

Climate Change Misinformation

Neethu Krishna and Divya Sindhu Lekha
Indian Institute of information Technology,
Kottayam, Kerala, India

Abstract—Anthropogenic climate change is a global threat that we are facing today and it affects the whole world. But the spread of misinformation about climate change weakens public support for climate action. The spread of misleading information is very old but the internet age has changed its effects. The spread of misinformation became faster and easier because of the absence of validation mechanism in online social networks. Climate change misinformation is funded, created and got spread by a network of actors and the misinformation is then repeated and amplified to reach the public by media, skeptical bloggers and politicians. Malicious accounts on social media and climate change debate on social media has high influence on misinformation diffusion. This paper explains climate change and reviews the climate change misinformation containment methods.

I. INTRODUCTION

It is a very complicated task to study about the climate change. The changes in temperature and weather are referred to as Climate Change and they can be natural. But, these days human activities are the main reasons for climate change. Climate change is a social crisis and is a major problem that we are facing. If we are not taking any public action to control it, it will bring a global threat to society and the ecosystem[1]. Activities of humans including burning fossil fuels and deforestation have the main influence on climate change and temperature. These activities add a high amount of greenhouse gases to the atmosphere and result in global warming.

Climate change will result in a disaster for humans. Reports show that the earth's average surface temperature has increased by 0.3-0.6 °C since the end of the 19th century. Such small variations in temperature may lead to a disaster for society[3].

Misinformation is fake or inaccurate information that is created purposefully and is spread intentionally or unintentionally[8]. With the development of technology, Online Social Network has emerged as an important medium for communication. OSN provides the fastest way to spread information, but on the other side it results in the fastest diffusion of misinformation too. The dissemination of misinformation has become a major threat in social networks which can lead to undesirable effects, such as the widespread panic in the general public. The spreading of misinformation results in major harm than the misinformation. According to Wen et al (2015) [10] Online Social Network is a two edged sword, the openness of Online Social Network platforms result in the wide spread of

misinformation. Bondielli et al (2019)[9] says that the absence of a validation checking mechanism makes social media a fertile ground for the spreading of misinformation. People can publish any post, or can share anyone's post without checking the source or even without checking the validity of the information.

Misinformation can have significant societal consequences. The spread of misinformation is not a new concept, it is an old concept. But the internet age has changed the frequency of misinformation spread. In this internet age, social media acts as a fertile ground for spreading misinformation. Through social media, misinformation got diffused very fast and easily. In 2014, online misinformation was identified as one among the top 10 global threats by World Economic Forum[4]. Different climate change misinformation is diffusing through social media. The climate change misinformation is mainly to confuse the public about the reasons for climate change. The misinformation can spread very fast in social media due to its openness.

II. CLIMATE CHANGE

Climate change refers to the significant changes in the temperature and weather conditions over a long period of time. Climate change can be the result of natural or anthropogenic activities. Sun's intensity, volcanic eruptions, natural changes in the concentrations of greenhouse gases are the natural causes of climate change. But its impact is very less. Anthropogenic activities are the main cause of climate change. Anthropogenic greenhouse gas (GHG) emissions result in to the rapid climate change[11]. Global warming trend observed from the 20th century.

Global temperature rise, warming ocean, shrinking ice sheets, glacial retreat, decreased snow cover, sea level rise, declining arctic sea ice, ocean acidification are the evidence for rapid climate change[12]. Global warming is one of the biggest threat of 21st century and is a general phenomenon of climate change which is characterised by increase in temperature. The increase in the amount of green house gases(GHG) in the atmosphere result into global warming.

The main source of anthropogenic GHG emission is burning of fossil fuels for electricity, heat, and transportation and the next major source is deforestation. Fertilizer usage, livestock production and some industrial processes that release fluorinated gases are the other sources of GHG emission[11].

The climate change impact is more worst than we think. Climate change results into droughts, floods, and wildfire and affects the species and property. It also result into an increase in sea level and also the acidification of sea level and it affects the coastal communities. It has impact on the biodiversity. The increase in temperature and other climate changes affects the species and populations in significant ways. Many species are disappeared due to this climate threat. Extreme storms which is an impact of climate change affects the lives and property[13]. Changes in the quantity and patterns of the rainfall affects the water supplies and water quality[14].

We can reduce the global warming by following the development in sustainable ways. We can use renewable energies like solar, wind, geothermal and biomass instead of fossil fuels. And also we should reduce our energy consumption and water consumption by using more efficient devices like LED light bulbs and innovative shower systems. We can reduce the GHG emission by encouraging public transportation and carpooling. We can also reduce the emission by moving to electric and hydrogen mobility. Usage of natural resources, controlling deforestation and making greener agriculture will also helps to reduce global warming.

III. CLIMATE CHANGE MISINFORMATION

Karin Edvardsson Bjornberg et al (2017)[15] reviewed scientific literature on environmental and climate science denial published in between 1990 and 2015. In his paper he discussed about climate science denial in terms of what is being denied and who denies. According to him climate science denial is most coordinated and deep-pocketed form of science denial particularly in the United States and also in UK and Australia. Different variants of climate science denial are: trend denial(no significant warming takes place), attribution denial(warming is due to solar activity), impact denial(accept human made climate change, but it do not have any negative impacts on humans or the environment and consensus denial(question the existing consensus among climate scientists about human made climate change). And he identify six categories of actors and organizations involved in climate science denial. They are: scientists, governments, political and religious organizations, industry, media and the public.

Robert J. Brulle (2018)[16] provided a sectoral analysis of lobbying expenditures on climate change in the U S Congress between 2000 and 2016 and he found that it was 3.9% of total lobbying spending. The corporations from fossil fuel, transportation and utility were the major sectors involved in climate change lobbying.

Schafer (2015) [17] identified four frames of climate change and their sponsors. Among that Scientific Uncertainty, Economic Development and Ecological modernization are against the anthropogenic climate change. The Central organizing idea of the frame Scientific Uncertainty is that there is no conclusive scientific evidence about climate change while that of Economic development is telling that there is no existence of climate change and the measures of climate change may seriously affect the economic development. And Ecological

modernization's idea is the technological development can fight against the climate change. Fossil fuel, coal, automotive, and electric utilities industry, their associations, think tanks, conservative politicians are the parties who give large amounts of monetary, cultural, personal, and symbolic resources to the issue.

Goldberg et al (2020)[18] analysed 14 pairs of election years and found out that oil and gas companies financially supported anti-environmental politicians.

Farrell (2016a, 2016b)[19][20] identified 164 organizations (think tanks, foundations, trade associations, grassroots and lobby firms) and 4,556 individuals (e.g., board members, employees, politicians, researchers) who involved in the climate change counter movement in between 1993 and 2013. All the written and verbal texts produced by this network about climate change during 1993 and 2013 are analysed and found that corporate funding organizations are more probably to have written and disseminated texts to polarize the climate change issue and the corporate funding influences the content of the polarization and the content got prevalence over time. Farrell (2019)[21] examined the link between climate misinformation movement and US philanthropy using the same data set and found that actors who spread climate change misinformation were increasingly integrated into the US philanthropy.

Corporate and philanthropic actors gave financial support to the actors who produce climate change misinformation. This misinformation is then repeated and amplified through influential actors (such as the media, politicians, bloggers, and religious organizations) and then it reaches to the public. Once it reach social media it spread very fast[4]

IV. COMBAT WITH CLIMATE CHANGE MISINFORMATION

Combating with the misinformation is a complex task. Fernandez et al (2018)[7] provide an outline about the technological development to combat with the online misinformation. Fernandez mentioned four strategies to deal with misinformation, and are a) inoculating against misinformation b) combating with facts c) detecting the malicious account early and d) use of information selection and ranking approaches based on the corrective information which is used by organisations like Facebook and Google.

A. *Inoculating against misinformation*

Linden et al (2017)[6] found that it is possible to protect the public preemptively from the climate change misinformation. He proved that communicating the scientific agreement about human made climate change increases the public awareness of the expert agreement thereby it is possible to protect the public from the spread of influential climate change misinformation.

According to Matt N. Williams et al (2020) [27] inoculation interference is more successful than simply informing about the scientific consensus. He stated that exposing the public to the correct information about scientific consensus on climate change can be more effective in reducing the impact of misinformation.

According to Maertens et al (2020)[1] climate change misinformation can be combated by inoculating individuals before they are getting any misinformation. Maertens et al replicated and extend the study of Van der Linden et al (2017) and concluded that consensus messaging and inoculation are effective methods to deal with the climate change misinformation and they proved that the inoculation effect remains stable for at least one week.

B. Combating with facts

Cook et al (2017)[25] experimentally studied about the impact of climate change misinformation and tested and found that the preemptive method in which inoculating messages that contains explanation about the fault argumentation in the misinformation or the scientific consensus about climate change is an effective method to neutralise the negative impact of the climate change misinformation.

According to Benegal et al (2018)[5], the source of corrective information plays an important role to counter the misinformation about climate change and climate science. They showed that most effective source to correct climate change misinformation is Republicans who speaks against their expected partisan positions. They suggested that the partisan gap on climate change opinion can be effectively reduced if the source of corrections are Republican elites.

Lawrence et al (2017)[22] used a climate change misinformation as a Facebook status to understand how people react with this misinformation. The most common reaction to the misinformation was to give either corrective information or agreeing with the misinformation by giving website links or quoting scientific findings or events that supported their views. Then the participants were grouped into three different groups, neutral respondents to the original status update, a corrective respondents, and a collaborative respondents, and they are asked whether they agree with the response or not. Lawrence suggest that collaboration is an effective way to counter climate change misinformation.

C. Detecting the malicious account early

Malicious accounts like bots, contagion, astroturfers, and spammers are detected initially. In Steve Webb et al (2008)[28] characterization and behaviors of social spammers are provided and a novel technique for tracking and monitoring social spam was introduced. They used honeypot profiles and identifies all of the spam profiles associated with the spam friend requests they got.

Emilio et al (2016)[30] reviewed bot detection techniques and divides them into three classes: Graph-Based Social Bot Detection (based on social network information), Crowdsourcing Social Bot Detection (based on crowdsourcing and leveraging human intelligence) and Feature-Based Social Bot Detection (use machine learning methods to identify highly revealing features that differentiate bots and humans). Some bot detection approaches uses combination of these approaches.

Gang Wang et al (2012)[29] studied and compared the source of workers on crowdurfing sites in different countries.

Kyumin et al (2013)[31] revealed the underlying ecosystem of crowdurfers and identified three classes of crowdurfers (professional workers, casual workers, and middlemen) and they developed models to differentiate these workers from the social media users.

Manuel et al (2013)[33] presented a novel approach (COMPA) that uses a composition of statistical modeling and anomaly detection to detect compromised accounts in social networks and they applied it to Twitter and Facebook. Sangho et al (2014)[32] proposed a malicious account detection scheme along with their creation time and they applied the method on Twitter data and they claimed that their method achieved reasonable accuracy.

D. Information selection and ranking Mechanism

Organisations like Google and Facebook, uses another type misinformation management method, in which feedback from users about misinformation content is collected and uses this feedback to improve information selection and ranking mechanisms.

V. CONCLUSION

Social media is an important platform for spreading climate change misinformation and the misinformation is getting diffused very fast and easily. In this paper we have reviewed misinformation containment in the context of climate change. We found that the research on misinformation diffusion is very little. And also it is very difficult to inoculate against every misinformation and to find the target audience. And also it is not clear what to do with the malicious accounts once it detected.

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