Perception of medical awareness of media analyzed by multilayer perceptron

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**The study considers the perception of medical errors and media awareness. This study identifies the effectiveness of the television media intervention in creating awareness on medical malpractices and it has find out the impact of maintaining medical records of a family online by the family doctor in reducing medical malpractices. This creates the importance of service quality in medical industry through the multilayer perceptron. At first, a substantial arrangement of components is figured out on each of the therapeutic mistake perceptions and media awareness. One inquiry of interest is how a multilayer perceptron (MLP) does handle such pointless inputs? The leftmost box plot shows, for cases that have observed awareness strongly disagree, the predicted pseudo-probability of category strongly disagree. The media awareness has been demonstrated observationally to be both predictable and valuable. MLP was used for data analysis.**

**Key words:** Multilayer perceptron (MLP), classification, medical awareness, probability, cumulative gains and television.

## INTRODUCTION

This study identifies the effectiveness of the television media intervention in creating awareness on medical malpractices. At first, a substantial arrangement of components is figured on each of the therapeutic mistake perceptions and media awareness. The news of the medical malpractices has started hitting the headlines in the daily news bulletins of the television media (Ravichandran and Arulchelvan, 2016; Ferreira, et al., 2013). Collected data were analyzed with the help of software package SPSS. The x-axis corresponds to the observed response categories, and the legend corresponds to predicted categories. Following a short description of the multilayer, the perception was analyzed for comparison of medical errors and media awareness (Deveugele et al., 2002). One expansion of the saliency

measure is its application of the shrouded hubs of a multilayer discernment. Opinion about medical service quality was elicited from the perspective of television media towards medical malpractices on features like reliability, reasons, conception, consumption and awareness. Results obtained using the MLP are at least as good as those obtained using this discriminated analysis (Ushie et al., 2013). Unexpectedly, little work has been refined to legitimately illustrate their presentation in such an application. The utilization of multilayer perceptions has been a lot of eagerness as classifiers in example of acknowledgment issues. The components may incorporate length-to-width proportion, normal restorative blunders, the complexity proportion of awareness, and so on. This study is to evaluate whether

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the data collected on all the measures fit the recommended value by the MLP model.

### Significance of the study

The aim of this study was to assess the use of the MLP, for discriminated analysis tasks. Following a short description of the multilayer perceptron has analyzed for comparison of medical errors and media awareness. Results obtained using the MLP, are at least as good as those obtained using this discriminated analysis. We conclude with some comments on how the MLP differs from more widely used discriminate analysis methods.

### Objectives of this study

This study identifies the effectiveness of the television media intervention in creating awareness on medical malpractices. It aims to find out the impact of maintaining medical records of a family online by the family doctor in reducing medical malpractices that create the importance of service quality in medical industry through the multilayer perceptron. This study aims to evaluate if the data collected on all the measures fit the recommended value by the MLP model.

## REVIEW OF LITERATURE

In the ancient Indian culture, the Vaidyar (doctor) was considered as a demy god. Merely by their art and knowledge, the physicians gained high social status regardless of their caste of birth. The court physician was of political importance and sat on the right side of the throne of a king, an important symbolic place. In those days the Vaidyar treated patients equally irrespective of their social status and focused only on curing their diseases.

In the middle of the 20th century, the advent of modern medicine brought out a new set of doctors with allopathic medicinal backgrounds, who treated patients in their houses (Gupta, 1976). The academic study of medicine is driven by a need to serve society. During the late 1950s, the government was running the medical colleges from where the doctors came out. The government (Berg and Ryymin, 2018) met 80% of the cost of running the medical educational institutions. At the end of the 20th century, to meet the needs of a growing population and to increase the doctor-patient ratio, the government gave permission to run private medical academic institutions in the country.

Private medical colleges began to collect huge capitation and tuition fees and doctors who pass out of these institutions began to focus only on ways to spin more money in order to meet the expenses incurred in

getting medical knowledge (Lindsay, 2018). These doctors started treating patients in haste in order to treat more and more patients within a short period leading to many mistakes during treatment. According to the World Health Organization (WHO) reports, India is 67th in the list of 133 developing countries with a doctor-population ratio of 1:1700, compared to a world average of 1.5,1000 (Economic Times, 2017). That means, not even one doctor is available for a population of 1000; even after more than half century of independence; the goal is still far behind as per the recommendation given by Bhore Committee in 1946, subsequently modified by Mudaliar Committee in 1961 (Narlawar et al., 2018) and Bajaj Committee in 1987. India can achieve this in 2031 within the framework of existing colleges and state of affairs. Meanwhile, during the late 20th century, more medical hospitals came under big banners, started as public limited companies. They floated public shares and employed doctors with big pay packages. These medical hospitals instead of providing service to the society have become money spinning factories answerable to their shareholders. Instead of being service oriented institutions, they have become profit oriented companies that do not show any empathy for the patients (Kirby et al., 2018).

Post globalization many global companies began to set up their shop in India leading to the increase in the per capita income. This has led to a modern life style which has resulted in the incidence of non-communicable diseases (Popkin et al., 2012). This has led to the introduction of costly modern medical gadgets and has resulted in tremendous growth in private sector hospitals in India. The total number of beds in private sector medical hospitals has crossed more than 50 percent compared to that of the government hospitals in 2012. The hospital industry turnover is \$25 billion (Rs.1500 Cores). The key players of the Indian hospital sector analyzed in this article are Apollo Hospitals Enterprise, Fortis Healthcare and Kovai Medical Center and Hospital. The revenue of the three key players of the Indian private sector hospitals has seen a fivefold increase between 2009 and 2014. Revenue as at 2009 was 390 million dollars and was 1983 million dollars in 2014.

The patient who has been treated by the big private medical hospitals and who has become a victim of medical malpractices has to fall back on the guardians of law for their support to file cases to get compensation. But the guardians of law, instead of helping the victims to file their petitions succumb to the pressure of the big medical hospitals and refuse to accept the complaints (Ravichandran and Arulchelvan, 2016). Before the advent of television media in the Indian continent, the print media was ruling the Indian media environment. The public or patients grieved by the medical malpractice had to approach the print media alone for publishing their grievances, but the print media reach had a limited scope of reaching the public due to various environmental

factors (Linehan, 2018). After the advent of the television in India the private television channels telecasted many medical news and programmes and the public awareness of the medical malpractices have grown up. The public who grieved over the medical malpractices have started approaching the television channels to let out their grievances and the guardians of law have been compelled to support the patient's grievances in filing the cases due to media exposure (Radsky, 2013).

Gerbner, (1967) have been analyzing sample weeks of prime time and daytime television programming (Gerbner, 1967). Cultivation analysis usually involves the correlation of data from content analysis (identifying prevailing images on television) with survey data from audience research (to assess any influence of such images on the attitudes of viewers). Content analysis by cultivation theorists seeks to characterize 'the TV world'. Such analysis shows not only that the TV world is far more violent than the everyday world, but also, for instance, that television is dominated by males and over-represents the professions and those involved in law enforcement.

Cultivation theorists are best known for their study of television and viewers, and in particular for a focus on the topic of violence. However, some studies have also considered other mass media from this perspective, and have dealt with topics such as gender roles, age groups, ethnic groups and political attitudes. A study of American college students found that heavy soap opera viewers were more likely than light viewers to over-estimate the number of real-life married people who had affairs or who had been divorced and the number of women who had abortions (Nabi and Sullivan, 2001).

In our country events that gain wide coverage by media only attract the public's attention and there are no proper criteria to identify or investigate errors in health care either in the public or private sector (Graber and Dunaway, 2017). A physician can be charged with criminal negligence when a patient dies from the effects of anaesthesia during an operation or during any other kind of treatment, if it can be proved that the death was the result of malicious intention, or gross negligence. Before the administration of anesthesia or performance of an operation, a doctor is expected to follow the accepted precautions.

The main drawback is that the onus of proving medical malpractice falls mainly on the persons who have filled the case. To prove and to back up the case they have to find out a medical practitioner to come and testify before the court of law, which has become very rare (Danzon, 1985). The television media which started exclusive medical malpractice shows have to do extensive research using the web and feature other eminent doctors to analyze the evidence for medical malpractices. This has led to grieved patients quoting and bringing eminent doctors as a backup for their cases filled in the court of law (Angell, 1997).

## METHODOLOGY

This study data were collected from 1000 patients from various hospitals in India in places like Chennai, Delhi, Mumbai, Hyderabad and Bangalore from November 2016 to February 2017. Opinion about medical service quality was elicited from the perspective of television media towards medical malpractices on features like reliability, reasons, conception, consumption and awareness. In this research study, the patients' perceptions were measured with self-administered questionnaires with MLP (Mannucci et al., 2010). The primary contributions of the present work are to address the computational challenge of analysis and visualization of multilayer information by providing a practical methodology, and accompanying software for the analysis and visualization of multilayer networks (Domenico et al., 2015). Collected data were analyzed with the help of software package SPSS. MLP was used for data analysis.

## RESULTS AND ANALYSIS

The demographic profile of the crime news of public having involved in this study is 1000 samples, out of which, 54.9% were males and 46.1% were females. With regard to the level of education, 22.9% of the public had school education; 26.0% of them were undergraduates, 34.3% of the public were postgraduates and the rest 16.9% were professionals. Concerning the marital status of the respondents, the majority of them that is 60.9% were married and the remaining 39.1% were unmarried. With regard to the type of families, 52.9% of the samples were in nuclear families and the rest 47.1% are from joint families. When questioned about the number of families in the household, 20.3% of replied three members in the family; 36.3% of the sample had four members in the family; 26.0% of the people surveyed had five members of the family and 17.4% had more than six members in their families. The collected data reveal that, in terms of occupation, 16.0% of the people queried were government employees; 25.7% of workers in private sector companies, 18.3% of them were self-employed; 17.4% of them had their own business and the rest 22.6% of the sample fall under other categories. The collected samples reveal that, in terms of the mother tongue, most of the respondents that are 86.0% of them speak Tamil while 14.0% had another language as their mother tongue.

The case processing summary in Table 1 shows that 1000 cases were assigned to the training sample, 694 to the testing sample (306). The 0 cases excluded from the analysis are media awareness about the medical errors. The classification (Appendix Table A) shows the observed value of awareness of media, overall percent in training, 52.4% in which awareness, 63.3% is very high. In the testing sample of overall percent, 50% in which awareness of media in television is 64%. The classification (Appendix Table B) shows the observed value of media, overall percent in training, 66.1%. in which Television 36.7% is very high. In the testing sample of overall percent 50% in which awareness of

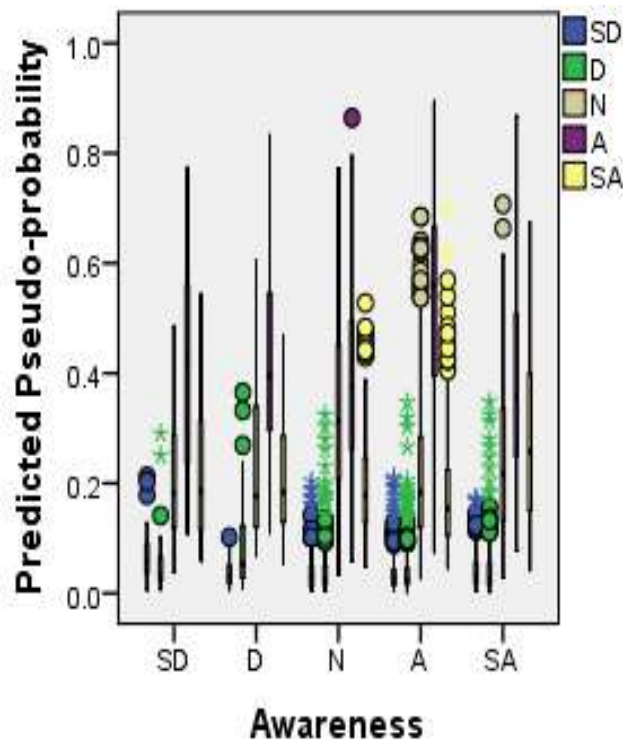


**Table 1.** Case processing summary.

		N	Percentage
Sample	Training	694	69.4
	Testing	306	30.6
Valid		1000	100.0
Excluded		0	
Total		1000	

**Table 2.** Overall percent correct.

Sample	Overall percent correct
Training	59.3
Testing	52.5

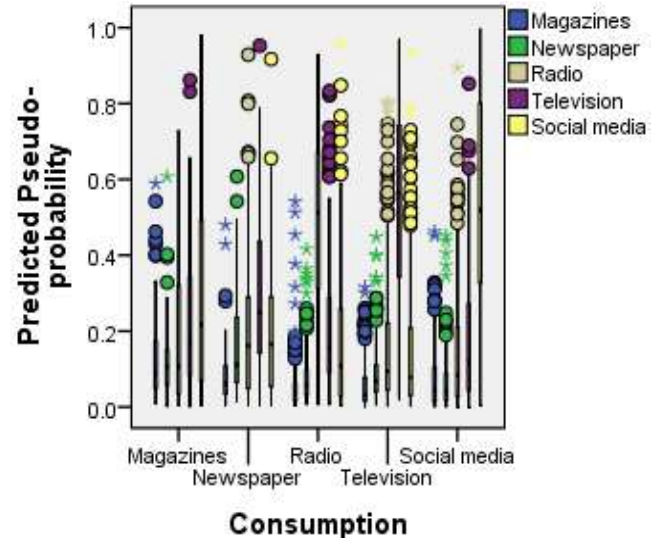


**Figure 1.** Observed chart of awareness.

media in television is 35.6%. Table 2 shows the overall percent of training, 59.3% and testing, 52.5%.

**Predicted observed charts**

The x axis corresponds to the observed response categories, and the legend corresponds to predicted categories (Figure 1). The leftmost box plot shows cases that have observed awareness powerfully disagree. The



**Figure 2.** Observed chart of consumption.

predicted pseudo-probability of category strongly disagrees. Remember from the classification table that roughly as many Strongly disagree customers were misclassification as Agree as correctly classified as Strongly disagree; thus, this boxplot is roughly equivalent to the leftmost. As a result, interpreting this plot for targets with more than two categories can be difficult, because it is impossible to determine, from looking at a portion of cases in one box plot, the corresponding location of those cases in another box plot. Finally, awareness of media is agree 0.8 and strongly agree, 0.7 in predicted value.

The x axis corresponds to the observed response categories, and the legend corresponds to predicted categories (Figure 2). Remember from the classification table that roughly as many magazines were misclassified as radio as correctly classified as magazine; thus, this boxplot is roughly equivalent to the leftmost. The fourth boxplot shows, for cases that have observed Consumption Magazine, the predicted pseudo-probability of Consumption Television. As a result, interpreting this plot for targets with more than two categories can be difficult because it is impossible to determine, from looking at a portion of cases in one boxplot, the corresponding location of those cases in another boxplot. Finally, Consumption of media is Social Media 0.8 and television media 1.0 in predicted value

**ROC curves**

An ROC curve (Figure 3) gives a visual display of the sensitivity by specificity for all possible classification cutoffs. Finally, awareness of media is Agree 0.8 and strongly agree 0.9 in sensitivity value. An ROC curve (Figure 4) gives a visual display of the sensitivity by specificity for all possible classification cutoffs. Finally,

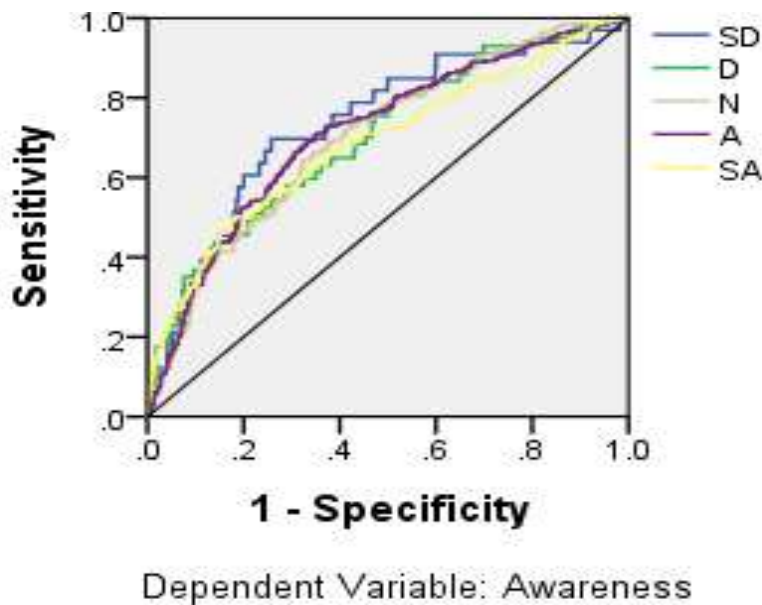


Figure 3. ROC curve of sensitivity.

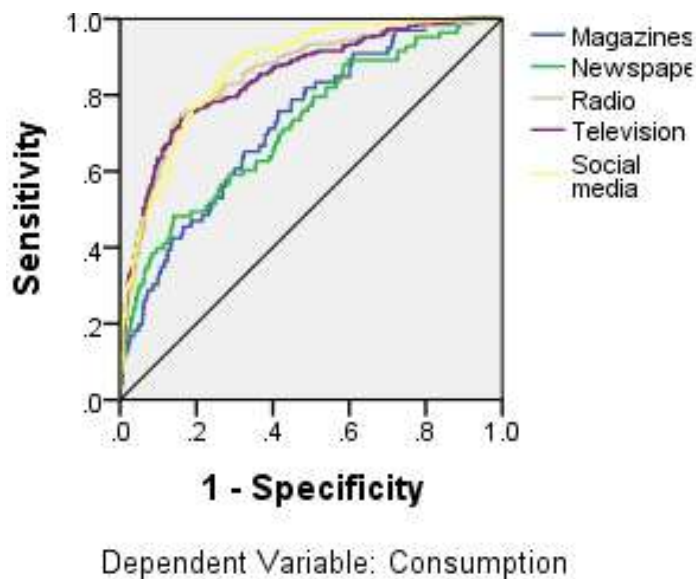


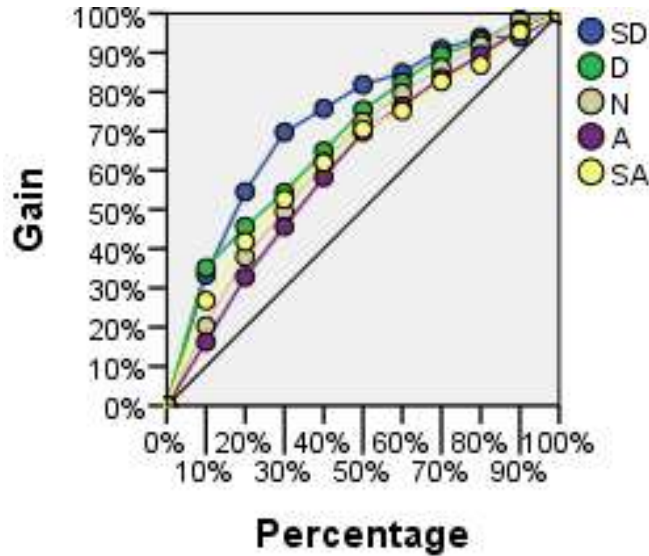
Figure 4. ROC curve of sensitivity.

consumption of media is social media 1.0 and television media is 1.0 in sensitivity value.

**Cumulative gains charts**

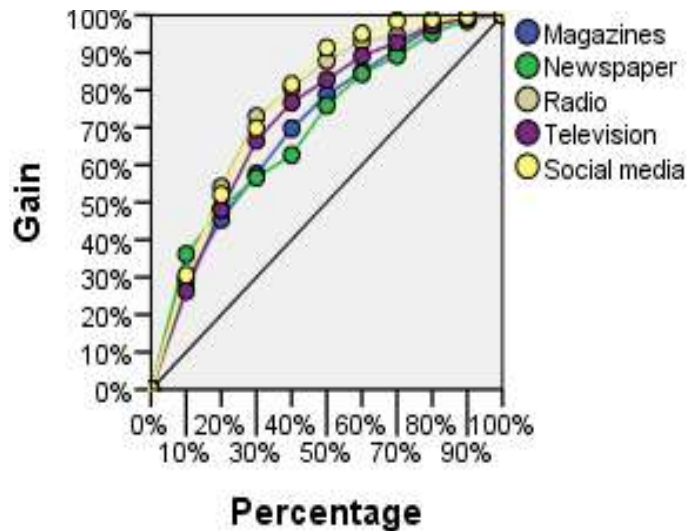
The first point on the curve for the Strongly agree category is approximate, meaning that if you score a dataset with the network and sort all of the cases by

predicted pseudo-probability of Strongly agree, we would expect the top 10% to contain approximately 20% of all of the cases that actually take the category Strongly agree. The diagonal line is the baseline curve; if you select 10% of the cases from the scored dataset at random, you would expect to gain approximately 10% of all of the cases that actually take any given category (Figure 5). Finally, awareness of media is disagree, 80% and strongly disagree, 90% in gain value. The first point on



Dependent Variable: Awareness

Figure 5. Cumulative gains charts of awareness.



Dependent Variable: Consumption

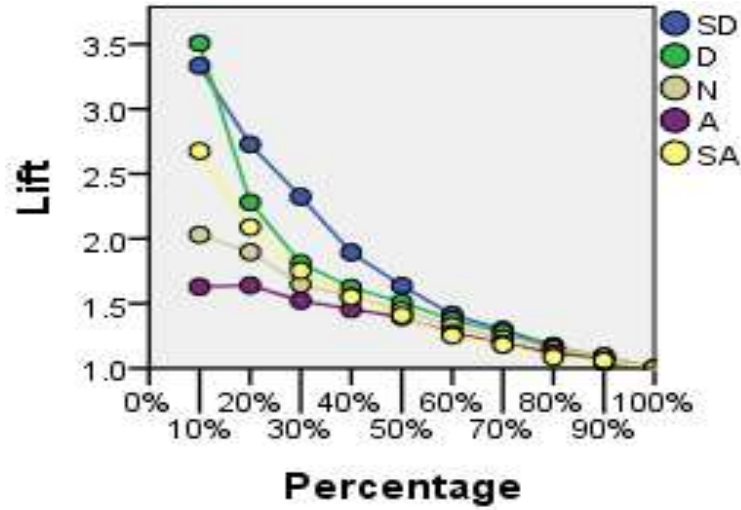
Figure 6. Cumulative gains charts of consumption.

the curve for the television category is approximate, meaning that if you score a dataset with the network and sort all of the cases by predicted pseudo-probability of television, we would expect the top 10% to contain approximately 20% of all of the cases that actually take the category Television. The diagonal line is the baseline curve; if you select 10% of the cases from the scored dataset at random, you would expect to gain

approximately 10% of all of the cases that actually take any given category (Figure 6). Finally, consumption of social media is 100% and television media is 90% in gain value.

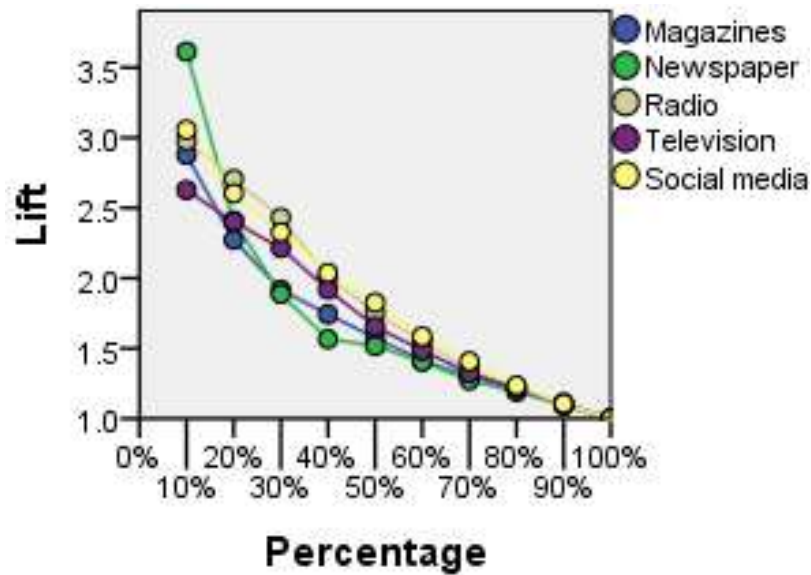
**Lift charts**

The lift chart is derived from the cumulative gains chart;



Dependent Variable: Awareness

Figure 7. Cumulative lift charts of awareness.



Dependent Variable: Consumption

Figure 8. Cumulative gains chart of consumption.

the values on the y axis correspond to the ratio of the cumulative gain for each curve to the baseline. Thus, the lift at 10% for the category strongly agree is approximately  $20\%/10\% = 2.8$ . It provides another way of looking at the information in the cumulative gains chart (Figure 7). Finally, Awareness of media is Disagree 3.5 and strongly disagree 3.4 in the lift value. The lift chart is

derived from the cumulative gains chart; the values on the y-axis correspond to the ratio of the cumulative gain for each curve to the baseline. Thus, the lift at 10% for the category Television is approximately  $20\%/10\% = 2.8$ . It provides another way of looking at the information in the cumulative gains chart (Figure 8). Finally, Consumption of Social Media is 3.0 and television media,

3.5 in lift value,

## DISCUSSION

The study demonstrated that apparent helpfulness had the most grounded impact on positive goal to receive, trailed by the patients' history being globalized with cloud structure to maintain a strategic distance from the medicinal blunders (Hecker, and Domres, 2018). Nevertheless, usability had an extra circuitous effect on aim to receive through its solid impact on handiness. This recommends if open is to keep away from the restorative acts of neglect they should consider it to be in effect simple to utilize, and trust that it offers significant advantages over existing learning MLP model. In this way, planning a framework to report has appropriately and precisely pharmaceutical mistakes (Chen et al., 2018).

The attendant learners need to enhance the quality of reporting drug mistakes or more in all setting. Pharmaceutical mistakes brought on by the unreliability of patients to get some answers to the data, the control framework can be enhanced to identify hoodlums (Alsubaie et al., 2018). The concentrate likewise demonstrated that the impact of expertise and involvement with the globalized therapeutic framework on the reception of cloud structure has interceded through the effect of handiness and convenience. This recommends being open to a noteworthy level of involvement and more propelled elements of the globalized therapeutic framework will be both happy utilizing it for learning and see the advantages it offers in supporting their field of restorative calling by ICT aptitude (Kunda et al., 2018). It was found that with open skillful fundamental media clients will probably receive medicinal awareness.

The study demonstrated that media effects will probably see new innovation as great and adoptable later on. While setting up general society for medicinal awareness, a more extensive center is required on how media is upheld and presented. The public should know that an essential level of media ability is prescribed before the general population is acquainted with restorative awareness (Kenneth, 2012). Since a number of the exercises completed on a therapeutic gadget have additionally attempted one PC, it might be useful to figure out how to adequately do on cloud structure before advancing to a restorative domain (Prayag, 2016).

## Conclusion

The aim of this research is to carry out an empirical analysis of the factors determining patients affected from medical related errors and influence of television media, medical malpractice, awareness in hospitals considering seven factors such as reliability, reason, conception,

consumption, awareness, demands and requisition pertaining to model, using an MLP model (Moreira, 2018; Ravichandran and Arulchelvan, 2017). The findings show that the television media slightly deviated from their known path of entertainment and started spreading awareness of the medical malpractices (Monroe, 2013). The news of the medical malpractices has started hitting the headlines in the daily news bulletins of the television media. In this paper, another strategy for positioning the significance of elements for an MLP has been produced (Parsaei et al., 2017; Lemoyne and Mastroianni, 2016). The media awareness has been demonstrated observationally to be both predictable and valuable. At the point when contrasted and the customary strategy for positioning information highlights by the likelihood of mistake model, it executed also and brought about a comparable positioning for the info highlights. Likewise, the back spread was contrasted with expanded common sifting utilizing the media awareness. It was found that both techniques for setting the weights in an MLP place relative accentuations on the components (Zhang, 2016). One expansion of the saliency measure is its application for the shrouded hubs of a multilayer discernment. The yields of the shrouded hubs are inputs to the accompanying layer; subsequently, the saliency of the concealed hubs can likewise be processed. The continuous examination into this region will, ideally, give a strategy to naturally measure the shrouded layers in a multilayer recognition.

## CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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**Appendix Table A.** Classification awareness.

		Awareness					
Sample	Observed	Predicted					Percent correct (%)
		SD	D	N	A	SA	
Training	SD	0	0	7	18	3	0.0
	D	0	2	6	22	3	6.1
	N	0	2	84	90	14	44.2
	A	0	1	38	234	19	80.1
	SA	0	2	30	75	44	29.1
	Overall Percent	0.0%	1.0%	23.8%	63.3%	12.0%	52.4
Testing	SD	0	0	2	3	0	0.0
	D	0	0	7	16	1	0.0
	N	0	0	27	40	4	38.0
	A	0	1	23	108	12	75.0
	SA	0	0	14	30	18	29.0
	Overall Percent	0.0%	0.3%	23.9%	64.4%	11.4%	50.0

**Appendix B.** Classification consumption.

		Consumption					
Sample	Observed	Predicted					Percent correct (%)
		Magazines	Newspaper	Radio	Television	Social media	
Training	Magazines	7	1	9	14	13	15.9
	Newspaper	1	11	10	27	15	17.2
	Radio	1	4	130	20	22	73.4
	Television	0	3	27	173	22	76.9
	Social media	2	4	19	21	138	75.0
	Overall Percent	1.6%	3.3%	28.1%	36.7%	30.3%	66.1
Testing	Magazines	1	2	7	5	7	4.5
	Newspaper	1	0	9	5	4	0.0
	Radio	4	2	43	12	17	55.1
	Television	0	0	12	71	23	67.0
	Social media	0	1	11	16	53	65.4
	Overall Percent	2.0%	1.6%	26.8%	35.6%	34.0%	54.9

*Full Length Research Paper*

# Forecasting, forewarning weather and disasters in the social web: A network study

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**Web 2.0 environments like the social web have redefined communication altogether through the proliferation of user generated content. With escalating global instances of disasters, people more particularly the millennial community tend to consume increased amounts of multitudinous information pertaining to weather and its woes in the social web apart from actively participating in the disaster discourse. The current research intends to examine the usage of social networking sites for disaster information dissemination by careful examination of a Facebook page dedicated to disaster and weather discourse. The efficacy of the social networking page in communicating real-time weather and disaster information is studied through network analysis of the page in the case of a tropical cyclone that hit the state of Tamil Nadu during the months of November - December in 2017. Tropical cyclones devastate the coastal stretch of Tamil Nadu State more frequently, and *Ockhi* was one such recent cyclone that caused a severe savage incurring very high social costs. The research is an attempt to explore the engagement and interaction of users in the social cyberspace under study during *Ockhi* cyclone. The research reveals the extent of user participation and engagement by identifying various elements in the social communication network.**

**Key words:** Facebook, social media, cyclone, *Ockhi*, disaster, weather, communication, Tamil Nadu, weatherman.

## INTRODUCTION

### Social media and the web 2.0 environment

Web 2.0 is term that refers to an upgraded version of its precursor web 1.0 (the very first phase of World Wide Web's revolution) and has scope for interactive, participatory and a collaborative culture of the web (O'Reilly, 2005). Web 2.0 applications use collective intelligence to provide interactive services that are network-enabled (Pew Research Center, 2006). Web 2.0 was a landmark technological development in the World Wide Web (www) that paved way for the emergence of user generated content through social

media, cloud computing and many other astounding technological developments. Social media is an umbrella term that encompasses various web-based and mobile-based technologies that just do not stop with providing and exchanging information but also transform communication into interactive dialogues (Techopedia, n.d.) and has redefined the aspects of digital information sharing and networking. Social networking sites are a part of social media that has an established social structure for communication where people sharing a common interest stay connected through networks. The social networking sites allow its users to create a

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profile that is either public or semi-public and defines a clear-cut list of users with whom they share a connection and extend their networks by traversing the list of users within the social system (Boyd and Ellison, 2007). Such networks set the stepping stone for the growth of global networks cutting across barriers and pave way for collaborating in bilaterally beneficial ways.

Social networks allow its users to become active participants in discussions and provides alongside a scope to share content in a wide array of formats ranging from simple text to videos and many more. Communication in the social networking sites has no boundaries since they have a scope for cross platform interactions and social sharing. Social network alter the velocity and volumes of information shared, redefine sender and receiver relationship and engage users through a range of real-time networking events. Such features in the social communication platforms become very handy during mass emergencies like disasters by paving way for swift emergency communication to the affected lot. Social communication platforms have redefined communication landscape and have stood as a driving force for people across the world to look up to them for any disaster and risk information. Users of the social communication platforms are not just mere consumers of information rather producers. During grave situations like disasters, people can report the situational inputs from ground zero through crowd sourcing applications in social media. It involves a simple validation of an information chunk or photograph, collective information sharing and much more all with a participatory approach.

### **Social networking informational uses during disasters – The Indian context**

Disaster that is weather-related, human-induced or prone to happen by other causal agents cause serious disruptions to the normal functioning of a society. Calamity, emergency, crisis, catastrophe are some of the terms used synonymously with disaster and have slight differences in their meanings. Information sharing during dire events like disasters mitigates the stress arising out of the uncertainty, provides crucial situational information, educates on the ways and means by which people can endure the disastrous event (Aisha et al., 2015). Doing so the adaptive capacity of people towards hazards is enhanced and their ability to evaluate risk and response to risk information is improved (Sharma et al., 2013). The information that aims to communicate approaching natural hazards has to be timely, simple and reliable so that highly anxious people undergoing the trauma are able to comprehend and act appropriately to achieve effective risk reduction. An open and flexible approach of communication is capable of establishing clear flow of information and increased level of transparency much needed during unstable conditions like disasters. In the

recent times social media like social networking sites have become flexible communication avenues during mass emergencies like disasters (Starbird and Palen, 2010; Jafarzadeh, 2011; Schultz et al., 2011; Simon et al., 2015). The aftermath of recent disasters in India like the Kashmir floods in 2014, Nepal earthquake in 2015, Tamil Nadu floods in 2015 and cyclones in the forthcoming years saw the emergence of social networking sites as a means of gratifying the emergency informational needs of the disaster hit communities.

Facebook, a popular social networking site clearly communicated the safety information of the earthquake hit Nepal people in the year 2015 through a feature called the “safety-check” tool deployed for the very first time in India (The Atlantic, 2015). Facebook introduced the crisis response tool with a view to allow the users to communicate their safety status and check the status of their acquaintances during emergencies (Facebook, n.d.). The tool became very handy yet another time in the same year for the near and dear ones of the flood hit people in Tamil Nadu. The tool allowed the users of the social networking site to have a check on the safety status of their relatives, friends and acquaintances apart from a feature that the flood-hit people who were in a positing to offer emergency assistance to those in need. Twitter is another popular social networking site that was extensively leveraged for disaster information dissemination across the world and more particularly during the Kashmir floods as well as the floods in Tamil Nadu in 2015 (One India, 2015). With growing incidences of frequent calamities across the globe, social networking sites have become indisputable communication medium during various phases of mass emergencies.

### **Surging use of social networking sites during disasters**

The use of social media like social networking sites for emergency management has a deep-rooted legacy of more than a decade (Reuter et al., 2016). And notably the past researches on social media uses during untoward grave events like inclement weather and related disasters have consistently been proving a fact that there is a sweep surge in the usage of social networking sites that surpass the conventional modes of communication (Takahashi et al., 2015; Reuter et al., 2016). Social networking sites during times of uncertain-weather conditions, serve to be crucial communication avenues that disseminate news pertaining to the ongoing situation. All it takes is holding an account in such social networking sites that extend opportunities for rapid distribution of critical information and thereby mitigate the dire impacts of calamities through the influential communication sphere (Panagiotopoulos et al., 2016). Social communication resources allow individuals to establish a sense of events taking place around them and the rest of the world, paving way for collaborative coping

with calamitous events (Takahashi et al., 2015). There is evident increase in the level of engagement of the users pertaining to social sharing of the crucial information they receive. Social networking sites serve to be integral resources for information dissemination and vehicles for sharing the disseminated information not just within the disaster-affected areas but even beyond. Apart from disseminating news and pertinent situational information, the social networking sites allows for bridging the requisites and the resources for the affected communities, shares information on aid and relief, collaborates with various agencies that work for managing the situation on ground, connect the displaced people, crowd sources for relief and geospatial information and much more.

The social networking sites stand as the sea of multitudinous information during dire emergencies like disasters. In the recent times the frequency and intensity of hazards both natural and man-made have tremendously surged and has caused extensive damage to people, their property and their environment thereby reducing the quality of life (Wisner et al., 1994; Cutter, 1996). The social networking sites are a hub of disseminating information at high velocities that facilitate the situational awareness with real-time updates from ground zero. The decentralized nature of social networking sites has driven them to become avenues of risk communication that increasingly disseminates sensitive information on approaching hazards being absorbed by millions of users. Social networking sites have repeatedly proven to be effective communication and information dissemination resources deployed into action during disasters. The multitudinous uses of social networking sites pave way for managing the associated risks, dissemination of official situational updates, advocating safe practices during emergencies, heighten awareness and guide the common man to mitigate the impending risks and much more (Panagiotopoulos et al., 2016).

### **Forecasting weather and forewarning disasters in Facebook**

The proliferation of communication technologies with wireless internet connectivity such as smart phones has galvanized the popularity of the social networking sites such as Facebook (Palen et al., 2007; Jafarzadeh, 2011). Facebook is a popular social networking site that has a very broad user base in India and its penetration is expected to surge in the years to come. Having the backdrop of a very broad user base and state of the art communication capabilities, Facebook has emerged to be the primary avenue for the users to engage in interactions and information exchange during mass emergencies like major weather disruptions and disasters. Forecasting of weather is done by the application of scientific knowledge to predict the trends and patterns of weather using a range of observations and models. Forecasts of extreme

weather conditions and communicating them to people likely to be impacted have proven to minimize the impending risk (Dube et al., 2000). The diffusion of such weather forecasts in digestible forms to the end user at their fingertip became a reality with the advent of the state-of-the-art communication features such as weather forecast applications and dedicated pages in Facebook. Ranging from independent weather forecasters to established government agencies there is a wide array of options in Facebook to choose from. These resources disseminate crucial weather forecasts as updates to the users in a language understood by the common man and intend to invoke weather-ready and disaster preparedness strategies. Technological advancements both in weather forecasting and communication systems have made it easy for integrating both and catering to the common man (Thomas et al., 2016). The mushroomed growth of such weather information dissemination resources has paved way for the weather updates to be a part of the content a Facebook user consumes in their homepage.

### **Rain man – Tamil Nadu weatherman**

Rain tormented the state of Tamil Nadu for consecutive years particularly during the Monsoon season in November-December. The unusual torrential rains and subsequent flooding battered the capital city of the state and the adjoining districts in December, 2015 followed by lashing storms in the name of *Vardah* cyclone in December, 2016 and during November-December, 2017 it was *Ockhi* cyclone. For many living in the state of Tamil Nadu, the floods in 2015 were a first-time experience in undergoing the wrath of a natural calamity. The Northeast Monsoon lashed the state with rains to such an extent that led to overflow and subsequent breakage of the water bodies ending up with flooding the arterial parts of the state. The consequence of the same was evident through a large-scale blackout that brought the normal life to a complete standstill. Parallel to the instance of the disaster the engagement level in Facebook shot up sky high where the users thronged with a sea of queries and concerns to the weather blogger Tamil Nadu Weatherman with a view to overcome the prevailing uncertain situation.

The timely updates from the weather blogger in the social networking page served to satiate the anxious and information thirsty users impacted by the deluge apart from eliminating baseless rumors that keep doing the rounds during unprecedented events like the floods. The episode echoed exactly a year later when people were anxiously glued to their mobile screens awaiting crucial updates from the weather bloggers in Facebook (The Economic Times, 2017) during *Vardah* cyclone in 2016. The cyclone gave a blow to the capital of the state with winds at a massive 140 kilometer per hour and swept a major crux of the tree cover in the capital city –

Chennai. The uprooted trees not only raised environment concerns but also snarled the road transport, the power infrastructure and the telecommunication lines. The accurate prediction of the landfall of the cyclone, parallel inputs on the progress of the storm, living up to the informational expectations of the page followers during the aeon of cyclone Vardah, 2016 were some of the stand-alone aspects of the weather blogger – Tamil Nadu Weatherman.

The social networking site - Facebook witnessed a sweep soaring in the fan following an unofficial weather forecaster–Tamil Nadu Weatherman (@tamilnaduweatherman) who rendered much-needed weather information service to the users in the network during the Northeast Monsoon season of the past three years. People exhibited an increased reliance on the independent and unofficial weather forecaster for weather and related information (The Economic Times, 2017). The fanfare of the page of the independent forecaster – Tami Nadu Weatherman commenced to scale up right from the time when floods hit the state in 2015 owing to the instant and reader-friendly updates posted in the network. The fan base was at mere thousands and until date has extended to a colossal 574,643 followers. A unique aspect of the weather forecaster's page in Facebook is the posts of weather charts that encourage the followers of the page to study the weather patterns and decipher the same with support information. In addition, the tone of communication is very informal and down to earth in nature that makes it digestible for the common man. These exclusive features are the major driving forces that aimed to bridge the common man with the forecasts of the official weather forecasting body – the Regional Meteorological Centre. The weather forecaster posts many weather-related communications pertaining majorly to the state of Tamil Nadu in the page. The passion towards weather has driven the forecaster towards storm chasing, tracking the trends and patterns of natural hazards and weather through data mining apart from dispelling rumors on woes of the weather through consistent and accurate forecasts and timely weather updates (The Better India, 2017). The information seeking behavior of the followers of the weather blogger thus saw a progressive trend particularly when the monsoon played havoc on the people of Tamil Nadu. The accurate weather forecasts and updates from the weather blogger Tamil Nadu Weatherman extended for the most recent tropical cyclone *Ockhi* that gave an intense blow to the state of Tamil Nadu in November-December, 2017.

**Disaster description: Very severe cyclonic storm Ockhi**

Tropical hazards of severe nature cause monstrous damage to people and their property and often

accompanied by torrential rain (Bahinipati, 2015; Janapati et al., 2017). The intensity and frequency of such tropical cyclones in the recent times (2013-2017) is found to be very high. A list of tropical cyclones that hit the north Indian Ocean has been compiled to understand the trend pattern of such cyclones (Table 1).

Like every other cyclone, *Ockhi* began as a low pressure over the South-west Bay of Bengal on the 28<sup>th</sup> November, 2017 and became intense the following day in the same region. The existence of favorable conditions paved way for the low pressure to intensify further and become a concentrated depression with a westward movement that drove it to the Cape of Comorin. The Depression (D) gained strength to become a Deep Depression (DD) and eventually into a Cyclonic Storm (CS) on the 30<sup>th</sup> of November, 2017 (IMD 2017). A day later, the storm progressed into a Severe Cyclonic Storm (SCS) and with further aggravation became a very severe cyclonic storm (VSCS) over the west of Lakshadweep. According to the Indian Meteorological Department, VSCS is considered to be third strongest cyclone categorization. The peak intensity of the storm was felt on the 2<sup>nd</sup> of December, 2017 with gusting winds lashing at a speed of 150 -180 kmph (kilometer per hour). The intensity of the cyclone sustained until the 3<sup>rd</sup> of December, 2017, weakened thereafter and the surge finally came to an end when it crossed the south coast of Gujarat. Even while the cyclone began as a low pressure the impact was felt in the state of Tamil Nadu by way of isolated heavy rainfall and as scattered heavy to very heavy rainfall in the forthcoming days. *Ockhi* was considered as a rare cyclone since it was very intense in nature that it surged as a cyclonic storm from a deep depression in a matter of just six hours in the Comorin area.

The life of the storm was longer (6 days and 18 h) than the usual (4.7 days) storms that surge the north Indian Ocean (Indian Meteorological Department, 2017). It was the first cyclone in the last 40 years to travel a massive distance of 2,400 km starting from Bay of Bengal and lasting until Gujarat (The Times of India, 2018). The south Indian states of Tamil Nadu and Kerala were battered by the cyclone. The state of Tamil Nadu is one among the states in the east coast that gets severely affected due to tropical cyclones almost every year (Sahoo and Bhaskaran, 2017). It has higher concentration of population growth than the other east coastal states considered as a worrying factor in respect of the disaster vulnerability factor (Mazumdar and Paul, 2016). The culmination of the cyclone was intensely felt in the southern districts of Tamil Nadu such as *Kanyakumari* and *Tirunelveli* that got 23 and 42% excess rainfall during the Northeast Monsoon season (The Times of India, 2018). The coastal town of *Kanyakumari* was worst battered by the cyclone; over 500 trees were uprooted due to the lashing winds, hundreds of fishermen who were already in the sea for fishing prior to *Ockhi* formation went missing, the power lines got snapped and

**Table 1.** Tropical Cyclones in the North Indian Ocean (2013-2017)

Cyclone	Timeline	Areas affected	Classification
Viyaru	10-17 May 2013	India, Thailand, Bangladesh, Indonesia, Sri Lanka and Myanmar (Burma)	Cyclonic Storm
Phailin	5-13 October 2013	Thailand, Myanmar, India and Nepal	Extremely Severe Cyclonic Storm
Helen	19-23 November 2013	Andhra Pradesh and Odisha	Severe Cyclonic Storm
Lehar	23-28 November 2013	Malay Peninsula, Andaman and Nicobar Islands and Southern India	Very Severe Cyclonic Storm
Madi	6-13 December 2013	Puducherry, Tamil Nadu, Andhra Pradesh, Kerala, Andaman and Nicobar Islands	Very Severe Cyclonic Storm
Nanauk	10-14 June 2014	Karnataka, Kerala and Lakshadweep	Cyclonic Storm
Hudhud	7-14 October 2014	Andaman and Nicobar Islands, Andhra Pradesh, Vishakhapatnam Odisha, Chhattisgarh Madhya Pradesh, Uttar Pradesh and Nepal	Extremely Severe Cyclonic Storm
Nilofar	25-31 October 2014	Oman, India and Pakistan	Extremely Severe Cyclonic Storm
Ashobaa	7-12 June 2015	Maharashtra, Goa, Karnataka, Konkan Coast, Gujarat and Kerala	Cyclonic Storm
Komen	26 July- 2 August 2015	Myanmar, Bangladesh, India	Cyclonic Storm
Chapala	28 October-4 November 2015	Oman, Somalia, Yemen	Extremely Severe Cyclonic Storm
Megh	5-10 November 2015	Oman, Somalia, Yemen	
Roanu	17-23 May 2016	Sri Lanka, East coast of India, Bangladesh, Myanmar and Yunnan	Cyclonic Storm
Kyant	21-27 October 2016	Andhra Pradesh	Cyclonic Storm
Nada	29 November-2 December 2016	Puducherry and Tamil Nadu	Cyclonic Storm
Vardah	6-13 December 2016	Thailand, Malaysia, Sri Lanka, Somalia, Tamil Nadu, Andaman and Nicobar Islands and Southern India	Very Severe Cyclonic Storm
Maarutha	15-17 April 2017	Sri Lanka, Myanmar (Burma), Andaman and Nicobar Islands	Cyclonic Storm
Mora	28-31 May 2017	Bangladesh, Sri Lanka, Myanmar (Burma), Andaman and Nicobar Islands and East India	Severe Cyclonic Storm
Ockhi	29 November – 6 December 2017	Maldives, Sri Lanka and Southern India	Very Severe Cyclonic Storm

the settlements were intensely damaged (NDTV, 2017). The lashing winds did not spare the electric poles; about 950 electric poles were damaged by *Ockhi* (John, et al., 2018). Reports confirmed the death toll due to the very severe cyclonic storm was as high as 108 in the state of Tamil Nadu and witnessed an economic loss of US \$ 5.07 billion (Thara, 2018). The weather blogger Tamil Nadu Weatherman broke the news of cyclone *Ockhi* in Tamil Nadu before even the official weather forecaster could declare the same.

### Need for the study

Increased incidences of climate change induced

disasters particularly cyclones in the recent times are intensifying the need for heightened contemplation on the issue. India is already experiencing drastic variations in normal temperature, sudden changes in the weather patterns (World Bank, 2013) that are potential enough to disrupt the lives of millions in the country. Accelerated use of social networking sites by various stakeholders of managing weather-related mishaps generates vast amounts of information that needs to be analyzed to determine the nature and the effectiveness of social web for disaster communication (Anson et al., 2017). A research on a social network that delves into timely weather forecasts to tackle the alarming issue of climate change in the context of an emerging super power nation like India is a dire need and gains heightened

significance. Social networking sites like Facebook are integrated more often in the disaster arena that warrants for a systematic study into the effectiveness of their communication. The ensuing events of the tropical cyclone *Ockhi* in November-December, 2017 prompted the social networking users to throng at the Facebook page @tamilnaduweatherman yet another time in spite of the availability of other social media handles for weather and relevant disaster information such as Chennai Rains, Kea Weather, Chennai Weather.org and many more. The network under study has repeatedly proved to be a timely, accurate and reliable weather and disaster information resource in the recent times. Previous studies have proven the significance and appropriateness of using social networking sites for emergency communication (Alexander, 2013; Houston et al., 2014; Middleton et al., 2014; Palen and Hughes, 2018) leaving a broader scope for studying the network underlying the social interactions that enable effective risk communication where users are manifested as active participants of communication. The present research throws spotlight on the usage social networking site - Facebook by its users in the context of a recent intense tropical cyclone. The study intends to investigate a network in Facebook based on the interactions within the stipulated study period to understand the dynamics and substantiate the efficacy of the network. A study on using a social networking site for emergency communication is drawn based on appropriate theoretical backdrop.

### Objectives of the research

The two-step flow model of communication in the context of the study examines the flow of the messages mediated in the social network by considering the concept of opinion leader and network ties that throw crucial insights on the variables that impact the flow. Based on the network position and attributes the efficacy of the opinion leader is ascertained. The research objectives designed for the study include:

1. To study the level of engagement of Tamil Nadu Weatherman network in Facebook by delving into the engagement metrics and understanding the resonance of the content shared during cyclone *Ockhi*, 2017
2. To determine the efficacy of the network of Tamil Nadu Weatherman in Facebook by analyzing the network measures to substantiate the role of opinion leaders

### THEORETICAL FRAMEWORK

Paul et al. proposed the two-step flow of communication way back in the 1944 in the book named *The People's Choice* (Encyclopedia Britannica, n.d.). The researchers were interested to analyze the influence of the mass

media messages on the voting decision of the people in the context of the 1940 United States Presidential Elections. The study found that the influence of the mass media messages very less on the voting behavior when compared to those of interpersonal and informal communication. The model formulated post the study stipulates that the mass media messages flow to the opinion leaders (individuals who are considered to be influential in a society) first and then to the less active population. These opinion leaders collect, interpret and diffuse the mass media messages to the people and subsequently makes interpersonal communication to be more influential than the mass media (Katz, 1957).

The current study is grounded in the two-step flow of communication framework since it is one of the theoretical approaches that best represent the influence of social networks (Liu et al., 2017). In the context of a rapidly changing media scenario, researchers argue that the role of opinion leaders is becoming less pivotal (Liu et al., 2017). Bennett and Manheim (2006) argue that flow of communication is transforming towards a one-step process that involves a refined targeting of messages to the individuals directly. The present research contrasts this view point and argues that the role of an opinion leader is crucial in exerting social influence. Tamil Nadu Weatherman is considered as the opinion leader who aggregates weather data and information from various media used by the Indian Meteorological Department for predicting weather (The Weekend Leader, 2017). The complex weather information is disseminated in simple and digestible form to the users of the network studied. The opinion leader is hypothesized to be effectively communicating weather and related disaster information to the users in the network. The flow of information (mediated message) from the opinion leader to the other entities is studied through network analysis that offers crucial insights on opinion leadership and other critical variables that impact the flow.

Individuals eventually become opinion leaders not because they possess certain influential attributes but due to the right positions they occupy in networks that allow for effective information diffusion. Centrality measures that determine the position in the network are useful for identifying such opinion leaders since these centrality measures quantify that certain nodes in the network possess more importance than others in the network (Wang et al., 2008). According to Freeman (1978) three measures reveal the centrality of a network viz. degree centrality, betweenness centrality and closeness centrality. The degree centrality measure throws light on the number of links that emerge to and from an individual in the network. The node in a given network that has the largest number of ties to other nodes in network possesses a high degree centrality. Individuals who have a high degree centrality are considered opinion leaders since they possess more social ties and have a greater scope for receiving and

disseminating information back and forth.

## METHODOLOGY

The social networking page “Tamil Nadu Weatherman” in Facebook was found to take the lead for communicating weather and disaster information in the recent times. The present study is aimed at investigating the use of “Tamil Nadu Weatherman” social networking page during emergencies like disasters to determine the usefulness and efficacy of the social networking page through analysis of engagement and network measures in the context of a tropical cyclone that hit the state of Tamil Nadu, India in 2017. The paper has a two-folded approach that considers two perspectives the audience and communication appropriate for the development of theoretical considerations. The current study adopted digital research methods that comprise various techniques for the purpose of data collection and analysis by virtue of the internet (Fielding et al., 2017) that allows for validating the objectives outlined for the study. Social network analysis is one of such methods that possess an exclusive ability to express the patterns of connections that exists in complex systems (Corlew et al., 2015).

The research design for the current study was divided into different phases. The first phase of the research comprises desk-based research in which the researchers identified the timeline for which the network data were aggregated from the Facebook page “Tamil Nadu Weatherman”. Ensuing data collection, the researchers processed and analyzed the network data in the social network analysis tool. With a view to gain an in-depth understanding of the network, the data were rendered to determine the network measures with which the efficacy of the network during an emergency like natural disasters is discussed. The analysis of the social network includes discovering the network, processing the network data to fetch various network attribute values, identifying the communities within the network and visualizing the entire social network (Akhtar, 2014).

### Data collection and case selection

The social networking site Facebook is considered as the most popular with a global penetration of 22.9% and has the highest audience base of over 270 million in India (Statista, 2018). The instances of disasters in the recent years have notable surged and so is the usage of the social networking platform Facebook. The users of the platform increasingly look up to the information resources in the social networking sites like the Tamil Nadu Weatherman page for want of information on weather forecasts, disaster forewarning and related aspects ever since the floods in 2015 devastated the city of Chennai and adjoining districts in the state. The popularity of the page shot up after the flood deluge in 2015 in Tamil Nadu (The Hindu, 2017). The social network of the Facebook page will be studied by aggregating the network data during the lifecycle of *Ockhi* cyclone in 2017. The scope of the study duration was in line with the lifecycle of the cyclone under research and thus network data from 28<sup>th</sup> November, 2017 to 7<sup>th</sup> December, 2017 were considered for analysis. Two days prior and a day post the cyclone were considered for inclusion in the study period to comprehensively analyze the social network with a view of encompassing all phases of the mass emergency under study.

The specified time period demanded continuous and progressive alerts pertaining to the cyclone -*Ockhi* from the network under study. The information posted during the study period necessitated to instill preparedness strategies, awareness, knowledge that bridges the gap in the perception of the risk communicated and alleviate anypanic in relation to the warning ahead of the approaching hazard (Reynolds and Seeger, 2005). The disaster

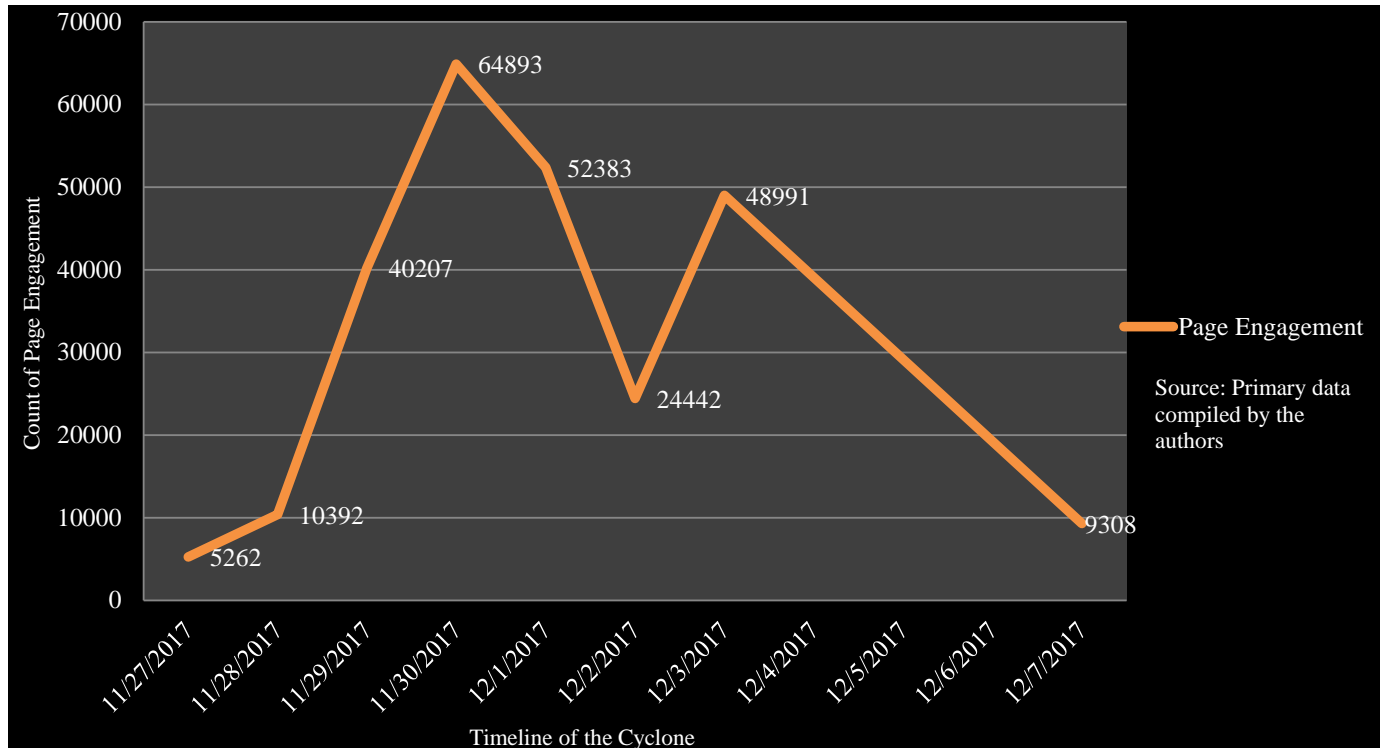
under study was selected due to influential selection criteria such as severity, impact, timeliness as the most recent disaster in the context of the study. The network under study was chosen based on the highest number of followers (570, 455 as on 12<sup>th</sup> July, 2018), highest ranking by the page users (4.9/5), active social communication sphere (typical query responses, timely updates), extent of posting accurate and crucial updates on weather, approaching disasters and related events.

## RESULTS

### Examining the engagement metrics of the network

The engagement metrics of a given network is a measure of the extent to which the members are connected in the verbal and non-verbal communication that takes place within the network. In the case of the social networking site Facebook, the engagement metrics are calculated based on the number of likes, comments and shares a particular post generates. A Facebook page is a public profile that is created with a purpose. Users of the social networking site can choose to mark the “like” option in a page and eventually become the fan followers of the page and doing so they endorse their agreement with the content published in the page. The page updates its fan followers with information in the form of messages, photos, videos, and web links and the same is referred to as “posts”. “Likes” is a way of expressing a liking towards the information shared in the network; “comments” refer to the expression of opinion over the information shared; share is a count of the number of times the information has been circulated within the network and even beyond since the network under study is a public group. The page engagement metrics also indicate the virality of a post shared in the network.

The network data aggregated during the study period were examined to determine the page engagement metrics of the network under study. Messages (posts) that deviated from the context of study posted in the network during the study period were excluded from analysis. The graph clearly implicates that the collective engagement of the network touched peaked on the 30<sup>th</sup> November, 2017 (the day the depression intensified into a cyclonic storm) at a massive 64,893 (Figure 1). In addition, the maximum number of posts (7 critical situational updates) shared in the network was on the 30<sup>th</sup> November, 2017. The number of posts shared in the network gradually reduced thereafter. The culmination of a disaster like cyclone can be felt on the day it attains peak intensity; its impact on the people and the environment is very dire. At this point of time there is an escalated need for timely situational updates on the intensity, velocity of the wind, amount of rain expected, impact likely to be caused and warnings on the dos and don'ts. The number of critical posts, the page engagement and the intensity of disaster attained their peak on the 30<sup>th</sup> November, 2017, indicating a fact that the network has timely communicated the impending risk



**Figure 1.** engagement metrics count of the network – *Ockhi* timeline.

of the disaster and thereby captivated the attention of the network users.

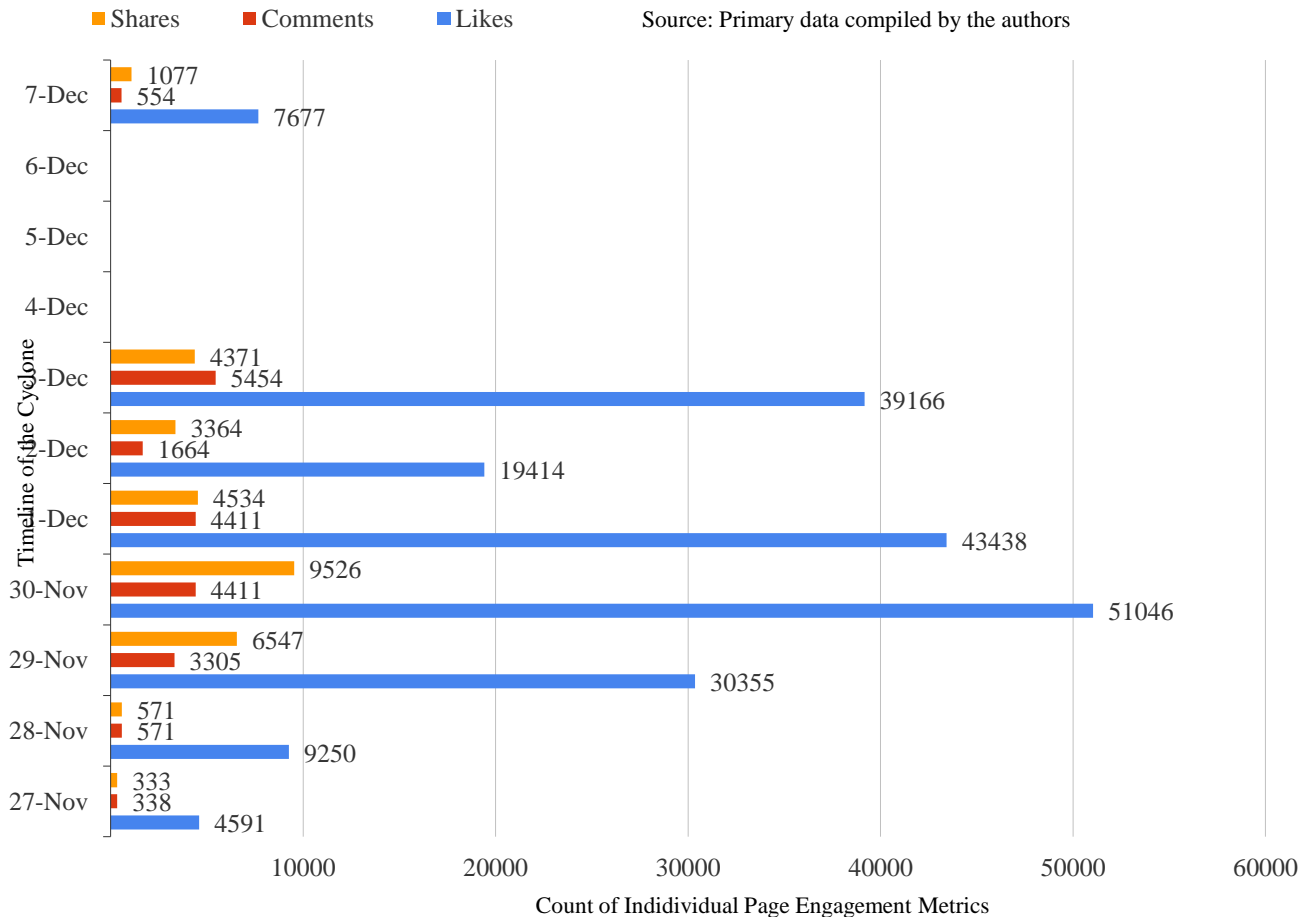
A closer look at the individual page engagement metrics of the network states that the number of likes (51,046) and the number of shares (9526) soared highest on the 30<sup>th</sup> November, 2017 in comparison to the other page engagement metrics (Figure 2). The “likes” metric is a vital tool to increase the visibility of a piece of information shared in a given network. When a user clicks the “like” option for a particular post shared in the network, every other post to be updated in the network shall be displayed in the user’s news feed (news feed is list of updates in the form of messages, photos, videos, links posted by people, pages associated with the user).

More number of likes yield better visibility of the information shared in the network. The messages posted on the 30<sup>th</sup> November, 2017 in the network have earned more than 50,000 likes and thereby paved way to seek better visibility of the updates to be posted in the network in the future. The messages posted on the same day have also earned 9526 shares meaning the critical messages gained virality by way of getting circulated to both members within and beyond the network. The Edgerank algorithm that determines the updates to be displayed in the news feed attaches increased weight age (1000% more importance) to the shares metric and therefore the number of the shares the message earns widens the reach of a message posted in a network. An added advantage to the shares option is that a fresh

dialogue is established by disseminating a previously posted message that also has the capability to incline other users in the network through endorsement. Various engagement metrics began to progressively increase as the storm gained intensity and faded along with it.

#### **Network analysis of the page – Tamil Nadu Weatherman (@tamilnaduweatherman)**

Social network analysis was found to be appropriate as a resourceful method that aims to assess the network among its spatial boundaries. Social network analysis comprises a wide approach to sociological analysis as well as a set of systematic techniques that intend to describe and investigate the evident patterns existing in the social relationships (Scott, 2017). The patterns refer to the construction of pictures (graphs) that disclose the patterns usually not apparent. The methodical analysis of social networks allows one to understand the social relationships existing in the network by discovering the structure of the network, determining the various network attribute values, identifying the communities in the network and visualizing the social network (Akhtar, 2014). The network data aggregated from the social networking site page are processed in *Gephi*. It is open-source software used to analyze and visualize networks by rendering graphs and statistical scores that allow for exploring the network and its underlying structure. The



**Figure 2.** Network engagement split-up – *Ockhi* timeline.

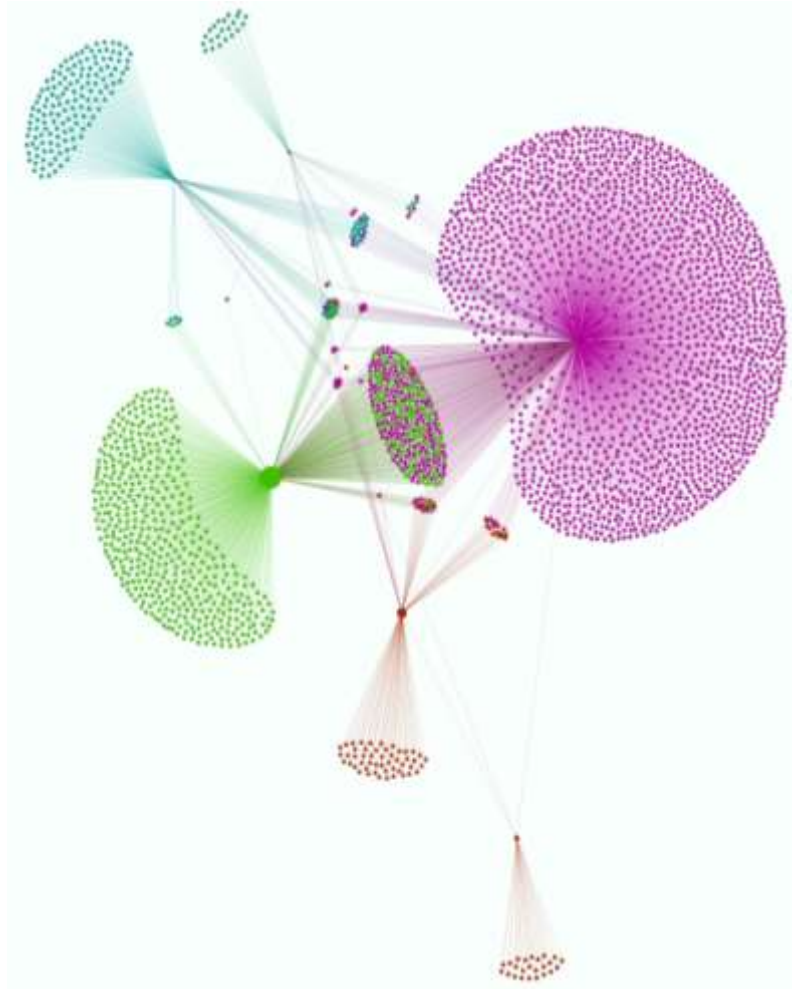
rendering of graphs is at the heart of network analysis and considered appropriate ways to manage network information and analyze the underlying patterns of relationships that is otherwise difficult.

Network visualization is a part of information visualization that envisions a network of connected components. The exploration of the social network begins with filtering the nodes in the network and processing them with layout algorithms thereafter (Bastian et al., 2009). The data associated with the network elements such as nodes (form the foundation for networks and represent the entities of the network) and edges (represent the links among the entities and thus defines the relationship between the nodes) determine the dynamics of the network. The network considered for analysis in the current study consists of 2768 nodes and 3257 edges. The network can be visualized by changing the layout of the graph using appropriate algorithm. The *Yifan-Hu* algorithm was rendered for the network data since it is recommended for large-scale network visualization (Pavlopoulos et al., 2017). The algorithm provides a multilevel force-directed layout for large graphs by reducing the complexity and making the

network more manageable. The algorithm computes the layout of the network by optimizing the overall internode repulsions where adjacent pairs of nodes are considered for computing the repulsions (Khokhar, 2015). The graph of the network converges after the algorithm is rendered to yield a graphical visualization that reflects the divisions of the network called as “communities” that are visible through the presence of “fan” like structures in the network (Figure 3).

Identifying and studying communities in social network analysis is fundamental; the same is computed in *Gephi* using the Louvian method (Blondel et al., 2008). The method partitions the given network into communities based on how densely the nodes are connected with each other. The modularity of the partition often lies between a scalar value of -1 and 1 that measures the density of the links within the communities than those that exist between the communities. In short, the modularity score describes the level of community structure in the network. The network overview statistical measure states that the network under current study has a modularity of 0.265 and has allowed for the identification of 5 communities in the network. The members of the





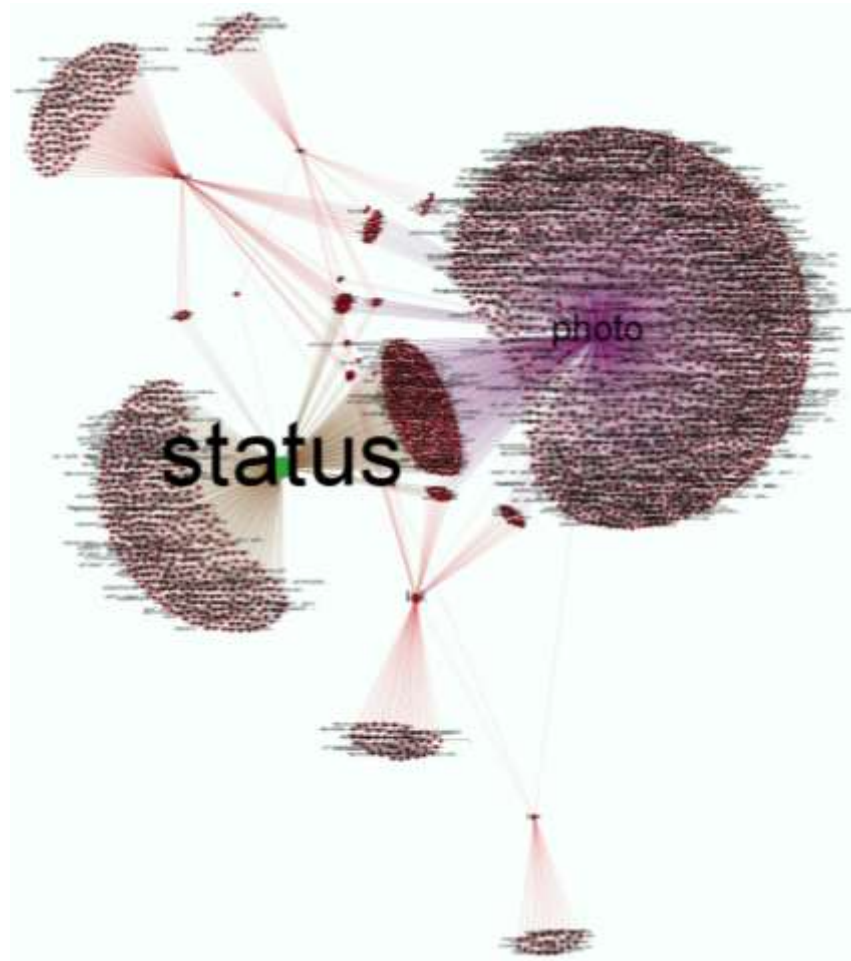
**Figure 3.** A Force Directed Graph of the Network during *Ockhi* Timeline partitioned by Communities: Status (Light Green), Photo (Magenta); Event (Cyan); Links (Brick Red) and Video (Dark Green).  
Source: Primary data compiled by the authors.

communities were clearly distinguished from each other (Figure 3) through color codes where each color represents a community. The interactions in the network revolve around these communities.

When the value of modularity is positive (0.265 in the current network) it indicates that the number of edges within groups exceeds those expected based on chance (Li and Schuurmans, 2011). The links among the entities within the communities in the given network is more than those expected at random. This indicates the connections within the communities in the network are very dynamic and well established. The centrality measures of the network under study during the tropical cyclone *Ockhi* throw added insights on the positions of the nodes and explore the network of edges that focuses on the formation of group of individuals around a central phenomenon. The communities are studied further through the centrality measures. The social network

analysis tool computes the centrality measures of the network to yield a visualization of the same (Figure 4) that cites the influential nodes around which the interactions in the network are established and proliferated. The nodes in the network visualization are sized according to the centrality; higher the centrality larger is the node size.

The communities that emerged during the period of analysis consisted of updates such as status, photo, link, event and video posted by the opinion leader in the study. The network under current research was built around these communities. The degree centrality of the status updates and photo updates were very high amongst all other communities. The network statistics indicating a fact that the status updates followed by photo updates held high centrality measures during the mass emergency *Ockhi* when compared to other posts shared during the study period. During an unpredictable event



**Figure 4.** Network visualization citing communities during *Ockhi* timeline in the order of centrality.

Source: Primary data compiled by the authors.

like disaster, people will look up for situational information and visuals that satiate their anxiety instigated due to the prevailing uncertain situation. The network has gratified its users with the emergency requisites of its members with status and photo updates during the study period. Status updates and photo updates are followed by web links, events and videos update in the order of depreciating centrality in the network. The network visualization clearly reflects the connectivity that exists among the communities in the order of centrality (Figure 4).

## DISCUSSION

The members of the network under study are engrossed with the content communicated and are proving a fact that the social network under analysis is exceedingly interactive during the lifecycle of the *Ockhi* cyclone in 2017. The content shared in the network has resonated

with the users evident through elevated Facebook interactions particularly during the pressing phase of the cyclone. A delve into the statistics on the total Facebook interactions (specifically on the likes and shares) allows us to understand which content was resonating among the members of the network. Posts that catered to the needs of the network users gained likes and subsequently shares in the network. These specific Facebook interactions were soaring high for the breaking news of the cyclone *Ockhi* followed by the posts that dispelled rumors on another cyclone likely to hit the state of Tamil Nadu. By earning soaring number of likes, the network has generated positive feedback for the content it had disseminated and through soaring number of shares the network has earned popularity from the users by becoming viral both within and beyond the network under study. Heightened content visibility and positive feedback have been contributing factors for content resonance during the study period. Case in point: among the content disseminated in the network during the life

cycle of *Ockhi* cyclone, 2017 the ones that necessitated of gaining momentum had indeed gained it by resonating well among the entities of the network. The active communication in the network is marked by a very good level of engagement and resonating content. The network is found to have earned heightened popularity evident through their empirical measures of engagement. Following a dire event like disaster, the common people generally seek the popular and familiar channels like Tamil Nadu Weatherman for reliable information. Popularity of the network has earned extensive fan following and subsequent information seeking during disasters.

Network visualization encapsulates the apparent relationship that existed among the entities of the network. Analysis of the network visualization established a fact that the network under study is very dynamic in nature visible through the presence of a greater number of edges than the nodes. The connectivity of the nodes is very dense and epitomizes the presence of communities that emerged during the study period. In the current research the network administrator-Tamil Nadu Weatherman is exemplified as an opinion leader in the context of the study and the communities that emerged in the network owe their origin around the various content types disseminated by the opinion leader in the network. The centrality network statistical measure validates the status updates posted in the network as the central hub through which all the interactions traversed through. Consecutive to the status updates is the community that emerged around photos in terms of network centrality. Previous researches on social media and emergency management have asserted a fact that additional crisis information such as pictures is valuable resource to improve the efficiency of emergency managers. Among all the other communities that emerged in the network during the study period, the community of status updates has been very influential in spreading the transmission of the interactions mediated in the network. The influence of the opinion leader has been more visible through the much-needed status updates.

The analysis of the data in the context of the current research substantiates the potential of social media like Facebook during mass emergencies by being efficient with respect to forewarning people about the impending risk of the cyclone, tracking its progress and updating the same instantaneously, rendering need-based emergency information apart from dispelling rumors. The research provides compelling evidence that underscores the potential of using communication technology such as Facebook for disaster risk communication. Authorities and those in power can make use of such communication platforms for developing and disseminating messages that aim to instill a sense of awareness on approaching weather-related hazards; a pro-active behavior pertaining to adoption of protective behavior against risks; a deep-rooted understanding on using social media for disaster

relief and recovery and achieve effective disaster risk reduction. But a critical look at the using of such technology for managing weather-related hazards like disasters in the aspects of strengths, weaknesses, opportunities and threats allows for a holistic perspective that aids in better understanding (Table 2).

## Conclusion

Effective disaster risk communication involves the provision of timely and reliable information based on which people interpret the risk to take necessary actions to protect themselves from the wrath of the risk by increasing their awareness about the impending risks. The informational gap that existed between the uncertain situation caused by the disaster and the anxious people was bridged with timely situational inputs on the weather and the dire impact the unpredictable weather is likely to cause and thus paving way for the emergence of a well-connected communication network. The research seconds the model of two-step flow of communication. The opinion leader – Tamil Nadu Weatherman interprets the complex weather data first and then subsequently mediates the interpretation to the members of the network. The opinion leader is found to be very influential in disseminating the content in the network through volunteered individual reports on the disaster. The users of the network – Tamil Nadu Weatherman regard it as a forum for risk communication and information sharing with which they seek, share and synthesize knowledge and awareness pertaining to weather and related events such as disasters. The network has redefined the landscape of social networking sites that are subject to be used as integral emergency management tools from a mere medium for communication.

Earlier researches that substantiate the influential potential of opinion leaders have attempted to do so based on certain key attributes such as individual characteristics, competencies and structural position in the network. The competency of the opinion leader in the study has been proved through the accuracy of the weather updates during earlier natural mass emergencies including the one under current study. The structural position is evident through statistical measures of the network analysis. In the case of the current research, the opinion leader possesses both competencies and the structural position in the network and effectively communicates in the network. The network statistical measures substantiate a fact that the network's efficacy has been high owing to the efficient opinion leader who mediates various contents in the network.

The study adds value to the theoretical considerations through its contribution of driving relevance to the two-step communication model even in the digital age. The empirical evidences validate the presence and efficacy of opinion leaders in the social cyberspace more particularly

**Table 2.** SWOT analysis of using social media for managing disasters.

<b>Strengths</b>	<b>Weaknesses</b>
(i) Instantaneous real-time information dissemination	(i) Technological limitations during prolonged power outages
(ii) Quicker consumption of the message disseminated	(ii) Increased reliance during power outages brings the disaster management process to a standstill
(iii) Connect the needs and the needy during post disaster phase	(iii) Social media disaster communication policy is unclear and needs attention
(iv) Harnessing power for crowdsourced geographical information	(iv) Privacy of information harnessed for response is at stake
(v) Fundraising through crowdfunding	(v) Credibility of the messages disseminated
(vi) Ability to notify the safety status of those in the area of disaster strike	(vi) Access to all segments (particularly to the economically disadvantaged) in a society
(vii) Usage as an early-warning system for approaching disasters	
(viii) Effective tool to manage various phases of a disaster	
(ix) Availability of a range of platforms with rich communication features	
<b>Opportunities</b>	<b>Threats</b>
(i) Widening access to all segments in a society	(i) Rapid spread of misinformation and rumors
(ii) Deployment of increased human resources to monitor information dissemination	(ii) Possibility of illicit usage of harnessed resources such as funds
(iii) Encourage administrative bodies to establish their presence in social media to communicate with the masses	(iii) Public perception of unmonitored disaster risk information disseminated can cause subsequent crisis situation
(iv) Offer training for handling and reporting pertinent disaster risk information	(iv) Overwhelming internet traffic due to surging social media use can impact the network efficacy
(v) Develop constructive communication to instill awareness on impending risks of natural hazards	
(vi) Run campaigns on the adoption of nature friendly practices and mitigate disaster risks	
(vii) Building of social media policy for disaster communication	

during mass emergencies like the one under study. They are influential curtain raisers towards disaster preparedness and risk reduction. In addition, network analysis performed in the current research throws important insights into the aspect of social power. The network approach reinstates a fact that “power” is intrinsically relational in nature. The opinion leader in the context of the current research is vested with social power using the same effective disaster, and climate risk reduction can be achieved.

#### LIMITATION OF THE STUDY

The current research was conducted for a short period beginning from 27<sup>th</sup> November – 7<sup>th</sup> December, 2017; it is limited to one disaster – the *Ockhi* tropical cyclone and thus the aggregated network data are of a small size. The findings of the research cannot be generalized. Future studies can be extended for a longer duration that yields bigger datasets pertaining to more than a disaster making

way for comparative research. The statistical network measures and properties were obtained from relatively less random, unbiased and small data. The application of the findings of the research is restricted to the context of the study but provides compelling evidence to the utilization of social media like social networking site for weather and disaster discourse to realize social resilience in a country like India that experiences frequent natural calamities and other weather associate mishaps.

#### CONFLICT OF INTERESTS

The authors have not declared any conflict of interests

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