SOCIAL MEDIA ANALYTICS SUPERBOWL - General Motors Ads Strategy

#GM #SUPERBOWL #EVERYBODYIN #NOWAYNORWAY

Introduction

It is no secret that firms are willing to spend millions of dollars for a couple of seconds worth of placement during a big event such as the Super Bowl. Is spending that much money worth it? The goal of our project is to measure the extent of such advertising campaigns on Twitter users and try to better understand why companies are willing to break the bank to advertise during such events.

To ease our analysis, we decided to focus on the GM advertising campaign which focused on their release of new Electric Vehicles. They hired Will Ferrell to play in their ad which you can watch in this link (https://www.youtube.com/watch?v=yCy-a_E2I3s). Their marketing campaign was separated into 3 main events: the release of their #EverybodyIn hashtag on Twitter on January 8th, the release of their ad on YouTube on February 3rd and the ad being shown to the Super Bowl audience on February 7th. Using Twitter data, we will try to understand the effect that this campaign had on online trends, customer sentiment and social networks.

Context

General motors have long been in the rear seat when it comes to Electric Vehicles. Although they are touted as the largest car manufacturers in the United States, that did not hold in the EV space where Tesla was sweeping all the market shares with its innovative and efficient models. It also helps to have a popular CEO in Elon Musk at the helm as General Motors comes nowhere near as talked about in the social media and google searches as Tesla.

However, this was not the case back when Electric vehicles started gaining traction. Back in 2012, General Motors was the one to beat in Electric Vehicles as they sold around 23,000 Chevrolet Volts, nearly double that of its nearest competitor in Toyota Prius. At the time, Tesla was still in its discovery stage with their Model S in production. Fast track to 2017 when Tesla revealed the Model 3, it was groundbreaking and suddenly, General Motors was the underdog. Even today, Model 3 is still selling strong and is considered the gold standard of Electric Vehicles. General Motors wanted to change this and wanted to get back in the EV game. In November 2020, the CEO of GM, Mary Barra announced a new shift in direction for the company as a whole. She said that GM has decided to invest heavily on Electric Vehicles in the upcoming years and was set to spend around 27 billion dollars. She said that the company would sell one million EVs by 2025 and would not stop until they become the number one EV manufacturers in the USA. This made some stir in social media with the ripple effect even having an impact on the shares and google web searches. However, for people to keep talking, they needed something more powerful. For this, they turned to social media, and more specifically, Twitter.

On January 8, 2021, General motors launched the #EverybodyIn campaign on twitter with the message of welcoming Generation E which stands for electric. This was followed up by several small commercials which attracted the social media users and it started to spread through retweets and quotes in twitter, quickly forming a network that was evolving over time. This acted as the foundation on which they later released the Superbowl ad and this worked wonders in social media as the already established network exploded

exponentially adding several clusters of people into the mix. The network analysis and evolution will be discussed in the later sections.

EverybodyIn campaign was launched with the message to the public that climate change is a real phenomenon and General motors intend to be one of the solutions to this massive problem. They promised that they would be launching 30 different EV lines globally by 2025, and they are excited to attract a new breed of consumers that they term as Generation E. The company is actively trying to change the brand identity by even changing their logo. The real backbone of their EV plans rides on the new Ultium Battery technology and platform which they say is a more reliable, flexible and efficient alternative to any other battery in the market.

With the first two vehicles, GMC Hummer EV and Cadillac LYRIQ set to be launched later this year and early next year respectively, it was crucial for GM to have a social media presence. The #EverybodyIn campaign was at the inception stage and was going strong.

Data Collection and Methodology

To analyze the campaign in its fullest, we extracted tweets using the official Twitter API for the query #Everybodyin and General motors (Please see the file gm_tweets.csv). This gave us a total of around 8000 tweets with the first tweet for this query coming in January 8, 2021 by General Motors, when they officially started the Everybodyin campaign. This dataset was primarily used to carry out all subsequent network analysis which is discussed in the coming sections. Even though we were able to understand the network structure, we were not able to really understand if people were positive towards the initiative or what they were really talking about with respect to General motors. For this, we extracted tweets just for General motors alone, excluding retweets and quote tweets, from December 2020 to April 2021 (Please see the file gm1_tweets.csv). With this dataset, we got some interesting insights on the hashtags being used for tweets related to General motors, how GM is being compared to its competitors and if Electric Vehicles are being tweeted often with GM. We have also collected Google trends data through the Pytrends python package for various platforms like web searches and YouTube which we have also used in our analysis.

For the network evolution, we decided to split the dataset into two buckets. The first set contained tweets related before the Advertisement was launched and the second was after the Superbowl Ad was launched on February 3rd, 2021.

# Data Preprocessing and Analysis

1. Data Preprocessing

The details of the pre-processing steps are as follows:

1. Tokenization: Each review was chopped into different sets of words; the words were stored in a list. We used to tokenize the library from the nltk package to perform tokenization.

2. Lower Casing: Since, python distinguishes string with upper case and lower cases, all the words were converted into lower case.
3. Removing Punctuation and Stopwords - Stopwords are the words in any language which does not add much meaning to a sentence. Thus in this step all the punctuation and Stop Words were removed from the data
4. Word Replace - We replace the word GM with general motors and EV/EVs with electric to get the correct picture on frequency of word and hashtags.

2. Frequency Distribution

We calculated the frequency distribution of the words 'General Motors', 'Electric Vehicles' and 'Tesla' in all the tweets extracted from December 2020 to March 2021. We found out there are three peaks for the work General Motors and Electric Vehicles in week 2, 4 and 6. (See Frequency Distribution plot below.) These represent the events; Tweet by the CEO of GM, Ad release and Superbowl, respectively. We also calculated the frequency of the word Tesla in the tweets to analyze whether the people are comparing the GM EVs with Tesla Evs. In the frequency distribution, we can observe a slight lift for word Tesla in week 4. Hence, we can say that people started comparing GM EVs with Tesla EVs.
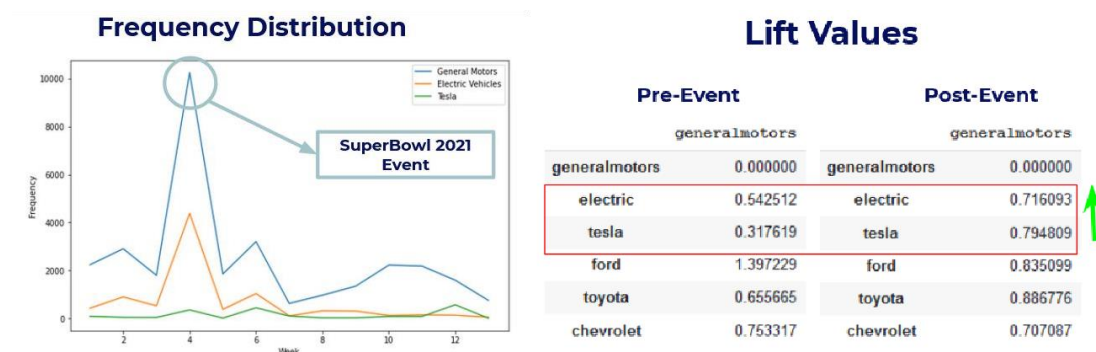

To analyze further as to how the association of word General Motors with Electric and Tesla changed pre event and post event. We used the concept of lift values to analyze the association of the two pairs.

We observed that for all the cases the lift values were less than one. However, for the pair general-electric and general-tesla the lift values increase from pre-event to post-event. That indicates that after the Superbowl event happened in February more and more people started tweeting about the new General Motors Electric vehicles and started comparing GM with Tesla.

3. Google Trends

As mentioned before, Google trends data was collected for both the US region and the world. Both results indicate a similar pattern in the user interest rate over time with 4 major peaks being distinctly visible. One was in November of last year when the CEO announced that the company would be going Electric, the second was during the launch of twitter campaign, the third was during the premier of the ad featuring Will Ferrel, and the fourth was the subsequent evolution of the campaign post the superbowl.

As we can see from the graph to the left, the hashtag General Motors has been tweeted the most during the release of the superbowl ad and many were tweeted with the hashtag electric as well. This shows signs that the campaign has been effective, and more people are entering the conversations. The evolution stage also shows encouraging signs as people still continue tweeting with the General motors hashtag. We also saw a small but interesting jump in the hashtag tesla during these events, which signify that people have actually started comparing the vehicle manufacturers even before GM's much anticipated EVs were not even launched. These show encouraging signs that the people are being pulled in by the hype and the network is continuing to evolve.
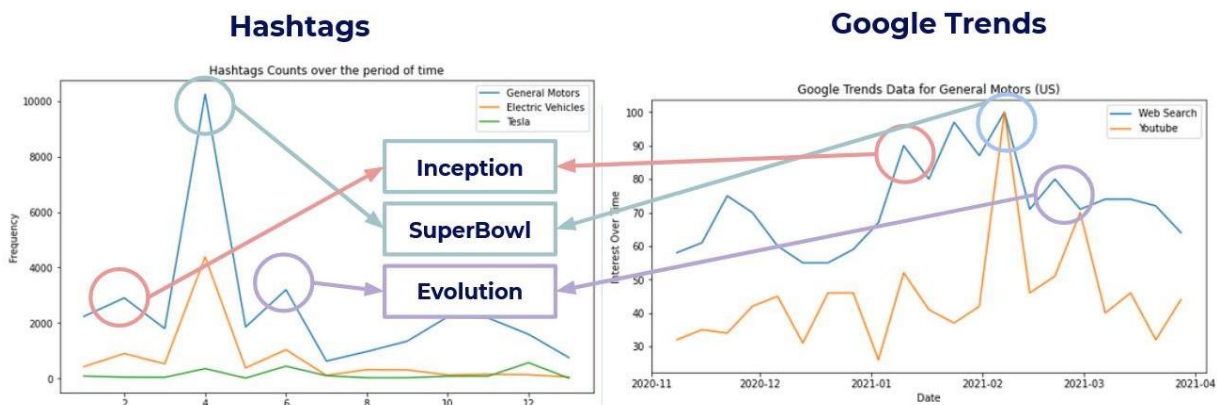
4. Sentiment Analysis

To start our sentiment analysis, we first imported the Vader package which will allow us to give a sentiment score to each of the tweets that we extracted from Twitter. We ran every tweet through that model and were able to get values ranging from -1 to 1, the earlier being a user having a bad opinion about GM and the later meaning that the user loves the brand. We then created an extra column with three possible values, those values being "positive", "negative" and "neutral". For all of the tweets that were classified as negative, we created a WordCloud where the words that were used most in those tweets were represented in an image.

Looking at that image, we can assume that a lot of the user's negative feedback comes from things such as chip shortage, their new logo or the branding of the company. GM can therefore look into this WordCloud and for example change their brand or try to fix whatever problems they have with their chips.

We created the same WordCloud with positive tweets and came up with the image to the right. The positive WordCloud also brings in a lot of insights for GM as we can for example see that keywords such as electric vehicle, norway ad and will ferrell are some of the major words being represented here. We can easily assume from this image that their Super Bowl marketing campaign was a success, as those were some key topics that were emphasised by GM on their online advertisements.

We then proceeded to plot the daily scatterplot of the sentiment score for tweets as seen below.

This plot in all honesty does not provide us with any insights whatsoever. We therefore calculated the weekly averages of those same sentiment scores in the table below.

```
Week_Number
1     0.079442
2     0.123456
3     0.119445
4     0.099097
5     0.127880
6     0.171747
7     0.116064
8     0.143987
9     0.101306
10    0.107211
11    0.101476
12    0.057668
13    0.025162
```

From this table, we were able to conclude that the ads only provided GM with a temporary increase in the sentiment that users have towards their brand. We were able to assume that from a higher sentiment value in week 2, 5 and 6 as compared to the previous week. Those three weeks are the ones that came right after major events in the GM marketing campaign timeline, respectively, the release of the hashtag #EverybodyIn, the release of the ad on Youtube and the ad appearing during the Super Bowl. Put short, when using Sentiment Analysis, we are able to infer that an advertising campaign run by GM during the Super Bowl only results in an acute increase in how customers view their brand before it goes back to its regular score a few weeks later.

5. Network Analysis

To understand how social media is creating awareness about GM's electric vehicle and uplifting their brand image, a network analysis was performed. To understand the changes in the network we have divided our data into two parts, one which is before the advertisement was released by GM i.e., before 3rd Feb 2021 and after the advertisement was released by GM (after 3rd Feb 2021).

We then calculated the centrality metrics in Gephi for each time period, formed the Network and identified the top influencers based on the **degree centrality, eigenvector centrality, PageRank, closeness and betweenness centrality.** After this we researched on the characteristics of each influencer for each time period as except for GM all other influencers changed after the advertisement was released.

Network Analysis before 3rd Feb 2021
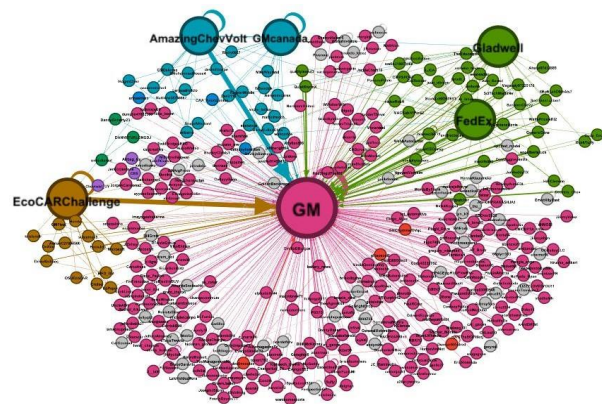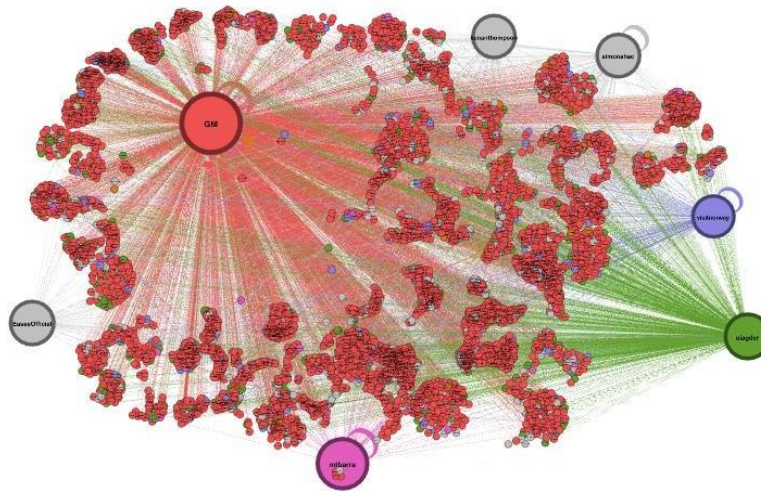
Statistics of the highly influential people

The network measures illustrated that the top six influencers in the pre-event were the users named as **GM, FedEx, Gladwell, GMCanada, AmazingChevVolt and EcoCARChallenge**.

Label	indegree	outdegree	Degree	closnesscentrality	betweenesscentrality	modularity_class	pageranks	eigencentrality
GM	320	2	322	1	0.001986	0	0.139972	1
FedEx	31	0	31	0	0	6	0.006955	0.105079
Gladwell	29	0	29	0	0	6	0.065553	0.149082
GMcanada	14	1	15	0	0	2	0.004918	0.030028
AmazingChevVolt	1	13	14	0.833333	0	2	0.000583	0.091149
EcoCARChallenge	6	7	13	1	0.000144	5	0.001464	0.090846

From these measures it was observed that **GM** was the main social influencer as it has the highest scores in all the metrics, and it influenced the majority of the people on twitter. This is because it is an official account of GM on twitter with 768K followers, and they tweeted and promoted their EV's on social media to reach more customers and spread awareness about their new product in the market. GM is low on the modularity class that suggests that it does not have the dense connections among vertices within the same group.

(https://plants.gm.com/media/us/en/gm/home.detail.html/content/Pages/news/us/en/2021/jan/0108-everybodyin.html)

Network Analysis including and after 3rd Feb 2021

Statistics of the highly influential people

The network measures illustrated that the top seven influencers in the post-event were the users named as **GM, uiagder, visitnorway, simonahac, kenanthompson and EaseOfficial.**

Label	indegree	outdegree	Degree	closnesscentrality	betweenesscentrality	modularity_class	pageranks	eigencentrality
GM	5849	17	5866	0.944444	0.002299	0	0.213802	1
uiagder	1173	1	1174	0.5	0.000001	28	0.020033	0.220678
visitnorway	171	5	176	0.538462	0.000056	7	0.004882	0.032963
simonahac	130	1	131	0	0	17	0.004188	0.014543
mtbarra	101	2	103	0.5	0.000021	33	0.002589	0.024157
kenanthompson	98	1	99	0.5	0	77	0.001533	0.026916
EaseeOfficial	69	1	70	0.5	0	26	0.001184	0.021743

From these measures it was observed that **GM** was the main social influencer as it has the highest scores in all the metrics, and it influenced the majority of the people on twitter. All the characteristics are as mentioned in the pre-event analysis (https://t.co/QH8kXRd4rp).

We have also investigated the tweets and user attributes of other influencers in the two tables above. More details on these are given in the appendix.

**Identifying number of social influencers before and after the advertisement**

We also wanted to understand how many people GM was able to influence through social media before and after the event. For this we extracted tweets containing (#EverybodyIn ((general motors) OR gm)) OR (#nowaynorway ((general motors) OR gm)) and divided the dataset into two parts which is **before 3ʳᵈ Feb 2021 and after 3ʳᵈ Feb 2021**.

We created a model to identify the most important features to weigh them and get the social influence scores. To build the model we created a new variable which was the total of retweet count and favorites count to get the target variable. We took these features as our target variable because the main aim of this project is to identify how much of the social awareness GM was able to spread and for that retweet count and the number of favorites matters the most. We trained our model and performed a feature selection algorithm.

We observed that for **pre-event**, most important features came out to be **Statuses count (which represents the total number of tweets and retweets a person has issued), eigencentrality, following count, followers count, degree, and listed count**.
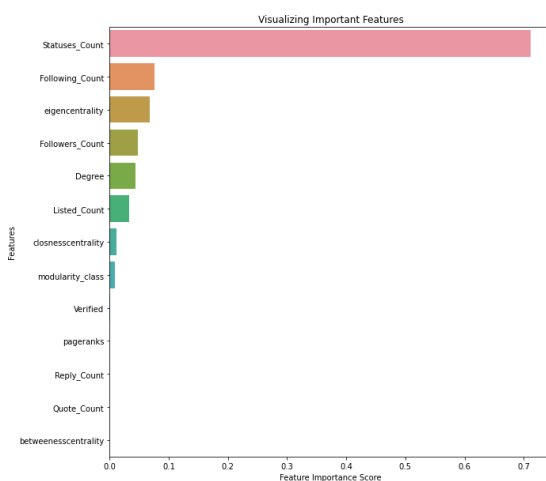
We then assigned the weights to these important features and gave highest weight to the most important feature and least weight to the least important feature and calculated the social influence scores of all the users. We also took a threshold which is the average of the scores (**0.05**) and applied a method that if the score is greater than the average score then count the unique number of users and this gives the number of social influencers which came out to be **60** before the advertisement was released.

Visualizing Important Features
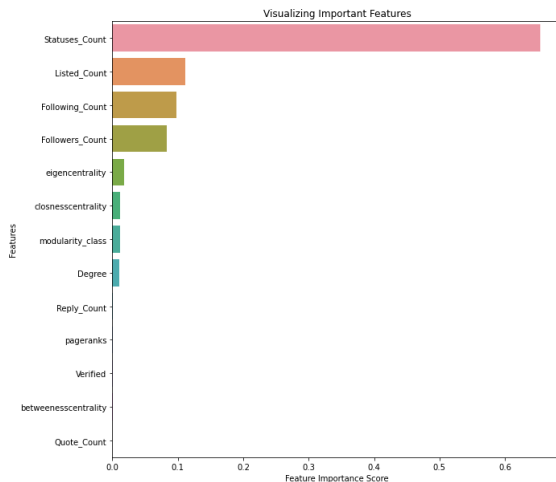
Similar model was built for the post-event as well and we observed that for **post-event**, most important features came out to be **Statuses_count, Listed_Count, Following_Count, Followers_Count, eigencentrality, closeness centrality.**

We then assigned the weights to these important features and gave highest weight to the most important feature and least weight to the least important feature and calculated the social influence scores of all the users. We also took a threshold which is the average of the scores (**0.44**) and applied a method that if the score of the user is greater than the average score then counts the unique number of users and this gives the number of social influencers which came out to be **1448** after the advertisement was released.

This clearly illustrated that GM had successfully created social awareness about its new product in the market through social media platforms and uplifted its brand image.

Recommendations and Conclusion

Through our analysis, we believe that the twitter campaign was highly beneficial for the company and the way they executed the campaign was clever and tactical to say the least. General motors never wanted to directly advertise their products to the public but they wanted to show the world their vision of a cleaner environment. They slowly but steadily created interest in the people's mind by first planting the seed through the announcement by the CEO. They followed it up by launching the #Everybodyin campaign on twitter which was the inception stage of a really inclusive social media network. This acted as the foundation on which they released the Will Ferrel ad which created a massive expansion of the network with people from as far as Norway tweeting about their stuff and creating buzz on Twitter. It is worth mentioning that the timings of these events were impeccably well crafted as all these events happened in a short span of 6 months. Now, with a strong network going for them and evolving, more people are eventually going to enter the conversation.

With 4 more months to go before the release of their first major vehicle in the new era, it is crucial to keep interests peaking in the people by tweeting more relevant news by the GM's official twitter handle which is identified as the biggest influencer and the central node in the network. GM should keep releasing short commercials from time to time as well to continue the network expansion and this would definitely have a positive impact on the actual sales.

Appendix:

Topic Modeling

We performed topic modeling on the tweets that we extracted. We split the data into two parts and perform the analysis individually on both of the dataset. The agenda to perform topic modelling was to identify if there were different clusters of the topic being discussed on Twitter. However, in the analysis we found that the optimal number of clusters were around 25 and 16 for pre and post events respectively. Also, there is no significant information that we can extract from different topics. Hence we thought of following the conventional approach of finding the frequency and lift values. (Discussed in section Data Preprocessing and Analysis.)

We have attached the script of the topic modeling analysis done with the assignment.

Network Analysis

More information on highly influential people

Influencers before 3rd Feb:

Gladwell: This was another high influencer on social media because of high degree and eigenvector centrality as well as high PageRank. This illustrates that Gladwell does not only have many connections but also many important connections. It is connected to the influential nodes of high degree. This can be explained from the fact that Gladwell is a New York Times bestseller author with 704.4Kfollowers and has also been included in the TIME 100 most influential people list and is touted as one of the foreign policy's top global thinkers. He also interviewed the GM's president who discussed the GM's long-term plans for an all-electric future. In addition to this, Gladwell also came into picture because the GM's tweet mentioning Gladwell got retweeted 30 times (https://twitter.com/GM/status/1349378255489523718). The outdegree metrics of Gladwell suggests that he did not tweet about the GM's advertisement, but he was mentioned in the GM's tweet which was retweeted 30 times. His modularity class suggests that he has very dense connections among the vertices within the same group which made him a highly influential person. He is also low on closeness and betweenness which suggests that although he was an influencer, he did not have any close relations with any other nodes in the network so the information through him did not flow quickly to other people and he also did not act as the bridge between other group of nodes to pass on the information.

FedEx: This is an official account of FedEx with 312.8K followers and they were high influencers due to high degree and eigenvector centrality and even higher PageRank after Gladwell and as compared to influencers such as GMCanada, AmazingChevVolt and EcoCARChallenge. Their outdegree is zero that suggest that FedEx did not post any tweet of GM's ad, but it was mentioned in the GM's retweet when GM reponded to FedEx tweet on Jan 13th (https://twitter.com/FedEx/status/1349023344159555587). This was majorly because GM and FedEx entered into a deal where FedEx would be officially using GM's BrightDrop EV600 as part of their electric transport vehicles which was revealed at one of the conferences (#CE2021). Many retweets from GM thanking Fedex has been posted since then (RT @GM: Thanks for being part of the EV movement and joining us on our journey to a zero-emissions future, @FedEx!

#EVerybodyIn). Since the modularity class was also high for FedEx it illustrates that FedEx has many dense connections through which lot of people were influenced by GM's initiative towards eco-friendly vehicles.

GMCanada: This user also became a social influencer based on its degree centrality and it was higher on PageRank as compared to AmazingChevVolt and EcoCARChallenge but low on eigenvector centrality which illustrates that it has many connections but very few of them were important or influential. In terms of having dense connections, it is better than GM and it was influential because it is a verified secondary account to GM and they either posted similar content or retweeted GM's tweets to spread awareness (#EverybodyIN) about the product among people in the network.

AmazingChevVolt: This user was high on degree centrality as compared to other users in the network, but its degree is not very high as compared to the top 4 influencers in the network. However, this user was high in closeness centrality which suggests that it is more closely connected to the other nodes in the network and has some amount of dense connection as well. Therefore, the information from this person flowed very quickly and easily to other people in the network.

This is a private non-verified account, but this person is a Huge proponent of Electric Vehicles, Renewable Energy and AI. It also has around 6K followers and retweeted all the major tweets from GM and subsidiaries throughout the last three months and is a big supporter of GM.

EcoCARChallenge: This user was high on degree centrality as compared to other users in the network, but its degree is not very high as compared to the top 4 influencers in the network. However, this user was high in closeness centrality and betweenness centrality scores which suggests that it is more closely connected to the other nodes in the network and has some amount of dense connection as well as it acts as a bridge between other group of nodes so that the information flows to greater network and large number of people. The information from this person flows very quickly and easily to other people in the network. It is a non-verified account and related to the Advanced Vehicle Technology Competition sponsored by the U.S. Department of Energy, General Motors and MathWorks. It was a three-year competition that built on the 19-year history of U.S. Department of Energy (DOE) advanced vehicle technology competitions by giving engineering students the chance to design and build advanced vehicles that demonstrate leading-edge automotive technologies, with the goal of minimizing the environmental impact of personal transportation and illustrating pathways to a sustainable transportation future. It has around 2000+ followers and mainly tweeted about the eco-friendly topics, AI, STEM etc. and also retweeted many tweets from GM. (https://en.wikipedia.org/wiki/EcoCAR)

The most influential tweets before the advertisement were released are as follows:

- Kristy Rasbach, Autonomous Vehicle Chief Engineer, @GM, on overcoming challenges personally and professionally. Tune into the #EcoCAR Podcast tomorrow to learn more about her journey to an all-electric future and facing the challenge of a generation. #everybodyin https://t.co/uzzJFCsfbM , - **@ EcoCARChallenge**
- As we embark on the next stage of our electric evolution, we're bringing #EVerybodyIn. Welcome to Generation E. **- @GM**

Influencers after 3rd Feb:

Uiagder: This user is one of the influencers because of the high degree centrality, eigenvector centrality and PageRank as compared to other people and influencers in the network. It also has 50% closeness centrality and some amount of betweenness centrality which suggest that it has close connections due to which the information flows quickly to other people and not only within the same group but also in different

groups as it acts a bridge between the connections and spreads information and awareness effectively. It is not a verified account with 45K+ followers and is related to the University of Agder in Grimstad and Kristiansand, Norway. It released a video in response to GM's #nowaynorway and their tweet included #EverybodyIn. It has only one tweet in the dataset, but it was retweeted 1241 times (https://twitter.com/uiagder/status/1358043788535562244).

Visitnorway: This user is high on degree centrality, eigenvector centrality and also better in closeness and betweenness scores as compared to other influencers except GM. It is also higher in PageRank as compared to simonahac, mtbarra, kenanthompson and EaseOfficial. This user is influential because it is an official account of the Tourism Board of Norway with 1800+ followers and has mostly posted tweets in response to Will Ferrell's advertisement and the first advertisement was Feb 3rd in the dataset. Also, their tweets received around 30 retweets (https://t.co/LXo03slcpd & https://t.co/u7LHiZLfd6).

Simonahac: This user is high on degree centrality but low on eigenvector centrality as compared to other influencers in the network, but it is high in PageRank as compared to mtbarra, kenanthompson and EaseeOfficial. This is a non-verified account with 62K+ followers and retweeted GM's tweet 136 times. This user is an energy transition specialist and informs opinions with data and insights. He is based in Melbourne, Australia and has tweeted about electric cars before (https://t.co/8YHHdCv2bL).

Mtbarra: This user is high on degree and betweenness centrality and it has some amount of closeness centrality and better in eigencentrality than EaseeOfficial. This suggests that this user is able to flow the information quickly and easily through the network and has some important connections. She is a Chairman and CEO of GM with 55K+ followers and works with a team to redefine the future of personal mobility. She is an Engineer, STEM education supporter and a Camaro enthusiast. She replied to GM's ad saying that Norway has set the bar high. She also tweeted on Super Bowl day how proud she was of her team for the new initiative which got retweeted 88 times (https://t.co/54aPDjyyEZ).

Kenanthompson: This user is high in degree and eigenvector centrality as compared to simonahac, mtbarra and Easeeofficial. It also has some amount of closeness centrality and very high modularity class which suggests that he has come close connections which are also dense and that helps in spreading the awareness about the brand quickly and effectively. He is the other actor from the ad along with Will Ferrell and has 173K+ followers and he tweeted the ad on Feb 8 and it got retweeted 95 times (https://t.co/JHUCuDotzo).

EaseOfficial: This user is high on degree centrality, has some amount of closeness centrality and modularity class with a decent eigenvector score. This suggests that the user has some dense close connections and spread information quickly. It is an account of a Norwegian based manufacturer of Electric Vehicle Chargers with 254 followers. They responded to Will Ferrell's ad by coming up with their own video which got retweeted 50 times (https://t.co/ZMuOdZkRi8 & https://t.co/LK7N8qEyB7).

The most influential tweets after the advertisement was released are as follows:

- Norway is crushing us at EVs. That's crazy. We have to do better. Are you in? #EVerybodyIn #NoWayNorway. **- @GM**
- You'd have to be a cotton-headed ninny muggins not to find your way to Norway #WillFerrell we got some locals to show the way #YesWayAmerica #EVerybodyIn #Norway #SuperBowl. **@GM and @visitnorway**
- All jokes aside, I am incredibly proud of the team who worked so hard to show the world how serious we are about our #AllElectricFuture. @GM has what it takes to put everyone in an EV. We see you, Norway. #EVerybodyIn**. -@mtbarra**

- Hey Will (and @GM), looks like you need a hug and a charge. We can give you both!It's Easee! #everybodyin #nowaynorway #yesway @erna_solberg. **-@EaseeOfficial**
- I'm sorry, sweetie. I know it's your birthday, but this is a pirate's life. Daddy had to go help Uncle Will and @GM crush Norway with all their electric vehicles. #EVerybodyIn #ad - **@Kenanthompson**