Climate Change Debate on Twitter During COP24

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We present a case study by analyzing conversations between two competing groups of Twitter users who believe in anthropogenic reasons of climate change (believers) and those who are skeptical of these reasons (deniers) during United Nation's (UN) Climate Change Conference – COP24 (2018), Katowice, Poland. We use hashtags used in tweets and retweets by each twitter account user to classify the user into denier, believer or neutral. We find multiple tweets with different conspiracies in climate change conversations mostly from the denier group. In conversations we found many exaggerations made about climate change effects which were targeted by deniers to strengthen their argument. Deniers call out believers as alarmists and believers call out deniers as hoaxers. Our results have implications for climate change messaging and to inform studies with conversations covering longer time span.

Keywords: Climate Change Messaging, Disinformation, Conspiracies, Twitter Conversations, UN's COP24.

1   Introduction

Social media platforms such as Twitter have become an important medium for debating and organizing around complex social issues (Segerberg & Bennett, 2011). One such complex issue with significant socio-economic and political implications is climate change. (Williams, McMurray, Kurz, & Lambert, 2015) studied how Twitter is used as a medium for debating climate change where the study found segregated polarized attitude towards origin of climate change creating ideological fault lines between groups of Twitter users who believe in anthropogenic reasons of climate change (believers) and those who are skeptical of these reasons (deniers).

Fault lines between groups could be attractive to entities seeking to manipulate consensus. Exposure to debates on anthropogenic cause of climate change may lead people to believe that there is no scientific consensus (Segerberg & Bennett, 2011). Additionally, social media is frequently used to spread disinformation (Allcott, Gentzkow, & Yu, 2019). Disinformation about climate change could be promulgated by bots- automated user accounts. Previous studies suggest that bots seek to create false

amplification of contentious issues with the intention to create discord (Ferrara, Varol, Davis, Menczer, & Flammini, 2016). There has been previous research to study false stories such as conspiracy theories in context of climate change (Uscinski, Douglas, & Lewandowsky, 2017). This paper looks at the popularity of different false stories and whether or not bots are active in conversations of these stories in social media conversations.

UN Framework Convention on Climate Change's (UNFCCC) Conference of Parties (COP) is an annual meeting of different states represented at the UN and acts as a venue to discuss the progress and establish obligations with regards to climate change (UN Climate Change, 2019). In UN's COP 24, in year 2018, countries were supposed to finalize the Paris Agreement guidelines (UN Web TV, 2019). The event provided an opportunity to look at the denier's and believer's climate change messaging on Twitter in context of an event of significance.

In this paper, we present a case study by analyzing conversations between two competing groups of Twitter users – Believers and Deniers during UN's COP24 (2018), Katowice, Poland. We examine what role, if any, that bots and disinformation stories play within denier and believer competing groups. This case study would be helpful to inform other climate change studies with conversations covering longer time span.

This paper is organized as follows. Section 2 describes our Data collection and method to identify groups, fake news and bots. Results are discussed in Section 3, while Section 4 contains discussion on our results.

2   Data and Method

In this section, we first describe our data collection procedure. Then we describe the method used to identify groups within the twitter users, to isolate fake stories, conspiracy theories and exaggerations, and to detect bots and news agencies.

2.1   Data Collection

We collected tweets with hashtags and certain keywords from 27th November to December 20th, 2018 using Twitter's API. We decided on collection hashtags based on hashtags related to #climatechange found on best-hashtags.com (Best-Hashtags, 2018). We added more keywords based on the hashtags and news articles about COP24. We report the hashtags and keywords used for collection in Table 1. The combined data set contains a total of 1,379,584 distinct tweets (including retweets).

Table 1. Hashtags and keywords used to collect data during COP24. Capitalization is done for better readability.

Hashtags	Keywords
#COP24, #ClimateChange, #ParisAgreement, #ClimateHoax, #IPCC, #In-	COP24, Climate Change, Paris Agreement, Climate Hoax, IPCC, NCA4, Climate

sideCOP24, #Climate, #ClimateChange-
isReal, #ClimateAction, #GlobalWarm-
ing, #NCA4

2.2 Method to Identify Groups

To identify more hashtags used by believers and deniers, we use a variant of Label Propagation algorithm (Zhu & Ghahramani, 2002). We chose hashtags which are most used with hashtag "ClimateHoax" and hashtag "ClimateChangeIsReal" and are associated with conspiracy in case of deniers or have similar meaning to "ClimateChangeIs-Real" in case of believers. We use these labels in a weighted hashtag x hashtag network, which is the co-occurrence network of hashtags, to find other hashtags commonly used by deniers and believers. We aggregate hashtags used by each user and found a weighted average of all hashtags used by a particular user. Overall, we found a set of 8,413 tweets from 2,170 deniers and 120,497 tweets from 15,640 believers. We randomly sampled 100 users from both groups of users and manually checked their timeline to find about 97 percent of denier's as showing activity akin to a denier and about 96 percent of believer's showing activity akin to a believer.

2.3 Isolating Fake News, Conspiracy Theories and Exaggeration

We searched for tweets within our data with fake and conspiracy stories as follows: We broke each tweet into unigram and bigrams and removed the stop words as done in (Demszky, et al., 2019). We then searched for keywords in our set of unigram and bigrams for keywords related to fake and conspiracy stories. We identified fake news shared in social media related to climate change from FactCheck.org, Politico, truthorfiction and hoax-slayer as listed in (Vosoughi, Roy, & Aral, 2018). We further collected keywords used in each conspiracy theory from list of conspiracy theories on Wikipedia (wikipedia.org, 2019). We then searched for keywords collected from conspiracy theories and fake news articles in our unigrams and bigrams made from tweets. We report the set of tokens we used in Table A.1. We searched for these tokens in unigrams and bigrams made for each tweet. Tokens such as "World End" were selected to find exaggerated claims about doomsday scenario of climate change.

2.4 Bot Detection

To find bots accounts in our data set we used CMU's Bot-Hunter (Beskow, et al., 2018). The output of Bot-Hunter is a probability measure of bot-like behavior assigned to each account. Unless otherwise stated, we report our analysis for a probability threshold of 0.5 i.e. we classified an account as bot-like if output probability from Bot-Hunter was greater than 0.5. At 0.5 threshold level we found 596,282 bot-like accounts out of total 1,035,416 user accounts in our data set.

3   Results

Using the corpus of stories, we found from our unigram and bigram search in Section 2, we manually checked each story to find fake news, conspiracies and exaggerations about climate change effects. We did not find fake news related to climate change listed in FactCheck.org, Politico, truthorfiction and hoax-slayer. We did find multiple fake stories related to conspiracies and exaggerations about climate change effects.

With regards to climate change the politicians have been vocal about their criticism of science, even using conspiracy theories as possible explanations (Uscinski, Douglas, & Lewandowsky, 2017). This makes study of conspiracy theories in climate change context even more important. We look at the most talked about conspiracy theories in our data set. In Figure 1, we report the number of unigrams and bigrams related to conspiracies found in tweets and retweets. User accounts tweet more stories containing conspiracy theory phases than they retweet. Conspiracy theory regarding QAnon, which is a deep state conspiracy theory originating from 4chan (Griffin, 2019), is the most popular conspiracy theory in our data set.
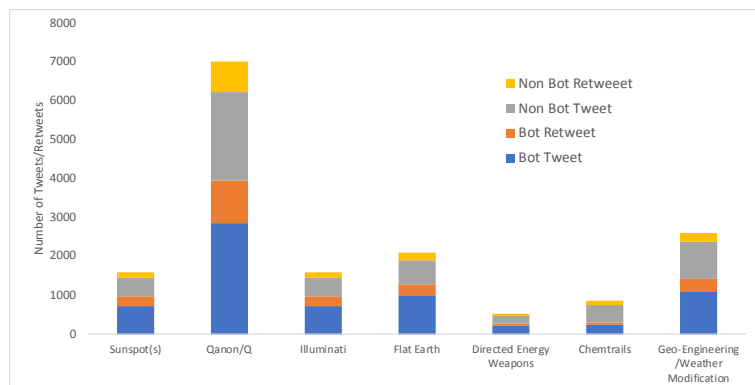

Fig 1. Number of tweets and retweets by accounts classified as bots and non-bots containing unigrams and bigrams related to conspiracy theories.

We looked at the user accounts spreading these conspiracy theories. We found that large fraction of denier tweets contained unigrams and bigrams related to conspiracy theories. We report our results in Figure 2. Also, much higher fraction of believer's tweets contained phrases related to conspiracy theories as compared to neutrals.
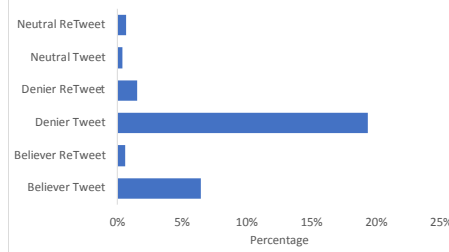
Fig 2. Percentage of tweets and retweets with unigrams and bi-grams related to conspiracies as reported in Table A.1.

We found a number of exaggerations made by climate change believers about the effects of climate change. These exaggerations are picked up by deniers and used as fuel to strengthen their argument. For example, a 1989 United Nations report claimed that "entire nations could be wiped off the face of the Earth by rising sea levels if the global warming trend is not reversed by the year 2000" (Spielmann, 1989). This story was shared 14 times, all by accounts we classified as deniers. We found tweets by believers describing "end of the world" if no action is taken soon, misquoting Intergovernmental Panel on Climate Change (IPCC). The COP24 report calls for immediate action so as to restrict global warming to a maximum of 1.5 degrees (Kiehl, 2019). In our data set we found believer's tweets calling that IPCC report predicts "end of the world in 12 years" if governments do not act now. Deniers use terms such as "Alarmist" or "Alarmism" to target believers posting exaggerated claims. On the other hand, believers use terms such as "Denier", "Hoaxer" and "Denialist" to target deniers in our data set. In Figure 3, we summarize our findings. Nearly 5% of believer's tweets contain terms "Denier", "Hoaxer" and "Denialist" compared to 2.5% in denier's tweets. Similarly, about 5% of the denier tweets contain terms "Alarmist" and "Alarmism" compared to 0.5% of believer's tweets. Overall, the messages mentioning terms targeting the other group are more in tweets than in retweets.
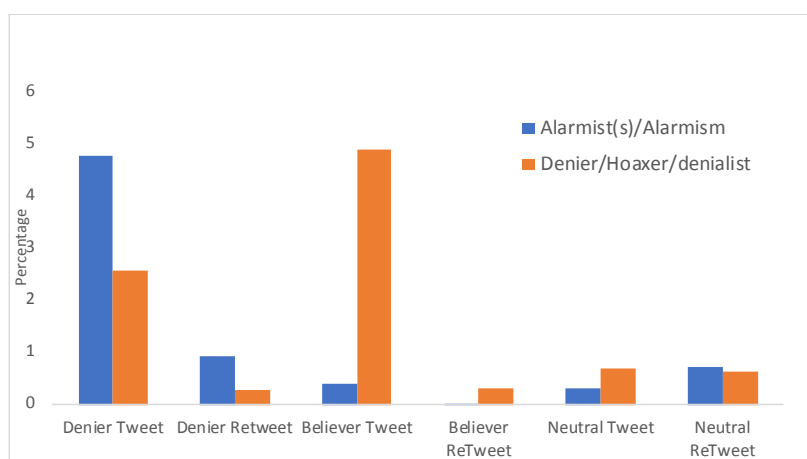
Fig 3. Percentage of tweets and retweets with unigrams Alarmist(s)/Alarmism and Denier/Hoaxer/Denialist for deniers and believers.

4   Conclusion

In this paper, we look at the conversations happening on Twitter during COP 24. We classify Twitter account users into users who believe in the anthropogenic cause of climate change (believers) and users who don't (deniers) by the hashtags the user tweets or retweets. We find about seven times the number of believers compared to deniers. We manually checked each denier and randomly sampled a large number of believers to confirm our findings. Our results confirm findings from (Williams, McMurray, Kurz,

& Lambert, 2015), which concluded that there are segregated communities in climate change conversations on Twitter.

In this paper, we explored fake news, conspiracies, and exaggerations about climate change in our data set. We divided the tweets into unigrams and bigrams and searched for terms related to these stories. We found multiple tweets with conspiracies mostly from the denier group. People believing in conspiracy theories are more likely to believe that a conspiracy theory is a possible explanation of climate change (Uscinski, Douglas, & Lewandowsky, 2017). Hence, conspiracy theories could be used as a potential recruitment tool by denier lobbyists. We also found exaggerations made by believers which were targeted by deniers to strengthen their argument. It would be interesting to find whether these exaggerations are used by deniers to recruit more members and create confusion within believers over time. In deniers and believers, a considerable number of original tweets were used to negatively attack members of the opposite group. Further research would be needed to check if bot-like accounts are creating confusion in different groups and hence creating a consensus among users that anthropogenic cause of climate change is still debatable. Furthermore, given that the collection period of our dataset is small, further research with data covering longer time span would be needed to see the dispersion and counter of disinformation in climate change conversations in social media platforms such as Twitter.

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A.1   Appendix

Table A.1. Unigram and Bigram search terms used for searching exaggerations and fake stories. Capitalization is done for better readability.

Unigrams	Bigrams
Fake, #Fake, FakeNews, #Fake-News	Fake News, #Fake News
WorldEnd, SocietyEnd, EndSociety, #SocietyEnd, #EndSociety	World End, Society End, End of, #Society End, #End Society
Alarmist(s), Alarmism, #Alarmist, #Alarmism, #Hoaxer, Hoaxer, Libtard, LiberalSociety, #LiberalSociety	Liberal Society, #Liberal Society
GlobalCooling	Global Cooling, #Global Cooling
Tree(s)Killed, #Tree(s)Killed, Animal(s)Killed, #Animal(s)Killed	Tree(s) Killed, Animal(s) Killed, #Animal(s) Killed, Population End

Rapidly, urgently, quickly, judgement-day, Biblical	Very Soon, judgement day
ClimateEmergency	Politicizing Science, Climate Emergency, Climate Totalitarianism
Sunspot(s), #Sunspot(s), Qanon, #Q, DeepState, Soros,#Soros, Pizzagate,#Pizzagate, Rothschild, Pertodollar, DEW, #DEW, ClubofRome, Chemtrails, #ChemTrails, WeatherModification, #WeatherModification, GeoEngineering, #GeoEngineering, Illuminati, #Illuminati, FlatEarth, #FlatEarth, PlanetX, Niburu	Sunspot(s) Activity, Deep State, Directed Energy, Energy Weapons, Club Rome, Weather Modification, #Weather Modification, Geo Engineering, #Geo Engineering, #Flat Earth, Flat Earth, Planet X, Planet Niburu