



HUSO 2022

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HUSO 2022

Forward

The Eighth International Conference on Human and Social Analytics (HUSO 2022) continued a series of events bridging the concepts and the communities dealing with emotion-driven systems, sentiment analysis, personalized analytics, social human analytics, and social computing.

The recent development of social networks, numerous ad hoc interest-based virtual communities, and citizen-driven institutional initiatives raise a series of new challenges in considering human behavior, both in personal and collective contexts.

There is a great possibility to capture particular and general public opinions, allowing individual or collective behavioral predictions. This also raises many challenges, on capturing, interpreting and representing such behavioral aspects. While scientific communities face new paradigms now, such as designing emotion-driven systems, dynamicity of social networks, and integrating personalized data with public knowledge bases, the business world looks for marketing and financial predictions.

We take here the opportunity to warmly thank all the members of the HUSO 2022 technical program committee, as well as all the reviewers. The creation of such a high-quality conference program would not have been possible without their involvement. We also kindly thank all the authors who dedicated much of their time and effort to contribute to HUSO 2022. We truly believe that, thanks to all these efforts, the final conference program consisted of top-quality contributions. We also thank the members of the HUSO 2022 organizing committee for their help in handling the logistics of this event.

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Shifting Trends of COVID-19 Tweet Sentiment with Respect to Voting Preferences in the 2020 Election Year of the United States

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Abstract—COVID-19 related policies were extensively politicized during the 2020 election year of the United States, resulting in polarizing viewpoints. Twitter users were particularly engaged during the 2020 election year. Here, we investigated whether COVID-19 related tweets were associated with the overall election results at the state level during the period leading up to the election day. We observed weak correlations between the average sentiment of COVID-19 related tweets and popular votes in two-week intervals, and the trends gradually become opposite for Democratic and Republican voting preferences. We then compared the average sentiments of COVID-19 related tweets between states called in favor of the Republican (red states) or Democratic parties (blue states). We found that at the beginning of lockdowns COVID-19 tweet sentiments in the blue states were much more positive than those in the red states. However, COVID-19 tweet sentiments in the red states gradually become more positive during the summer of 2020 and persisted until the election day.

Keywords—COVID-19; Election; Twitter; Sentiment Analysis.

I. INTRODUCTION

The year 2020 saw a wide variety of government-issued responses to the outbreak of the SARS-CoV-2 pandemic in the United States. It has been acknowledged by researchers that these measures were quickly politicized and highly partisan. For example, Gusmano et al. reported the disparity between measures taken by Democrat state leaders, suggesting that these tended to be more immediate based on suggestions by federal health organizations, as opposed to Republican state leaders, who it is said were likely to take less restrictive measures based on the cues of the Republican sitting president at the time [1]. Though it is evident that politics played a significant role in the implementation and adherence to measures regarding public health and safety, there are other factors to consider that would play into how these issues were discussed throughout the year leading up to the presidential elections in November. For example, Harvey discussed the effect of lockdown fatigue, or the role of stress involved in the isolation and uprooting of daily life because of COVID-19 lockdown measures, which led to discontent and reduced adherence to isolation measures as time went on [2]. This would suggest the expectation of changing trends in sentiment as people became more uncomfortable with the lockdown measures. Particularly in a discussion of Twitter discourse during the pandemic, it has been observed that social media overuse during lockdown may have contributed to this fatigue, such as the negative effect that the constant stream of information had on the generation Z age cohort [3]. This means that the data gathered from social media can be particularly

valuable as it was not just a reflection of users' views but also that it impacted the users who read it during this period, thereby exerting influence on the wider population. This is important as it ties into the spread of misinformation, which has also been a widely documented issue in politics, especially during the pandemic. Social media, such as Twitter, has been a hotspot for the quick spread of misinformation, such that many websites were set up to fact-check many posts related to COVID-19 [4]. This indicates that Twitter has been accepted as a source of political information by many of its users, making more evident the value of social media analysis as a line of inquiry regarding politics and the pandemic.

For the United States, the red and blue states refer to states whose voters predominantly choose the candidates from the Republican Party or Democratic Party, respectively [5]. Here, we wanted to investigate if it is possible that analyzing the COVID-19 tweet sentiment in online discussion of the politicized issues in different areas of the country would give insight into the local political leanings when it came time to vote in the 2020 presidential election. Our goal is that the information gathered here can have applications in politics, allowing for the ongoing analysis of the online discourse of issues as a more efficient and less selective method of gauging constituent interest rather than polling individuals and that these results can potentially be used to understand and hopefully reevaluate the role of politics as it is leveraged even in the face of a major emergency such as a global pandemic of COVID-19.

Twitter sentiment analysis has previously been used to track public opinion over an election cycle, such as the tracking of responses to individual events in the 2012 presidential races [6]. Our research focuses particularly on the effect of pandemics on a time of emergency, which is a significant source of intrigue in the social sciences for how they expedite change and magnify issues. This means that the political issues of the election would have been much more pressing than in a year of less hardship for the general populace. Our comparison of these polarizing issues will contribute to the existing literature on the study of sociological and political impacts of the COVID-19 pandemic.

Below, we will describe our data sets and methods in Section II, present our results in Section III, followed by discussion in Section IV and conclusion in Section V.

II. MATERIALS AND METHODS

This study used publicly available popular voting data broken down by state and party and published location-tagged daily Twitter sentiment data.

A. Twitter Data

We parsed 472,288 geotagged tweets from a dataset of COVID-19 tweets collected based on a selection of key terms related to the pandemic [7]. The collection of this dataset started on March 20, 2020, just at the beginning of states issuing stay-at-home orders and lockdown procedures [8]. We ended our analysis on the date of the general elections, November 4, 2020. We partition the geotagged tweets to each state in the U.S. and then proceed with average daily sentiment analysis.

B. Voting Data of the 2020 U.S. Election

Popular voting data arranged by state was obtained from a public online nonpartisan source [9]. This data set was imported and indexed by state abbreviation. For this study, we parsed out only the quantitative popular voting data and which party was called for each state.

C. Tweet Sentiment Analysis

Tweet sentiment analysis was performed using VADER Sentiment Analysis, a tool designed with social media posts in mind in order to better attune the expected input [10]. VADER utilizes Natural Language Processing (NLP), machine learning methods, and five generalizable heuristic rules to assign each text a sentiment score between -1 and 1, representing perfectly negative and perfectly positive sentiment intensity, respectively. Retweets and duplicated tweets were excluded from sentiment estimation. We estimated the daily average COVID-19 tweet sentiment intensity for each state in the United States, which then was imported to Jupyter Notebook using the pandas package. The dates were parsed as indices to generate the data frames. A few example of the COVID-19 related tweets and their estimated sentiment values (S) are presented in Table 1. We presented two positive, one negative, and two neutral examples.

TABLE 1. SAMPLE TWEETS WITH ESTIMATED SENTIMENTS (S)

Sample Tweets	Date, Location	S
Dinner tonight is a B.L.T. and a corona. Sponsored by Covid-19 @ Miami Beach, Florida https://t.co/GyznR8Yqed	2020-04-11 Miami Beach, FL	0
Bare shelves: the time of #corona @ South Burlington, Vermont https://t.co/idfYhEOFFV	2020-04-11 South Burlington, VT	0
EMBRACE THE SUCK: In spirituality, contrasting experiences refers to the ones we'd really rather not have. Maybe it's seasonal chronic illness woes (☹️ \u200d♀️), perhaps it's various elements of Corona chaos, or it could https://t.co/upvcBRBAZS	2020-04-10 Long Beach, CA	-0.87
The best alone time I can have. Wanted to share 🙋\n#stayhome #staysafe #socialdistancing #stayhomestaysafe #inspiring #fun #creative #art #collab #teamwork #newmusic #newalbum #cancel #corona #solo #guitar #life https://t.co/cdpaPmXrHa	2020-04-10 Los Angeles, CA	0.91
This quarantine turning me into Joe Jackson 🙄🙄🙄\n.\n.\n.\n.\n.\n#llfruge #tallformyheight #mvpofnochildleftbehind #quarantinedad #jacksons #beyonce #Brooklyn #corona #corona #covid #fatherdaughter #florida @ Fleming https://t.co/xmAhSg39hZ	2020-04-11 Fleming Island, FL	0.83

D. Data Processing

We removed any locations that were not shared between both datasets and transposed the sentiment dataset such that the indices are the state abbreviations, allowing for the concatenation of these data frames by row. Of the voting data, we removed every column except for the state abbreviation

indices, the qualitative data of which party won that state, and the percentage of the vote for Democrats, Republicans, and others. We combined the data frames by index, and the state abbreviation, and turned the percentages into decimals such that the voting data is now on a similar scale to the sentiment data (Figure 1).

	called	dem_percent	rep_percent	other_percent	2020-03-20	2020-03-21	2020-03-22
TX	R	0.465	0.521	0.015	0.156886	0.158173	0.279156
CA	D	0.635	0.343	0.022	0.159037	0.322140	0.253292
CO	D	0.554	0.419	0.027	0.632033	0.467900	0.291575
IL	D	0.575	0.406	0.019	0.220340	0.194075	0.423533
HI	D	0.637	0.343	0.020	0.000000	0.000000	0.000000

Figure 1. Sample of the combined data frame. The average COVID-19 tweet sentiment for each state is estimated daily.

E. Correlation and Heatmap

Pearson correlation was performed using Python pandas.corr function, and the correlation coefficient matrix was visualized with Python Package Seaborn [11] to generate the heatmaps to compare the correlation between national popular vote percentages by party and average COVID-19 tweet sentiment during the corresponding time periods. We trimmed this data frame to dates along the y-axis and percentages along the x-axis for ease of viewing and comprehension.

F. Sliding-time-window analysis

Daily averages of tweet sentiment are highly noisy. We, therefore, applied a 14-day sliding window to estimate the two-week trend. In order to compare the tweet sentiment intensity between blue and red states, we estimate a ratio between the average sentiment for Democrat-called versus Republican-called states in the sliding time windows.

III. RESULTS

A. Shifting correlations of COVID-19 tweet sentiment with voting preferences

In order to examine the potential association of COVID-19 tweets with voting preferences, we performed a two-week sliding window analysis. In each two-week window, we estimate the correlation coefficient between the average COVID-19 tweet sentiment intensity and the percentage of votes for Democratic, Republican, and other parties.

We visualize these two-week sliding window correlation results in a heatmap (Figure 2). A Positive correlation is represented by the intensity of the red color, whereas a negative correlation is represented by the intensity of the blue color. The center of the color representation is near gray color, corresponding to a coefficient of zero.

Because votes for the other parties at 1.8% are an extremely small fraction, we expect that Democratic and Republican votes would correlate with average COVID-19 tweet sentiment in opposite ways. For example, in each row of Figure 2, a red cell in the column of Democratic voting percentage often correspond to a blue cell in the column of Republican voting percentage.

When examining the correlation results from March to November (Figure 2), we can observe a shift that is occurring from mid-April to late May of 2020. Before mid-April, there are

generally weak positive correlations between average tweet sentiment with Democratic voting percentages. After May, there are generally weak negative correlations between average tweet sentiment with Democratic voting percentages. This shift can be verified in the column for the Republican voting percentage, except that the color pattern changes in the opposite direction (Figure 2).

Overall, we can observe that positive correlations between COVID-19 tweet sentiments and Republican voting percentages occurred more often from June to October before the election. It is noteworthy that the incumbent presidential candidate was from the Republican party during the 2020 election.

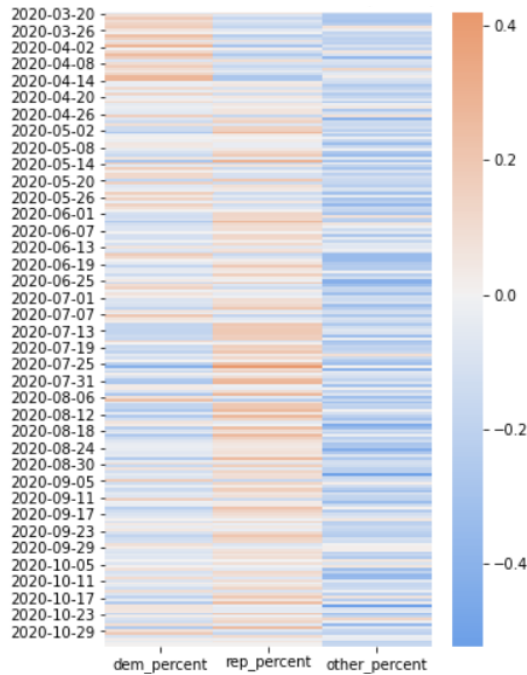


Figure 2. Shifting correlations of average sentiment intensities of COVID-19 tweets with the percentages of votes for Democratic (dem_percent) and Republican (rep_percent) parties. Vote for other party is represented by other_percent.

B. Switching of relative sentiment of COVID-19 tweets in blue and red states over time

To further investigate the possible association of COVID-19 tweets with the 2020 voting results, we compared the trend of COVID-19 tweet sentiment in blue and red states overtime during the 2020 election year (Figure 3). The blue states are the states where the Democratic presidential candidate was declared the winner based on a simple majority, and the red states are those where the Republican presidential candidate was declared the winner. No state was won by other parties other than the Democratic or Republican parties.

In order to discern the trend over time, we chose to use a sliding window technique to mitigate the daily fluctuating noises of tweet sentiment. We estimated the average sentiments of COVID-19 tweets in a two-week sliding window from March to November 2020, in blue and red states, respectively.

In order to highlight the relative change over time between the blue and red states, we estimate the ratio of average COVID-19 tweet sentiment intensity in the blue states versus that in the red states in each sliding window, plotted as dashed line in green (Figure 3). To illustrate the difference between blue and red states, we add a gray horizontal line corresponding to a ratio of 1 in Figure 3. It can be observed that, from March to May, the average sentiment intensities of COVID-19 tweets were generally more positive in the blue states than in the red states. The ratio of blue versus red state sentiment intensities has a declining pattern during the summer of 2020, and generally stays below the gray horizontal line of 1 from the summer to the election day.

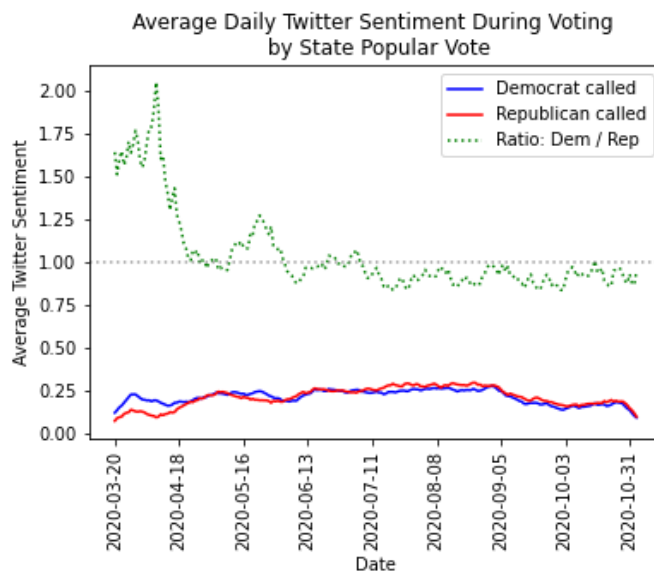


Figure 3. Shifting trend of relative sentiment intensities of COVID-19 tweets in blue and red states over time.

Hence, the changing pattern of the blue-versus-red ratio in Figure 3 is consistent with the correlation heatmap in Figure 2. Both figures show that COVID-19 tweet sentiments were initially more positively associated with Democratic voting preference at the beginning of the pandemic, but this correlation declined after May 2020. Gradually, the positive intensity of COVID-19 tweets associated with Republican voting preference slightly overtook that with Democratic voting preference.

IV. DISCUSSION

We are aware of some limitations to the present work. Location-tagged tweets are a small subset of the overall tweets. Twitter users are not a fair representation of the general population of the United States [12]. The COVID-19 related lexicon is a changing definition on its own, and a variety of topics are politicized and polarized. The sentiment analysis also has its limits. For example, we expect similar sentiment scores for negative tweets about mask requirements and negative tweets about anti-mask behaviors. It is also known that slang, sarcasm, and other cultural language particularities may be challenging for accurate sentiment intensity estimation. There is likely an interwind of COVID-19 tweets with other social and

political events. For example, the Black Life Matters movement intensified in May 2020. We are also aware that the partition of the states into two categories of blue and red ones is oversimplified.

One point of intrigue in this work is the evident negative correlation between Twitter sentiment and the popular vote for either of the major parties for prolonged periods of 2020. There did appear on the heatmap to be a slightly greater correlation between the sentiments and popular vote for the Republican party, which would be understandable given that it was the party in power during this time, suggesting that people who publicly voiced approval for the state of the country at the time would vote in a way to keep it the same.

Looking at both the heatmap and time series charts, there are also two points in which the sentiment shows a much greater correlation with Democrat voters, so it could be valuable to look closer at the data from the beginning of the pandemic to find out what caused such a significant drop off as well as what caused the spike in May. The first drop may be attributable to lockdown fatigue, which would make it interesting to analyze the possible correlation between the sentiments in that time period to the adherence to stay-at-home orders or social distancing.

V. CONCLUSION

We observed weak correlations between the average sentiment of COVID-19 related tweets and popular votes in the 2020 election in the United States. We observed that COVID-19 tweets were more positive in blue states than in red state during the beginning of the pandemics. We found that sentiments in the red states gradually become more positive during the summer of 2020 and persisted until the election day. We observed this shifting trend using both a heatmap and a ratio-based comparative analysis. Future work will be required to investigate the possible sources of these changes and their overall implications for the role of social media and the SARS-CoV-2 pandemic in the politics of the United States.

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Integrating New Technologies in Human-Driven Professions: How Can Tourist Guides Leverage Digital Transformation?

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Abstract—Qualified tourist guides are professionals in cultural, technical, and scientific mediation and they work mainly in public spaces, museums, and historical monuments. The digital transformation of the 2010s has revolutionised the approach to knowledge and has led to a change in the role of qualified tourist guides. By this we mean the explosion of Wikipedia and social networks, as well as the introduction of multimedia in museums. The effects of the current health crisis (Covid) have added to all this and imposed profound changes and irreversible developments. Our reflection is about, on one hand, the way in which the qualified tourist guides can rely on digital technology during a tour and, on the other hand, the new skills that student guides must acquire during their scholarship. We seek to understand where and how digital technology can be an ally of qualified tourist guides without replacing them. We will rely on the professional degree of qualified tourist guides (in French: *guides-conférenciers*), prepared in our Gustave Eiffel University, as well as on our connections with the National Federation of Qualified Tourist Guides, to analyse the digital approach of future professionals in the sector.

Keywords – *Tourist Guide; Guide-lecturer; digital tools; cultural mediation; museums.*

I. INTRODUCTION

Since 2010, the tourism sector has been facing a profound digital transformation and has also hit the shock of a health crisis. This is particularly true for qualified tourist guide's profession. We propose to analyse the evolution of the profession of qualified tourist guides, or in French *guide-conférencier* [1], in the global context of digital transformation and Covid pandemic. After an introduction (Section I), we explain our scientific positioning (Section II) and we give an overview of human mediation (Section III). Then, we outline the use of digital new tools in the mediation (Section IV). Finally, we analyse the future of qualified tourist guides facing the Information and Communication Technology (ICT) (Section V) and we give

a conclusion (Section VI). Observing our students over the last few years and following the experience of a qualified tourist guide, we realised that it became necessary to re-think the profession of tourist guide by integrating digital tools. Through their master's dissertations and their internships, our students reflect on how to integrate digital tools in their job. We intend to analyse their approach of this subject during their studies and also after, when they will start to work. We want to understand in which way digital technology can be an ally of a qualified tourist guide and will try to provide an overview of the current situation.

The decree n. 2011-930 of August 1st 2011, relating to persons qualified to conduct guided tours in museums and historical monuments [2], has modified the status of the qualified tourist guide. From now on, the law recognises only one professional figure that groups together the four professions that existed until 2011 (regional guide-interpreter, national guide-interpreter, guide-lecturer of the Cities and Countries of Art and History, national lecturer): the qualified tourist guide or in French *guide-conférencier*. Obtaining the professional license, which is valid throughout France, is subject to the validation of a professional bachelor's degree or a master's degree if the following courses units have been validated: tourist guide skills, professional practice, and modern foreign language. The professional bachelor's degree is characterised by its multidisciplinary approach. The bachelor's degree proposed at the Gustave Eiffel University, for example, focuses on three fundamental aspects: history of art, cultural heritage and general knowledge; practical aspects with guiding techniques and oral mediation of the public; professional aspects of communication, marketing and occupational integration. The aim is to provide students with tools allowing to deal with any type of situation and being able to practice their profession independently or in collaboration with tourist offices and other tourist or cultural establishments, as well as connecting and networking with

professionals of the National Federation of Qualified Tourist Guides [3].

The profession of qualified tourist guide is in constant evolution. It requires constant adaptation to the various audiences and the context or subject of the visit. This is especially true with the arrival of new technologies in the 2010s, which have revolutionised the approach to knowledge and have led to a change in the role of the qualified tourist guides. Three stages in the evolution of the profession of qualified tourist guide allow us to better understand its link with the evolution of the Information and Communication Technology (ICT). The first one is about the operating mode of the mediation of the public in general and is related to the evolution of public's expectations. The second is more specific to the content of the tourist guide's presentation, which has evolved with the availability of online information. The last stage combines the two previous ones, gathered in the digital solutions developed in the field of public mediation.

In the following sections, we will detail these three stages in order to understand how the profession of qualified tourist guide must evolve and adapt to the new socio-cultural context. We will analyse the context of the professional bachelor's program of *Guide-Conférencier* at Gustave Eiffel University, and more specifically the relationship of future guides to the digital world. These analyses will be carried out using an information and communication sciences approach.

II. SCIENTIFIC POSITIONING: CONVERGENCE BETWEEN LINK, MEANING ACTION AND KNOWLEDGE

This communication associates two teacher-researchers, one in information and communication sciences, the other in computer science, a research engineer working on cultural heritage and a qualified tourist guide, teacher in the same University. They constitute a large part of the supervision and teaching staff of the *Guide-Conférencier* professional bachelor's degree at Gustave Eiffel University. This work is placed in a perspective of research-action and transdisciplinarity, with the construction of knowledge for action starting from new uses of socio-technical devices.

Our scientific position is in the field of information and communication sciences, within a research team: DICEN-IdF (Information and Communication Devices in the Digital Era). We therefore have an approach that integrates the dimensions of communication (exchanges, interactions), uses and production of data and the use of socio-technical devices. We position according to F. Bernard [4] insisting on the convergence of link, meaning, action and knowledge.

Our work is mainly action research, in particular to analyse activity situations, with the dimension of social constructivism: construction of social reality by the actors. We thus integrate the "situational and interactionist semiotics" approach proposed by A. Mucchielli [5] with the dimension of feelings, emotions and the body as social media, as proposed by F. Martin-Juchat [6], which is particularly important in times of health crisis.

From a methodological point of view, we are depending on the context, in situations of "participant observation", but more often in "observer participation", by being very involved in the follow-up of students in professional situations or in professional activities (all range of touristic and cultural structures).

This double positioning, which is also a positioning of theoretical reflection and strong practical involvement, allows us to be particularly proactive in a reflection on the employability of new graduates and the evolution of this profession of mediation for the development of cultural and tourist heritage in the territories. In an approach of economic and territorial intelligence [7], we insist on the reliance (links, interactions) to participate in the resilience of territories, in the double context of digital transformation and health crisis. As in the idea to search for new ways in Competitive or Economic Intelligence [8].

Reliance and resilience by insisting on the informational and communicational stakes of activity situations, to improve the added value and employability of the qualified tourist guides for a better adaptability to meet the expectations of new audiences, and to be much more active in their stays and visits and much more sensitive to the authenticity of the territories and to personalised experiences.

III. OVERVIEW AND EVOLUTION OF HUMAN MEDIATION

The scope of intervention of a qualified tourist guide is very vast and covers the whole of the French cultural and natural heritage.

In France, qualified tourist guides are the only ones allowed by law to conduct visits and lectures in museums and historical monuments (except for curators and teachers, to a certain extent). We, therefore, chose to focus on museums and historical monuments where the digital element is increasingly important.

The functions of the museum, as we recall, are exhibition, conservation, scientific study and animation. Museums bring their collections to life and offer different approaches to reading them for different types of visitors. Animation acts as a driving force in the museum institution and can take various forms: educational activities, guided tours, lectures, concerts, workshops, events and demonstrations of all kinds [9]. Consequently, mediation approaches, whether human or digital, are based on the knowledge of the public's expectations. In fact, the *modus operandi* of mediation professionals has evolved to adapt to the expectations of the public by moving from the simple discourse (from "saying") to action (to "doing"), with the rise of performative and participative interventions. As Stéphanie Airaud reminds us, "The mediator's discourse proposes to go beyond the guided tour to play on the springs of aesthetic experience. Embodied by the lecturer for an audience, this speech uses taste, sound, imagination, fiction, the illusion of image and word to invent a performative maieutic. It therefore seems possible to move from saying to doing" [10]. We consider here "*dire*" (say) as an oral transmission of a discourse on the artistic works, and "*faire*"

(do) as the creation of a situation, a space for play and the advent of a form. Many guides and lecturers then invented new forms of mediation, in which the public more easily speaks up during debates, physically invests the tour framework in artistic forms (dance, poetry, meditation, etc.) or playful forms (photo rally, treasure hunt). The most important thing is to become an actor (or "spect-actor") of a new type of participative visit.

The discourse of tour guides has also evolved with the increasing access of the public to information. From the mid-2000s onwards, Wikipedia revolutionised public access to online information. As its diversity and reliability grew, tourist guides gradually lost their status as knowledge holders. They questioned the content of their discourses and sought to offer more reflection and perspective in addition to the raw information. Since the explosion of social networks in the mid-2010s, the youngest users now rarely consult traditional media and instead lock themselves into information loops. For these audiences, the discourse of the qualified tourist guide has evolved further with the return of popularisation content combined with increased vigilance on discernment since the explosion of fake news from 2016.

IV. DIGITAL, NEW TOOLS FOR MEDIATION IN THE MUSEUM AND PUBLIC SPACE: THE THIRD STAGE IN THE EVOLUTION OF THE TOURIST GUIDE PROFESSION

Our reflection here is about the way in which the qualified tourist guide can rely on digital technology during a guided tour. We therefore exclude the use of digital technology for communication and marketing purposes [11]. The same applies to creative content of a cultural and immaterial nature which excludes *de facto* human mediation (eEducation/EdTech, video games, digital publishing, digital press, 3D animation, virtual reality, augmented reality, music, audiovisual, radio, television, cinema).

We will try to show how digital can be a complementary tool for guides without trying to replace them. The Covid 19 pandemic and its many lockdowns have proved the need of human relationships and interactions in education and leisure activities. Hence, the importance of closely associating and balancing the level of intervention of the digital world and the human in the mediation with the public. We can define three levels of intermediation in which digital takes a more or less important place.

In 100% immersive mediation, the public wanders through spaces with a high level of scenography which use interactive digital tools in different contexts and for different purposes and where guides do not have a lot of opportunities for their intervention. The first type offers immersive exhibitions of digital creations on artistic themes, such as the *Atelier des Lumières* [12] in Paris. The second type offers a tour combining immersive content and varied interactive digital content with the aim of facilitating the understanding of a subject. This is the case of the *Château d'Auvers sur Oise* [13] focusing on 19th century art. In a constrained tour, visitors wander from room to room interacting with various contents and operating modes. It should be noted that this type of mediation can be very

useful for people with motor or visual and hearing disabilities.

Finally, the third type makes use of new technologies as an innovative positioning in terms of product, which enables it to stand out in the cultural offer of a destination. This is the case of the *Hôtel de la Marine* in Paris [14], which opened in 2021 and offers an immersive tour within highly planned environment and constrained pathway using various devices to enhance the visitor experience.

Some cultural places offer interactive or immersive contents while allowing the guide to intervene at key moments in the visit. This is the case at the *Cité des Sciences* in Paris [15], where permanent and temporary exhibitions are accessible on their own or with a guide. In this case, it is necessary for the guide or scientific mediator to be aligned with the imposed scenography by becoming familiar with contents and operating modes of the digital tools in order to integrate them into his tour and its discourse. Consequently, he must be a specialist in the subjects covered in order to be able to deliver the necessary information, answer to certain questions from the public and achieve an optimal customer experience.

The third level of intermediation takes place in environments with lesser scenography and leaves much more opportunities to the guide to integrate digital technology into his visit. This is the case of the *Sainte Chapelle* in Paris [16], which has a freely accessible interactive digital table offering 3D reconstructions of the place and its surroundings during the history. It is large enough for a dozen people to gather around and can easily be used during the visit to support the guide's presentation. Augmented reality offers a significant cognitive support in understanding and reinforcing the content delivered by the guide. Here again, the guide must be familiar with the contents and functionalities of the tool in order to be able to integrate them perfectly into his tour scenario. Similarly, the *Conciergerie* in Paris offers its visitors *histopads* [17], which provide 3D reconstructions of the site, also in augmented reality, accompanied by written information. These can easily be integrated into a tour in which the guide will find in this tool an ally enabling him to evoke the atmosphere of a place that is now not so furnished and decorated.

In these places, the digital visit materials are very often designed and produced without taking the guide into account, not involving them into the creative, design and planning process. Even if, for some museums, guided tours represent a less important part in terms of attendance than the self-guided tours for which these tools are designed, we can only encourage a dialogue in which museums consults its guides or mediators for the selection of digital tools and the drawing up of specifications for the contents and operating methods. The objective is to meet the needs of the public in a guided tour situation and to offer the guide a better appropriation and a more relevant integration of the tool in his visit according to contents and operating methods that are adapted to his visit.

The emergence of digital technology must be integrated into a perspective of human interaction to encourage the

creation of new services. The 100% immersive intermediation, in particular, forces the actors of cultural and scientific mediation to a new approach of service definition and guides more precisely to an in-depth reflection on how to give a new added value to their profession.

Despite the interest and progress brought by the variety of digital tools, we do not think that 100% digital is the most relevant approach in terms of services, public mediation, and product. In the same way that we have integrated the hybrid into professional, medical or relational perspectives, human mediation must remain at the centre of these approaches, and this is why we propose to integrate the expertise of qualified tourist guides into the design of digital tools. In the graph from Figure 1, we show the difference between opportunities of mediation and easiness of mediation according to the degree of digitization:

- The opportunities (dotted line) exist as soon as there is at least one digital tool, and they decrease with the intervention of immersive content and scenography

- The easiness for the guide is optimal when he has more variety of choice of digital supports as he is not forced to use the one and only available which may not be relevant for his visit.

Easiness starts to drop as soon as the content is immersive (histopad for example with its predetermined immersive scenario), and collapses in an immersive scenographic environment.

Note that the difficulty of mediation also depends on the complexity of the scenario of the digital tool, which the guide should manage and be comfortable with to integrate it in his visit.

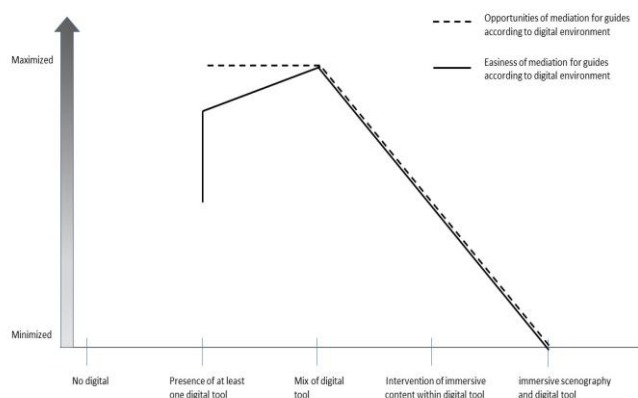


Figure 1. Difference between opportunities of mediation and easiness of mediation according to the degree of digitization.

V. FUTURE TOURIST GUIDES-FACING ICT

The digital media present in the museums are designed to accompany an individual visit and provide in-depth information that the visitor must be able to use independently. The mediation offered by the museum is not necessarily intended to use these media either. At the same

time, within the framework of our bachelor's degree, we have noticed that until now future qualified tourist guides have not shown a significant interest in new technologies, but this is changing very quickly with the renewal of generations. The profession of guide is still largely perceived in a purely interactional reading without measuring the interest and need of the integration of new technological tools. The relationship with digital technology is still limited to treasure hunts or to a complementary communicative role, which may raise questions about the employability of future tourist guides, particularly regarding the acquisition of new segments of the public who are increasingly equipped with tools and applications that can be used to carry out a tour otherwise perceived as basic. Furthermore, appropriating new technologies would allow guides to position themselves in the market of 3D reconstructions and 100% immersive, thus ensuring the continuity of the profession. A qualified tourist guide, in addition to his cultural background and knowledge of the various audiences, could show and additional knowhow in technical skills that would be useful for the design of digital products offering progressive interpreting frameworks required by the different stages of a well-prepared visit.

To fill this gap in the integration of qualified tourist guides in the design of public mediation projects, Gustave Eiffel University encourage a close collaboration between touristic sites and guides to involve them in the creation of digital tours. For example, in 2018, a student of our professional degree developed a tour of the Gallo-Roman site of *Le Fâ* (*Barzan, Charente-Maritime*) using geocaching [18]. The visitors were offered to walk through the site on their own with the aim of finding caches according to an itinerary planned by the management and the guide. The scenario of visit foresaw that the guide would be near strategic caches to offer additional information on the history, archaeology, the site, etc., and to answer to visitors' questions. This twofold interpretative approach responds to the issue of the types of discourse explained in part 2: to propose a framework of information completed by exchanges in the form of questions.

Gustave Eiffel University and IFIS [19] are currently setting up exchanges between student guides and students of the Tourism and New Technologies professional degree in order to allow exchanges on each other's practices, and also to help our future guides to integrate an ICT dimension into their end-of-study projects in order to better prepare themselves to accompany publics who make increasing use of tools, applications and digital practices.

Some students from the *Guide-Conférencier* degree are currently working on a project for a guided tour of the Louvre Museum in Paris in the form of a treasure hunt using digital tablets. They are preparing specifications for the developers to work together on the content, ergonomics and functionalities of the application in order to make this treasure hunt fun, by integrating immersive and participative solutions. The didactic content will be provided by the qualified tourist guides who will be positioned at strategic points to offer additional information and answer questions.

VI. CONCLUSION

We have traced here, although in a synthetic way, the evolution that the profession of tourist guides has undergone over the years and with the arrival of digital technology.

We have shown how much the new uses of digital technology condition the evolution of this profession of mediation facing of audiences that are increasingly using digital technology. To ensure the sustainability of their profession, guides must know how to adapt to this new context and give added value to their interventions. All these developments in the digital transformation take on an additional significance in times of the Covid pandemic, which reminds us how essential and necessary human interaction is. This new perspective has moreover imposed a major reinvention of the profession of qualified tourist guides, notably towards new remote services now integrated into their service offer. It is therefore not a question of putting ourselves in opposition to digital media, but rather of learning to use them so that they become our allies.

Starting from this initial analysis, we wish to conduct research among the students of our professional bachelors' degree to better understand their approach to digital technology and to propose an educational pathway that meets the requirements of the market. Secondly, we would like to develop collaborations between guides and computer scientists to make the tour app even more effective [20] [21].

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An Investigation of Twitter Users

Who Gave Likes to Tweets Disclosing Submitters' Personal Information

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Abstract—Nowadays, many people use a Social Networking Service (SNS). Most SNS users are careful in protecting the privacy of personal information: name, age, gender, address, telephone number, birthday, etc. However, some SNS users disclose their personal information that can threaten their privacy and security even if they use unreal name accounts. In this study, we investigated Twitter users who gave likes to tweets disclosing submitters' personal information that potentially threatened submitters' privacy and security. We collected 318 tweets promising to disclose submitters' personal information. Then, we investigated the relations between the submitters of these 318 tweets and users who gave likes to them. The results of our survey showed that the submitters followed most of the users mutually before the users gave likes to tweets promising to disclose submitters' personal information. On the other hand, most of the users did not follow each other although they followed the same submitters and gave likes to their tweets.

Keywords—personal information; Twitter; SNS; mutual follows; privacy risk; unreal name account user.

I. INTRODUCTION

Nowadays, many people use a Social Networking Service (SNS) to communicate with each other and try to enlarge their circle of friends. SNS users are generally concerned about potential privacy risks [1]. To be specific, they are afraid that unwanted audiences will obtain information about them or their families, such as where they live, work, and play. As a result, SNS users are generally careful in disclosing their personal information. However, some SNS users, especially young users, disclose their personal information on their profiles, for example, real full name, gender, hometown and full date of birth, which can potentially be used to identify details of their real life. In order to discuss the reasons why some SNS users disclose their personal information willingly, it is important to investigate who they want to read their SNS messages disclosing their personal information. However, it is difficult to ask them who they want to read them. To solve this problem, it is important to investigate who gave responses to their SNS messages disclosing their personal information. This is because, if submitters felt unwanted audiences read and gave responses to their SNS messages disclosing their personal information, they would delete them. In order to investigate who gave responses to SNS messages disclosing submitters' personal information, we investigate Twitter users who gave likes to tweets disclosing submitters' personal information. Furthermore, we investigate whether users concerned with a tweet disclosing submitter's personal information followed each other. In other words, we investigate whether

- a submitter followed users who gave likes to his/her tweet disclosing his/her personal information,
- users who gave likes to a tweet disclosing submitter's personal information followed the submitter, and
- each user who gave a like to a tweet disclosing submitter's personal information followed every other user who gave a like to the same tweet.

In this study, we examine these points by checking their Twitter follow relations. The investigation is based on an idea: when an user follow someone on Twitter, he/she is not a stranger to the user. By using the results of the investigation, we discuss the relations of submitters of tweets disclosing their personal information and users who gave likes to the tweets. The results of the investigation might improve social media design elements, such as privacy controls and friend introductions.

The rest of this paper is organized as follows: In Section II, we survey the related works. In Section III, we show how to collect tweets where submitters seemingly disclosed their personal information honestly and detect users who gave likes to them. In Section IV, we examine whether users concerned with a tweet disclosing submitter's personal information followed each other and discuss the relations of them. Finally, in Section V, we present our conclusions.

II. RELATED WORK

Personally identifiable information is defined as information, which can be used to distinguish or trace an individual's identity, such as social security number, biometric records, etc. alone, or when combined with other information that is linkable to a specific individual, such as date and place of birth, mother's maiden name, etc. [2] [3]. Internet users are generally concerned about unwanted audiences obtaining personal information. Fox et al. reported that 86% of Internet users are concerned that unwanted audiences will obtain information about them or their families [1]. However, Internet users, especially young users, tend to disclose personal information on their profiles, for example, real full name, gender, hometown and full date of birth. As a result, many researchers discussed the reasons why young users willingly disclose personal information on their SNS profiles. Acquisti and Gross explained this phenomenon as a disconnection between the users' desire to protect their privacy and their actual behavior [4]. Also, Livingstone pointed out that teenagers' conception of privacy does not match the privacy settings of most SNSs [5]. On the other hand, Barnes argued that Internet users, especially teenagers, are not aware of the nature of the Internet and SNSs [6]. Viseu, Clement, and Aspinnall reported that many online

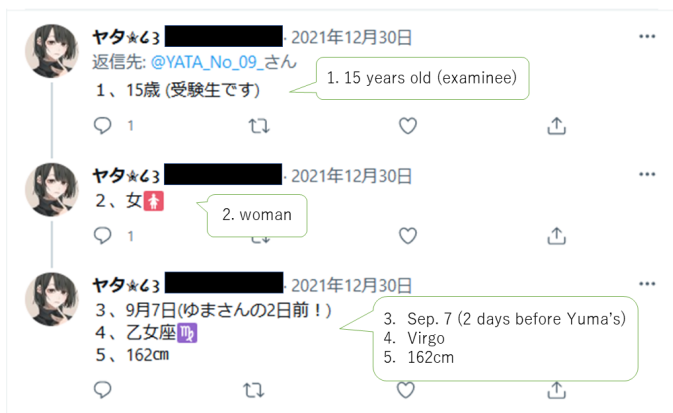
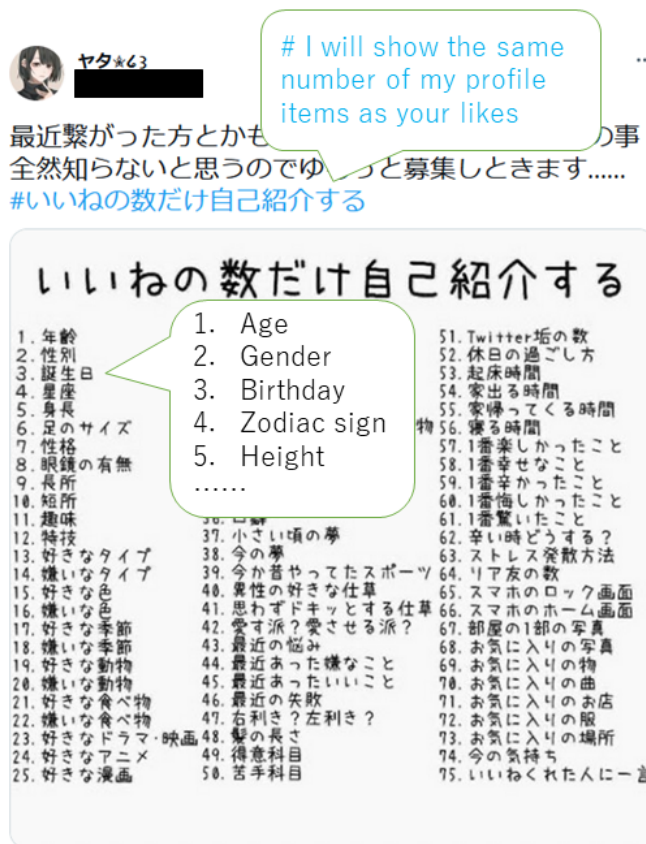


Figure 1. An unreal name account user, Yata, disclosed her personal profile items in her tweets.

users believe the benefits of disclosing personal information in order to use an Internet site is greater than the potential privacy risks [7]. The authors think that most SNS users are seriously concerned about their privacy and security. However, they often underestimate the risk of their online messages and submit them. Hirai reported that many users had troubles in SNSs because they never thought that strangers observed their communication with their friends [8]. Watanabe, Nishimura, Chikuki, Nakajima, and Okada reported that some Twitter users submitted tweets disclosing their personal information that can threaten their privacy and security even if they use unreal name accounts [9]. In this study, we investigate what relations existed between users concerned with a tweet disclosing submitter’s personal information. In order to analyze relations in communities, many researchers have adopted tie strength. Granovetter defined tie strength as the strength of a friendship: close friends are strong ties and acquaintances are weak ties [10]. Both strong ties and weak ties are useful because they provide access to different types of resources [11]. For example, strongly tied peers have greater motivation for assistance and provide access to information known by the group [10]. In contrast, weak ties provide diverse perspectives as well as novel information and resources [12]. Panovich, Miller, and Karger investigated the relation of tie strength to answer quality and showed that social network Q&A is more effective when the asker and answerer know each other well [13]. Gilbert and Karahalios proposed a predictive model of tie strength on Facebook using profile characteristics [14]. In this study, we investigate what relations existed between Twitter users concerned with a tweet disclosing submitter’s personal information by checking their Twitter follow relations.

III. A COLLECTION OF TWEETS DISCLOSING SUBMITTERS’ PERSONAL INFORMATION

It is difficult to collect tweets disclosing submitters’ personal information, such as tweets in Figure 1, directly. To solve this problem, we focused on tweets where submitters promised their audiences to disclose the same number of their own personal profile items as likes to their tweets. Figure 2 shows a tweet submitted by Yata on December 30, 2021. Both in Figure 1 and Figure 2, her screen name is redacted for privacy. Figure 2 shows that Yata promised her audiences to disclose the same number of her personal profile items as likes to her tweet.



午後9:02 · 2021年12月30日 · Twitter for Android

Figure 2. A tweet promising to disclose the same number of submitter’s personal profile items as likes to it.

Actually, as shown in Figure 1, Yata submitted three replies disclosing her five personal profile items to her tweet shown in Figure 2 on December 30, 2021. Watanabe, Nishimura, Chikuki, Nakajima, and Okada reported that Twitter users seemingly disclosed their personal information honestly when they promised to do it, such as Yata’s tweet in Figure 2 [9]. As a result, it is easy to collect tweets disclosing submitters’ personal profile items when we collect tweets promising to disclose submitters’ personal profile items. Furthermore, they often used the same sentence in their tweets, like a game password, as shown in Figure 2, # I will show the same number of my profile items as your likes. In order to collect tweets promising to disclose submitters’ personal profile items, we used the shared sentence as key to collect them. To be specific, we collected these tweets by using Twitter API v2 [15]. Twitter API v2 helps us to collect tweets where the given sentence is used. Also, Twitter API v2 helps us to collect user accounts who submitted a specific tweet and who gave likes to it. Every 10 PM, we tried to collect user accounts and their tweets

- that contained # I will show the same number of my profile items as your likes
- that were submitted in the past 24 hours, and
- that were given one or more likes.

After we obtained the tweets promising to disclose submitters’ personal profile items, we tried to collect user accounts who

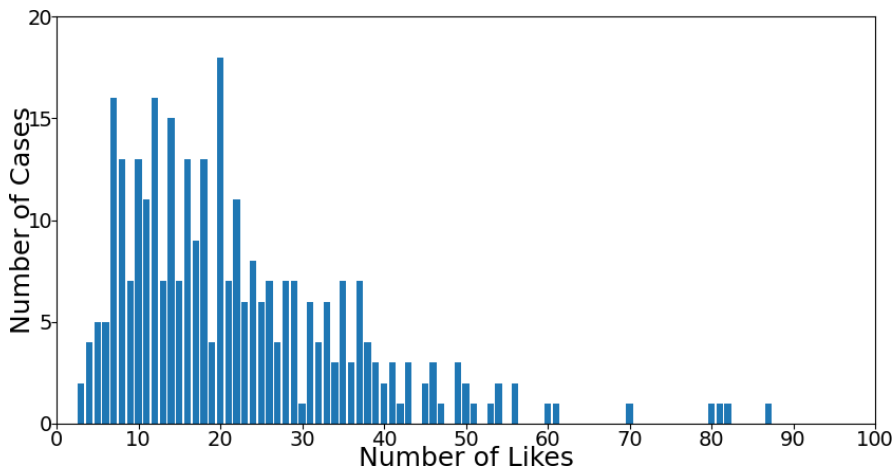


Figure 3. The histogram of the number of likes given to the 318 tweets promising to disclose submitters’ personal information.

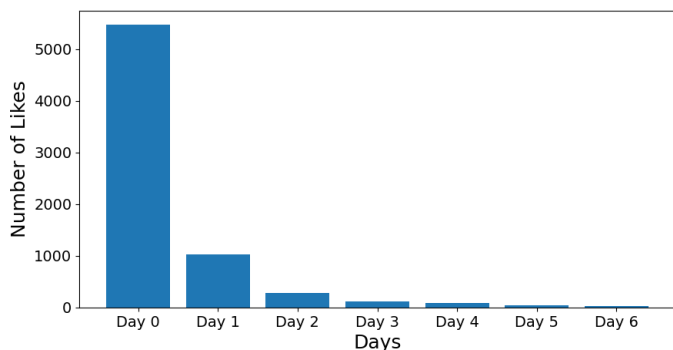


Figure 4. The daily number of likes given to the obtained 318 tweets since the tweets were submitted.

gave likes to the obtained tweets every 10 PM for a week. Finally, we collected 318 Japanese tweets promising to disclose submitters’ personal information. These 318 tweets were submitted from December 30, 2021 to January 31, 2022 by 317 users. One out of the 317 users submitted two tweets promising to disclose his personal information on January 12 and 17, 2022. These 318 tweets were given 7060 likes by 6325 users within a week after they were submitted. Figure 3 shows the histogram of the number of likes given to the obtained 318 tweets promising to disclose submitters’ personal information. Figure 4 shows the daily number of likes given to the obtained 318 tweets in the investigation period. Day N in Figure 4 means that N days have passed since the obtained tweet was submitted and our investigation started. Day 6 was the last day of the investigation period. Figure 4 shows that 77 % of likes were given on Day 0. 30 tweets out of the 318 tweets were deleted within a week after they were submitted.

IV. AN ANALYSIS OF TWEETS DISCLOSING SUBMITTERS’ PERSONAL INFORMATION

In this section, we investigate whether users concerned with a tweet disclosing submitter’s personal information followed each other. To be specific, we survey

- Twitter users who submitted tweets promising to disclose the same number of their own personal profile

- items as likes and
- Twitter users who gave likes to these tweets and investigate
- whether an user who submitted a tweet promising to disclose his/her personal information followed users who gave likes to the tweet,
- whether users who gave likes to a tweet promising to disclose submitter’s personal information followed the submitter, and
- whether users who gave likes to a tweet promising to disclose submitter’s personal information followed each other.

The investigation is based on an idea: when an user follow someone on Twitter, he/she is not a stranger to the user. We can know whether an user follows someone on Twitter by using Twitter API v2.

After collecting user accounts of submitters and users who gave likes to submitters’ tweets, we analyze the relations between them. The relations between a submitter and an user who gave a like to submitter’s tweet can be classified into three types:

- mutual follow relation: The submitter and the user mutually followed each other.
- one sided follow relation: The submitter followed the user, however, the user did not. Or, the user followed the submitter, however, the submitter did not.
- no follow relation: The submitter and the user did not follow each other.

Furthermore, we analyze the relations among users who gave likes to submitter’s tweet. They can also be classified into three types: mutual follow relation, on sided follow relation, or no follow relation.

Let us consider one example. As shown in Figure 2, a Twitter user, *Yata*, submitted a tweet promising her audiences to disclose the same number of her own personal profile items as likes on December 30, 2021 at 9:02 PM. We detected her tweet on the same day at 10:00 PM, and then, recorded that she received five likes and submitted three replies disclosing

her five personal profile items on December 30, 2021. After that, every 10 PM, we tried to check whether someone gave likes to her tweet. On January 5, 2022, we confirmed that five users gave five likes to her tweet on December 30, 2021, as shown in Figure 2, and finished the investigation on her tweet. Then, we analyzed the relations between *Yata* and each of the five users and confirmed that she followed them and each of them followed her. As a result, the relations between *Yata* and each of the five users were mutual follow relations. Furthermore, we analyzed the relations among the five users. There were ten cases to choose two out of the five users. In one case out of the ten, two users followed each other. On the other hand, in nine cases out of the ten, two users did not follow each other. As a result, the relation of one case was a mutual follow relation and the relations of the other nine cases were no follow relations.

A. Follow relations between submitters and users who gave likes to submitters' tweets

At first, we discuss the mutual follow relations between submitters and users who gave likes to submitters' tweets. In order to discuss this problem, we introduce the ratio of mutual follow relations between a submitter and users who gave likes to his/her tweet. Suppose that the number of users who gave likes to tweet t is n and m of them are mutually following the submitter of tweet t . Then, the ratio of mutual follow relations between the submitter of tweet t and the users who gave likes to it, $P_{MF1}(t)$, is defined as follows:

$$P_{MF1}(t) = \frac{m}{n}$$

Figure 5 shows the distribution of the ratio of mutual follow relations between the submitters of the obtained 318 tweets and the users who gave likes to them. Furthermore, Figure 5 (a) and (b) shows the distribution of them investigated on the Day 0 and Day 6, respectively. As shown in Figure 5, it is probable that most of the users have followed the submitters mutually before they gave likes to submitters' tweets promising to disclose their personal information. In other words, the submitters and most of the users were not strangers to each other. The distribution of the mutual relation ratio on Day 6 (Figure 5 (b)) moved to the left than that on Day 0 (Figure 5 (a)). It showed that the number of users who did not follow the submitters and whom the submitters did not follow increased. It is probable that submitters were careful to follow unfamiliar users even if they gave likes to their tweets.

Next, we discuss the no follow relations between submitters and users who gave likes to submitters' tweets. In order to discuss this problem, we introduce the ratio of no follow relations between a submitter and users who gave likes to his/her tweet. Suppose that the number of users who gave likes to tweet t is n and l of them are not following the submitter of tweet t and the submitter is not following them, too. Then, the ratio of no follow relations between the submitter of tweet t and the users who gave likes to it, $P_{NF1}(t)$, is defined as follows:

$$P_{NF1}(t) = \frac{l}{n}$$

Figure 6 shows the distribution of the ratio of no follow relations between the submitters of the obtained 318 tweets and the users who gave likes to them. Figure 6 shows that the number of users who had the no follow relations with the

submitters was small on Day 0 and increased after Day 1. It is probable that the delays were caused by the time it took to find tweets disclosing submitters' personal information.

B. Follow relations among users who gave likes to submitters' tweets

At first, we discuss the mutual follow relations among users who gave likes to submitters' tweets. In order to discuss this problem, we introduce the ratio of mutual follow relations among users who gave likes to a tweet. Suppose that the number of users who gave likes to tweet t is n and there are m cases where two users of them are following each other. Then, the ratio of mutual follow relations among the users who gave likes to tweet t , $P_{MF2}(t)$, is defined as follows:

$$P_{MF2}(t) = \frac{m}{n(n-1)/2}$$

Figure 7 shows the distribution of the ratio of mutual follow relations among the users who gave likes to the obtained 318 tweets. Figure 7 shows that it is probable that most of the users did not follow each other mutually. In other words, most of the users were strangers to each other although they followed the same submitters and gave likes to their tweets.

Next, we discuss the no follow relations among users who gave likes to submitters' tweets. In order to discuss this problem, we introduce the ratio of no follow relations among users who gave likes to a tweet. Suppose that the number of users who gave likes to tweet t is n and there are l cases where two users of them are not following each other. Then, the ratio of no follow relations among the users who gave likes to tweet t , $P_{NF2}(t)$, is defined as follows:

$$P_{NF2}(t) = \frac{l}{n(n-1)/2}$$

Figure 8 shows the distribution of the ratio of no follow relations among the users who gave likes to the obtained 318 tweets. The distribution of the no relation ratio on Day 6 (Figure 8 (b)) was similar to that on Day 0 (Figure 8 (a)). It showed that it is probable that not many users started to follow users within a week even if they gave likes to the same tweets. It is probable that users were careful to follow unfamiliar users even if they gave likes to the same tweets.

V. CONCLUSION

In this paper, we investigated the relations of submitters of tweets promising to disclose their personal information and users who gave likes to the tweets. The results of our investigation show that most of the users had followed the submitters mutually before they gave likes to submitters' tweets promising to disclose their personal information. On the other hand, most of the users did not follow each other although they followed the same submitters and gave likes to their tweets. As time went on, the number of users who gave likes to submitters' tweets but did not follow the submitters and whom the submitters did not follow increased. It is probable that submitters were careful to follow unfamiliar users even if they gave likes to their tweets. Also, users were careful to follow unfamiliar users even if they followed the same submitters and gave likes to the same tweets. The system that understands these relations might carefully treat users who choose not to friend someone with good reasons.

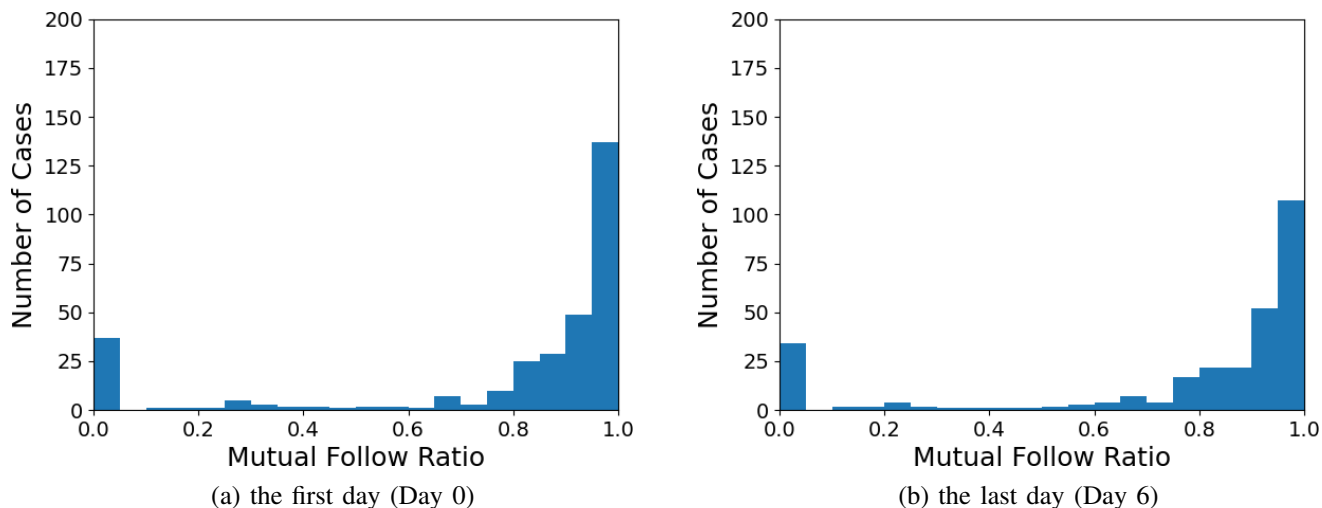


Figure 5. The histograms of the ratio of mutual follow relations between the submitters of the obtained 318 tweets and the users who gave likes to them on the first day (Day 0) and the last day (Day 6) of the investigation period.

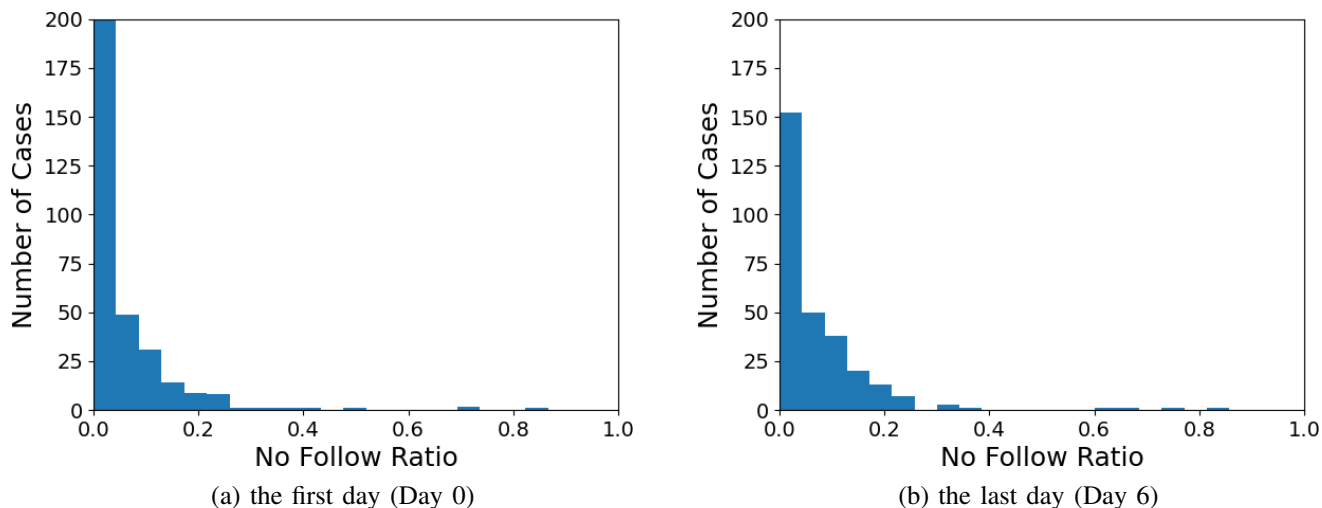


Figure 6. The histograms of the ratio of no follow relations between the submitters of the obtained 318 tweets and the users who gave likes to them on the first day (Day 0) and the last day (Day 6) of our observation.

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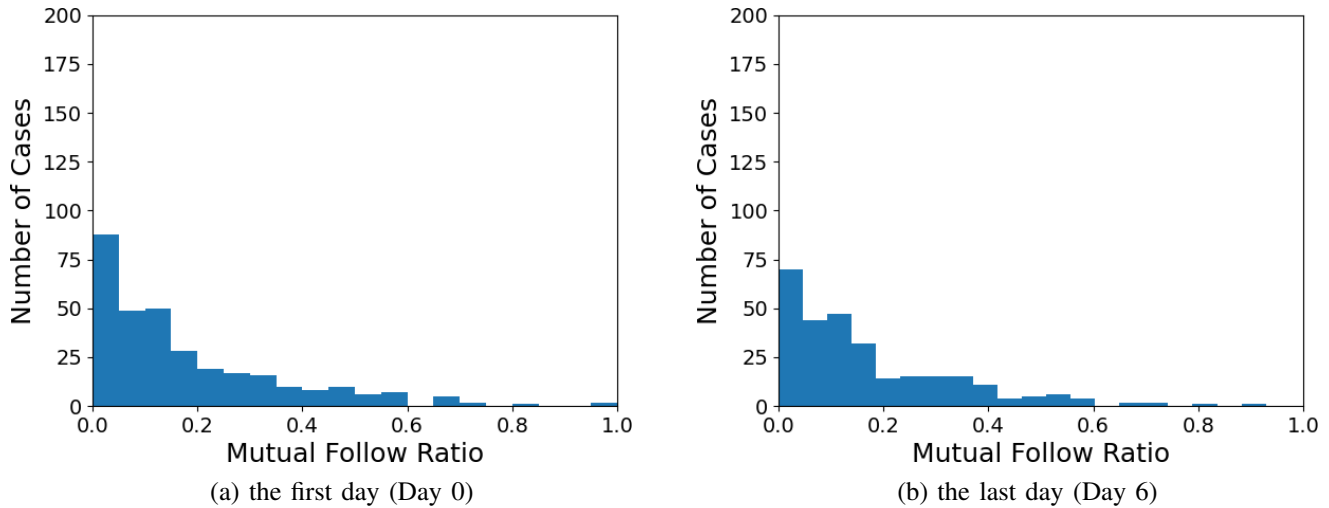


Figure 7. The histograms of the ratio of mutual follow relations among the users who gave likes to the obtained 318 tweets on the first day (Day 0) and the last day (Day 6) of our observation.

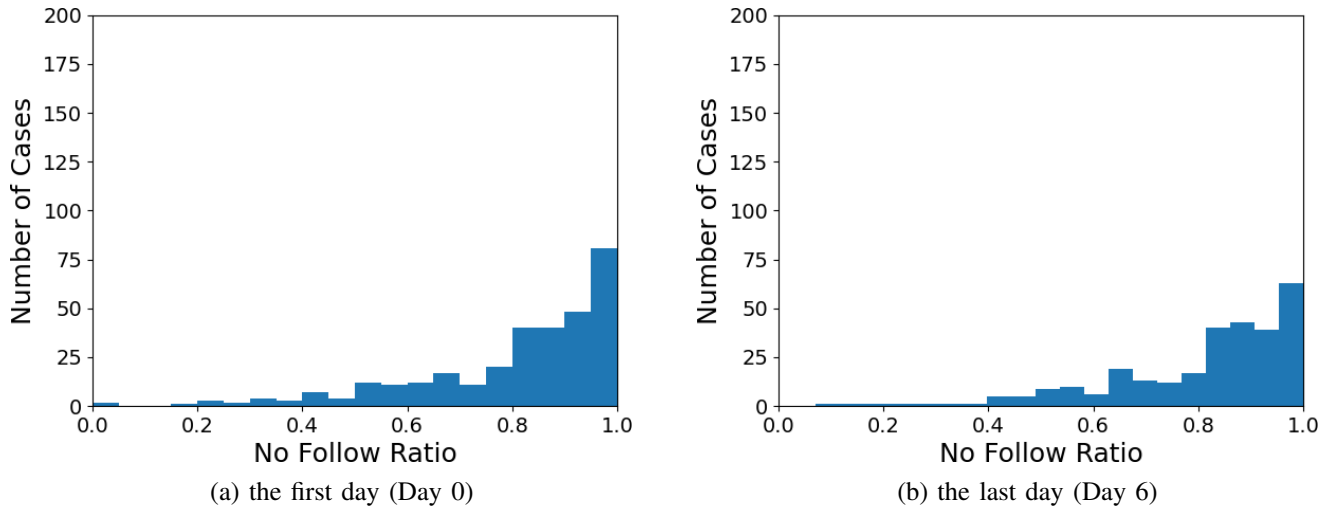


Figure 8. The histograms of the ratio of no follow relations among the users who gave likes to the obtained 318 tweets on the first day (Day 0) and the last day (Day 6) of our observation.

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Extracting and Visualizing Narratives from Social Video Sharing Platforms

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Abstract—Social video sharing platforms are intended to allow users to associate with similar people to share their beliefs and encourage democracy. Nevertheless, deviant actors have used them to subvert the system. Deviant groups collaborate on digital platforms to propagate fake news, misinformation, and disinformation because of anonymity and perceived lower individual risk. Agenda setting, content framing, and weaponizing narratives are strategically employed to radicalize mobs and cause hysteria on uncontrolled social video sharing platforms, such as YouTube, which give a richer space for content development. Recent events and protests orchestrated via those platforms highlight the essential need for systems that can detect these fringe ideologies from the start. In this work, we show how to use a narrative visualization tool to help analysts find major topics and related narratives. The tool is based on a previously released framework for extracting narratives from video posts and is open to the public.

Keywords—narrative visualizations; narrative; social video platforms; narrative extraction.

I. INTRODUCTION

YouTube, being the largest video sharing platform, not only enables its users to collaborate and share; it also serves as a treasure trove of data to study user behaviors. However, the recent infodemic of fake news on social media platforms has spread to YouTube as well. Rogue crowds are raising their presence within such online communities, spreading fake narratives by exploiting the ability to hide their identities with a low chance of being discovered. Their goals are to stir up, change, and divide people. For instance, with the latest COVID-19 pandemic, frauds, false information, and conspiracy theories have increased dramatically [3]. False information is spreading like the pandemic, therefore, it was named infodemic or misinfodemic [8]. Since those fringe narratives arise within dark web communities and spread to mainstream media, tracking those false narratives is harder than watching the growth of the pandemic. Unfortunately, we cannot “lockdown” or deactivate the internet to stem the infodemic. We need to actively track misinformation while it evolves, by establishing opposing courses of action to rapidly halt the damage to our communities within those video sharing websites.

However, to be able to analyze those false narratives precisely and create opposing courses of action, we would need algorithms that have efficient narrative extraction abilities and visualizations that are engaging to help analysts deeply navigate through them. While many studies have focused on extracting narratives from a collection of text documents [4] [11], only few have developed visualizations that would increase user engagement. This paper proposes a solution

by developing a narrative visualization tool that enables its users to analyze narratives from video titles, descriptions, and transcripts visually. The tool extracts narratives leveraging our published research [1] [10] on narrative extraction and is integrated with the Vtracker [17] application, providing users a tree-like structure to visualize narratives anchored around prominent keywords or keywords of interest. The tool allows users to provide feedback, thereby helping to improve the narrative extraction approach. The proposed tool is scalable, language-agnostic, and adaptive to other narrative extraction approaches. It further offers several customizations, discussed in Section 4, to improve the overall user experience.

In the next part of the paper, Section 2, addresses the literature related to narrative extraction and visualization. In Section 3, the narrative extraction framework is discussed. In Section 4, the developed narrative visualization tool is explained in detail. In Section 5, we examine a case study and derive our findings. In Section 6, we explore the challenges and limitations of the proposed visualization. Finally, in Section 7, we state our plans for the future and conclude.

II. LITERATURE REVIEW

Narrative is defined as “a spoken or written account of connected events”, researchers have conducted several studies to visualize and analyze those narratives to help discover interesting themes. In the next subsections, we summarize a few of those studies and try to draw conclusions on their findings:

A. Narrative Extraction

Venugopalan et al. [16], Sah et al. [15], and Wang et al. [18] from their studies have all proposed different approach to address the common problem of translating videos to sentences using a unified deep neural network. Venugopalan et al. [16] proposed a solution to narrow down (extract) the important actions, subject and object (e.g. a person playing a guitar video then the object would be guitar) of the video and incorporating neural networks throughout the pipeline of those actions, from pixels to phrases (words), which enables model network training and tuning. Sah et al. [15] approach for translating videos to sentences differed a bit from Venugopalan et al. [16] the approach was to summarize videos and then annotate it. The summarization of video was first done by capturing the frame-to-frame movement of the video and capturing the cinematography all blended in an innovative method to create a summary from lengthy recordings. The approach involves use of method which is Recurrent Neural Network

(RNN) (Method that involves sequences of frames) to capture the summary of the video and use the SumBasic(Method to generate text summaries) to summarize the textual annotations. Another study in the same field by Estevam et al. [5] demonstrated how to improve performance on the dense video captioning problem by not only utilizing visuals of the video but also take cues from the audio. The model created showed how audio and speech modalities may improve a dense video captioning model. Independent studies have shown the effectiveness of both super frame cuts and key frame selection models. The major difficulty faced by different models was creating the textual summary. Hosseinzadeh et al. [7] in his model performed two tasks at the same time: anticipatory captioning (to forecast the future outcome) and video description development (to create the text summary).

The model by Venugopalan et al. [16] have demonstrated the approach to generate sentences by first predicting a semantic role representation i.e. high-level concepts such as the actor, action and object. Then to use a template or statistical machine translation to translate the semantic representation to a sentence. This strategy creates superior sentences and additionally, it provides insights that utilizes deep neural network models that automatically generate descriptions for images. The framework developed by Wang et al. [18] works on an end-to-end Dense Video Captioning Framework with Parallel Decoding (PDVC), which approaches dense video captioning by segmenting the video precisely into a lot of event pieces. Without requiring a dense-to-sparse proposal generation and selection phase, PDVC generates a set of temporally localized sentences directly based on the segmented video and makes the two sub-tasks deeply interrelated and mutually promoted through the optimization and considerably simplifying the conventional “localize-then-describe”(create and store the object and use it as reference) process. The objective of Hosseinzadeh et al. [7] is to build a statement that expresses the film’s likely future event. It tackles the problem by first anticipating the next event in the semantic space of convolutional features, combining contextual information into those features, and then forwarding them to a captioning module. The framework works by studying the sequence of historical frames in Red, Green, and Blue (RGB) space; i.e., each pixel is broken down into to RGB color code format and it predicts the next frame(s) in RGB space. For example, a javelin throw will have an event of the javelin traveling in projectile motion. So, the model can forecast the frames and develop the description. Chen et al. [2] proposed a unified caption architecture that extracts unsupervised multimodal topics from data and feeds them into the caption decoder. Multimodal themes that have been mined are more semantically and visually cohesive than pre-defined subjects and can more accurately mimic the distribution of video topics. It helped in better content understanding in deep multimodal applications. The proposed model can be used to predict the latent topics of videos and then generate topic-oriented video descriptions with the topic guidance jointly in an end-to-end manner. Iashin et al. [12] tried to tackle the problem of video understanding by combining a multi-headed

proposal generator with a bi-modal transformer that was unique. The captioning module was influenced by transformer architecture, notably how the attention module combines the information from both sequences. Each proposal head in the bi-modal multi-headed proposal generator is inspired by You Only Look Once (YOLO), a very efficient object detector. Estevam et al. [5] presented a technique for unsupervised semantic visual information learning that is based on the notion that complex events (e.g., minutes) can be deconstructed into smaller events (e.g., a few seconds) and that these simple events are shared across several complicated events. Using a clustering approach like K-means clustering, they recover their latent representation from a long movie divided into short frame sequences. As a result, a visual codebook is created (i.e., a long video is represented by a sequence of integers given by the cluster labels).

B. Narrative Visualization

Storytelling has a long list of merits that profit its recipients; it helps them memorize the information, relate to the content, and improve their comprehension. We live in an open data world that is huge and complicated and there is a need to integrate storytelling into visualizations to spread that information effectively. After reviewing the literature related to the subject, we have identified two main themes. The first theme is a group of studies that surveyed existing visualizations for factors affecting our comprehension of a narrative visualization. Figueiras [6] addressed the problem by conducting a focus group of 16 individuals to investigate the most effective narrative elements utilized in a collection of 11 professionally produced visualizations hosted over the web. Additional information about the focus group’s likability, comprehension, and navigation preferences for each visualization was also collected. The results of the investigation led the authors to consider introducing the narrative elements of: context, empathy, and time to enhance the previously mentioned visualizations. Context helps users get a better grasp of the data. Temporal structure, can enhance users feelings about the story flow. Empathy helps in memorization and joy.

Another study by Segel et al. [14] considered a review of the current design methodologies used by online story writers like journalists to build advanced data visualization systems that enhance traditional storytelling. In some cases, a whole story can be replaced with a visualization. Several case studies related to media outlets and data visualization research were examined to recognize the different types of narrative visualization, and how factors like interactivity and narrative flow can affect readers’ perception of the story. After researching several visualizations, the authors proposed their own set of procedures, to be followed by journalists and educational media to design promising narrative visualizations.

The aforementioned studies lacked several aspects like a wider user base for testing, additional research on other types of visualizations, and investigating other effective storytelling elements. There is a need to do extra investigation of author

vs reader-driven elements. Author-driven components provide information and structure, while reader-driven components enable interactivity and exploration.

On the other hand, the second theme consists of a different group of studies dealt with the extraction and visualization of entities and their narratives from text. Hussain et al. [9] used the Latent Dirichlet Allocation (LDA) model to extract topics from prominent entities. They showed how to use a narrative visualization tool to help analysts identify important themes and linked narratives. The technology is available for public use through the Vtracker tool [17].

Kanjirang et al. [13] discussed how machine learning techniques can be utilized to help automate the creation of visual summarizations of any given narrative text. They mentioned several techniques used to achieve the required results, for instance, natural language processing tools were used to recognize named entities, Density-based Spatial Clustering of Applications with Noise (DBSCAN) a clustering algorithm was used to investigate characters and their aliases, a statistical analysis technique was used to detect the relationships between some of the important characters, and an undirected graph was used to visualize those characters and their relationships as nodes and edges. Finally, special sentiment analysis techniques were used to calculate sentiments to decide the colors for those characters, nodes and their relationships. According to the authors, the machine learning techniques they used proved to be having a deeper depiction of a given novel, and a case study of a series of books was conducted to prove their theory.

Both of the above narrative visualizations need further user testing to evaluate their success in providing analysts with the proper visual elements to understand the narratives. Another issue is related to the accuracy of the proposed grammar rules. They can be improved to make them less biased and work for complicated sentences. Finally, it is worth mentioning that we did not find literature that completely relates to the work we are conducting for narrative extraction and visualization from social video posts.

III. RESEARCH METHODOLOGY

Using our formerly published approach here, [1] (see Figure 1), we begin by extracting narratives from a set of videos using their title, transcript, and accompanying description. To achieve that, we obtain the names of notable personalities or locations from the videos and then center our attention on discourses related to them. We do that by extracting named entities and calculating their rankings based on their importance using document frequencies within the list of videos. After that, a mixture of the resulting list of named entities and videos is fed into a network topic modeling module to discover topics connected to those extracted entities.

In addition to recognizing topics exclusive to specific entities, the network topic modeling module assists in spotting overlapping topics. For instance, after examining the latest world events, we can recognize multiple rising entities like Putin's war, and inflation. There are topics exclusive to Putin's war like nuclear attack, defending Europe, war

crimes, and any misinformation related to that event. On the other hand, inflation has unique topics like the economic recovery, Biden's family inflation shield, interest rates, etc. Meanwhile, intersecting topics may include Putin's war effect on inflation and how oil and gas prices are going higher, as well as, disinformation concerning those two prominent entities. The overlapping of topics allows a closer look into the investigation and can help improve analysis.

After extracting a specific number of topics for each entity, we can now adjust the accuracy of the LDA model to get the proper number of topics. We find the optimal number of topics by computing a range of topics (10 to 100) and picking the model with the highest coherence score. The LDA model has two main variables that we can modify, the log-likelihood, and beta. Topic distributions - over documents and words, have correspondent priors in LDA, which are often indicated with alpha and beta and are denoted as hyper-parameters because they represent the parameters of the prior distributions. The log-likelihood for any dataset is computed for every repetition that includes topics like 1, 5, 10, 25, 50, and so on. In an ideal world, the LDA model is supposed to improve data analysis in every iteration over time. As successive iterations make minor changes to the model, this value will ultimately normalize. Low beta values, conversely, emphasize that each of the topics should have only a small number of prominent words. As a result, combining these hyper-parameters aids in selecting the number of themes.

When the topics are extracted from the discovered named entities, we reduce the size of the video postings to the most prominent contributors according to their distributions within those topics. Then, out of these video posts, we extract the sentences that reference the entity connected to the topic. After that, we extract noun phrases and verb phrases utilizing Natural Language Processing (NLP) methods like Part of Speech (POS) tagging, and chunking. Later, we extract narratives by defining grammar rules that catch empirically recognized patterns. Lastly, for each entity we combine narratives according to their resemblance, and rank those narratives based on how prevalent they are in the dataset. We only explored English video posts in this study. But, we are planning to use our methods on non-English text too, and see how effective it will be.

IV. NARRATIVE VISUALIZATION

After extracting the narratives from video titles, descriptions, and transcripts, they are represented visually by the Vtracker narrative visualization tool [17] (see Figure 2). The proposed narrative visualization tool enlists important entities in a column view of keywords, where each keyword has narratives related to it. The aim of the column layout is to enhance user experience by hiding data complexity and enabling users to center their attention on one keyword or group of keywords per time. For instance, if a user wants to explore which narratives belong to a specific keyword, they would select that keyword to show all the narratives related to it. At that point, they can also select a particular narrative

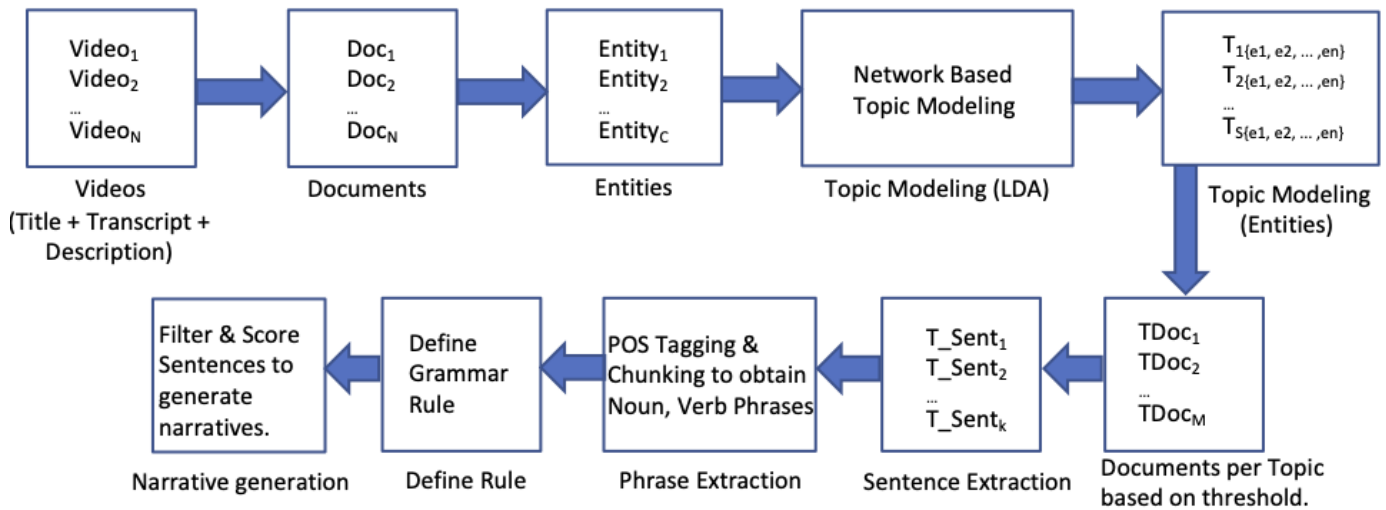


Figure 1. Framework to extract narratives from videos (Title, Transcript, and Description).

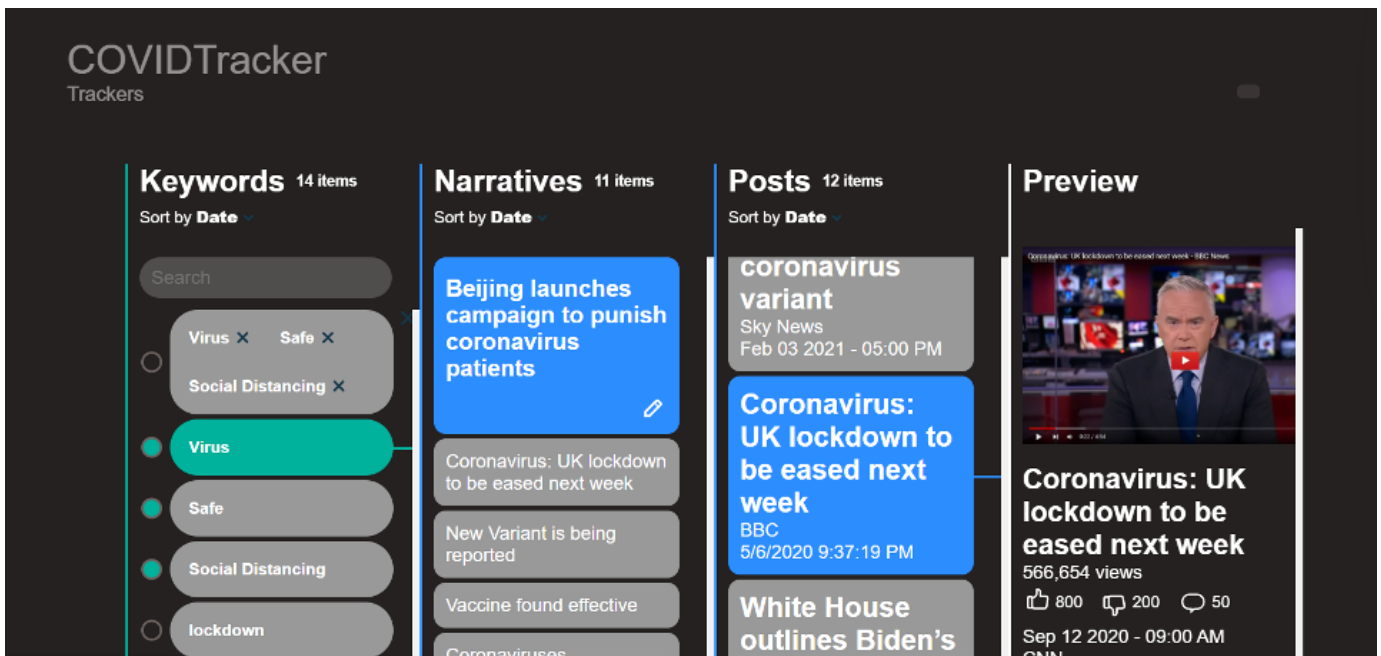


Figure 2. Narrative visualization tool in Vtracker application, showing multiple selected keywords to be combined into a collection to assist in spotting overlapping topics.

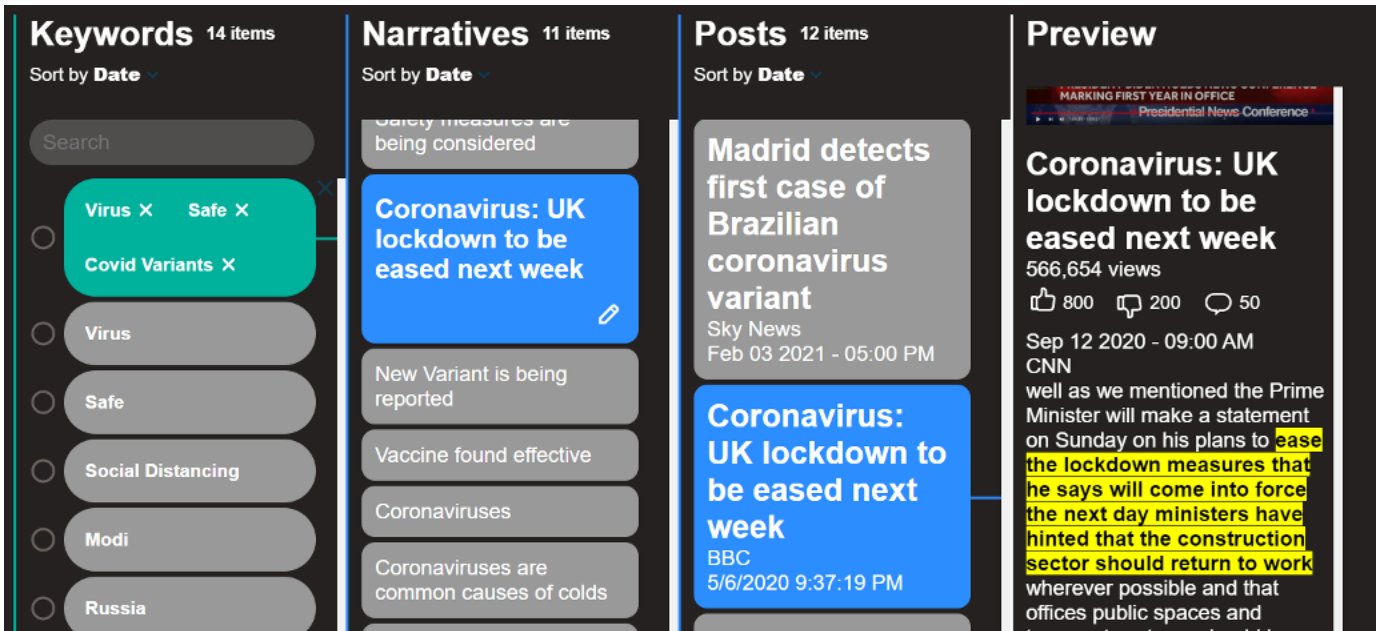


Figure 3. Narrative visualization tool showing a collection of keywords being selected to reveal its top associated narratives.

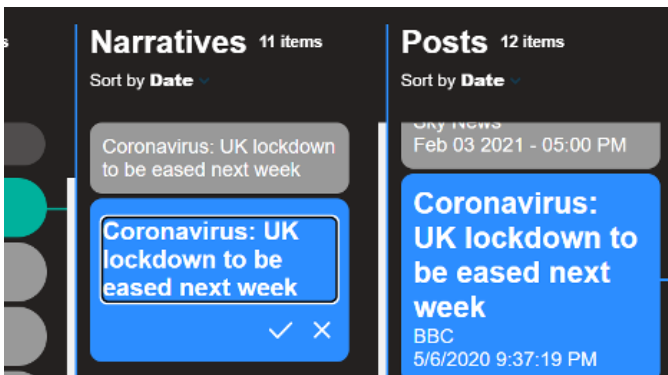


Figure 4. Narrative visualization tool showing capability for a user to edit a narrative.

to list its related videos. The video can also be clicked to show its title, description, and transcript, if any. The tool also highlights where narratives have been referred to within the selected video data.

In addition to that, the Vtracker narrative visualization tool enhances user investigative powers by providing them with the ability to customize, search, and add new keywords. The tool will continually show all related keywords each time a user utilizes the search box. Once an item is selected from the search box drop-down list, it is added to the list of keywords that are being analyzed. Users can also investigate overlapping narratives that appear within multiple keywords by grouping them together, then selecting that group to view the related narratives. That can be done by enabling edit mode within the narrative visualization tool. In that mode the keywords list becomes editable where each keyword can be selected and

combined to form groups of subjects. Groups can be deleted, and keywords can be removed from within a group (see Figure 3). Overlapping topics allows extracting compound narratives and keyword mixing.

User feedback can also be provided to improve the narrative extraction algorithm being used by the tool (see Figure 4). Users can edit a specific narrative and provide it as a suggestion for moderators to review and advance the extraction method. Additionally, the visualization tool is adaptive to change, the narrative extraction algorithm can be easily updated with any other future approach. Furthermore, the extracted narratives are pre-calculated and stored within the database, which makes the tool scalable to huge video sharing data sets.

Lastly, the visualization tool is coded with intense, lively, and vivid colors, where every color plays a specific role in enhancing user engagement. For instance, keywords were given a green color. Blue was used to represent narratives and videos. Whereas, yellow was used to highlight narratives within a video description to show its occurrence within the text.

V. FINDINGS

For our initial analysis, we had considered YouTube videos spanning from May to December of 2020 and extracted various narratives from those videos using topic modeling. COVID-19 was one of the most prominent entities, and the most dominant narratives were related to the control measures taken by the various nations to control the pandemic. For instance, the narratives related to easing of lockdown in the UK captured the keywords like “new scheme”, “the economic cost”, “hopefully”, “safe” leading us to conclude that the

government of the UK is trying to ease the ongoing lockdown to minimize the further economic loss and are hopeful it will be safe. In contrast, we can find the negative narratives regarding steps taken by the Chinese government with the extraction of words like “Chinese”, “targeting”, “patients”, “leader” leading us to the narrative extracted that Beijing has launched a campaign to punish coronavirus patients. These are the narratives that escalated in May of 2020 while there were videos leaking in the media of Chinese police dragging people out of their homes. “Social distancing”, “Lockdown”, “economy”, etc. are some of the overlapping keywords found while looking for COVID-related videos.

VI. CHALLENGES AND LIMITATIONS

Although the narrative visualization tool in the presentation accurately recognizes narratives, the narrative extraction algorithm used in the above-mentioned technology has severe challenges and limitations. The application deals with large amounts of data, which is one of the major issues, as is integrating data from many sources. Because it is based on subject-based and empirical findings, the grammar rule needs to be updated. Because of the complexity of sentences and the language barrier, as well as many noun and verb phrase patterns, chunking may be a critical component of this framework, resulting in the rule’s failure. To be more effective, the narrative extraction algorithm must be enhanced. For example, it may have restrictions owing to the kind of words or phrases that the narrative library is exposed to, as well as translation and inference of what the video or blog is saying. It needs a particular level of precision to achieve it.

While narrative visualization allows analysts to customize it to help them identify narratives related to their keyword(s) of interest, it does have certain limitations. Furthermore, this type of research is prone to subjective bias, which must be avoided. Consequently, the proposed framework may be tested against several different research datasets. The various narratives that have been generated may not be completely true, but they can aid analysts in understanding. The only people that tested the User Interface (UI) were analysts and developers who were already familiar with the video tracker team. The usability of the user interface should be evaluated by a larger audience.

VII. CONCLUSION AND FUTURE WORK

The trend of using video-sharing social media platforms like YouTube is growing rapidly to share fake narratives. So, the advantage of using such a tool lies in its ability to extract those narratives from videos to identify the extreme and fringe ones being spread. This paper demonstrates that tool and its potency to identify videos with similar narratives which can be clustered to spot the channels, which can be helpful for the authorities to control circulation. The tool is based on the previously published narrative extraction algorithm [10] and has inherited the same level of accuracy, independence, and scalability but also it struggles to handle complex sentences and form grammatically correct sentences. However, the tool itself is independent of algorithms and can be adopted to better

narrative extraction algorithms in the future. Also, it helps to collect user feedback as the tool lets users edit and save the extracted narratives.

Although the narrative visualization tool can extract simple and compound narratives, we are working to improve the extraction algorithm by making it faster, accurate, and platform-independent. Furthermore, we are also planning to include features to track and visualize the evolution of narratives to identify their origins as well as prominent events after which narratives evolve by merging, splitting, or even completely flipping, as observed in our previous study [9]. This can also help to detect intervals where a fringe narrative becomes dominant and vice versa.

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