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Social Media: An Exploratory Study of Information, Misinformation, Disinformation, and Malinformation

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***Abstract* – The widespread use of social media all around the globe has affected the way of life in all aspects, not only for individuals but for businesses as well. Businesses share their upcoming events, reveal their products, and advertise to their potential customers, where individuals use social media to stay connected with their social circles, get updates and news from social media pages of news agencies, and update their information regarding the latest activities, businesses, economy, events, politics, trends, and about their area of interest. According to Statista, there were 4.59 billion users of social media worldwide in 2022 and expected to grow up to 5.85 billion in the year 2027. With its massive user base, social media does not only generate useful information for businesses and individuals, but at the same time, it also creates an abundance of misinformation and disinformation as well as malinformation to acquire social-political or business agendas. Individuals tend to share social media posts without checking the authenticity of the information they are sharing, which results in posts having misinformation, disinformation, or malinformation becoming viral around the world in a matter of minutes. Identifying misinformation, disinformation, and malinformation has become a prominent problem associated with social media.**

***Keywords* – Disinformation, information, information life cycle, malinformation, misinformation, social media.**

I. Introduction

Researchers in [1] explain social media as an Internet-based platform that offers communication facilities for masses for interaction and mainly drives their value from content generated by its user base. Nguyen [2] defined social media as an idea of an extensive grid of websites and applications that provide a platform for its users to instantly share a particular piece of information they want to share and to communicate and interact with others. The author, C. Fuchs, explains social media, in his book "Social Media: A Critical Introduction" [3], as a term having multi-dimensional meanings. It can be a tool for communication, collaboration, content sharing, or community building.

In today's modern era, social media profoundly has its effects on the masses. Gathering information from social media platforms during natural disasters, catastrophes and emergency is common not only among the general public but also among news agencies and even within government organisations as well [4]–[6]. Moreover, a real-time tornado warning system was created using publicly available information on social media [7]. The tornado warning system and any other related system, in general, cannot function efficiently if the available information on social media platforms is misinformation or disinformation, or mal-information. The research in [8] argued that the availability and accessibility of social media eased the generation and propagation of misinformation in form of rumours, spam, and fake. As social media has a huge impact on its users, any information or misinformation shared can affect public mindset and actions with grave consequences for the consumers of the shared information [9]. Dictonary.com in the year 2018 announced "Misinformation" as their Word of the year and asserted that the widespread propagation of misinformation was a new threat to all. In the accompanying video with the article, Ed Wasserman, Dean of Graduate School of Journalism at UV Berkeley, said that "The weaponization of falsity is something that we will probably, in retrospect, look back on this moment as a defining feature" [10]. Now the question arises what are the definitions of these terms, i.e., information, misinformation, disinformation, and malinformation, and how one can differentiate between these terms?

A. Information

Merriam Webster's dictionary defined information as "the communication or reception of knowledge or intelligence" [11]. Whereas the Britannica Dictionary describes the information as knowledge about any noun [12]. Information is the processed form of data and has characteristics as Table I below [13].

B. Misinformation

Researchers in [8] describe misinformation as an incorrect or inaccurate piece of information that is knowingly generated and exculpatory spread. The reputed news firm Business Insider explains misinformation as malicious information that is created to deceive its audience, but the person sharing such information is not sharing it on purpose [14] and believing it to be true. United Nations Educational, Scientific, and Cultural Organization (UNESCO) describes misinformation as a piece of false information, but not shared to cause any harm [15].

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C. Disinformation

Disinformation also denotes wrong information which is often distinguished from misinformation by the means of intent involved to deceive the viewer of the spread of information [8]. In simple terms, disinformation is intentional or on-purpose misinformation. UNESCO explains disinformation as information that is not only false but deliberately propagated to harm a person, social group, organisation, or country [15].

TABLE I
CHARACTERISTICS OF INFORMATION

Accurate	Must be correct and without any errors
Accessible	Accessible to authorized users/persons whenever required
Complete	Must be complete without any inconsistency or ambiguity
Economical	In terms of both time and cost
Formatted	Should be available in the desired format
Flexible	Easy to use for different purposes
Reliable	Dependable, generated using correct and complete data
Relevant	Relevant, can be used by the right person and the right organisation
Secure	Accessible to authorized users/persons only
Simple	Easily understandable and usable
Timely	Available when it should be required
Verifiable	Should have means to cross-check

European Commission's report, "A Multi-Dimensional Approach to Disinformation", defines disinformation as "includes all forms of false, inaccurate, or misleading information designed, presented and promoted to intentionally cause public harm or for profit" [16].

D. Malinformation

There is yet another type of true and correct information and it is based on reality and used to inflict harm on a person, group, organisation, or country as described in UNESCO's report on Journalism and Fake News [15]. Table II below shows information types along with their nature and intent.

TABLE II
INFORMATION TYPE, NATURE, AND INTENT

Type	Nature	Intent of Harm
Misinformation	False	False
Disinformation	False	True
Malinformation	True	True

This paper consists of four parts. The introduction presents the basic overview of the subject, the second part – the literature review – compiles work done by the researcher so far on this subject, the third section covers the way forward, and, finally, the last section of this paper presents discussion and future research area.

II. LITERATURE REVIEW

According to [8], 33 % of American adults use social media to read news and 20 % of them do it on a regular basis. The researchers argued that the open and timeliness nature of social media opens the doors for speculation, rumours, spam, and misinformation. The researchers defined misinformation as the thoughtful spread of fake news, which may be part of intentional propaganda [8]. Statista's graph shows the social media user base from the year 2017 to 2027 as shown in Fig. 1 below [17].

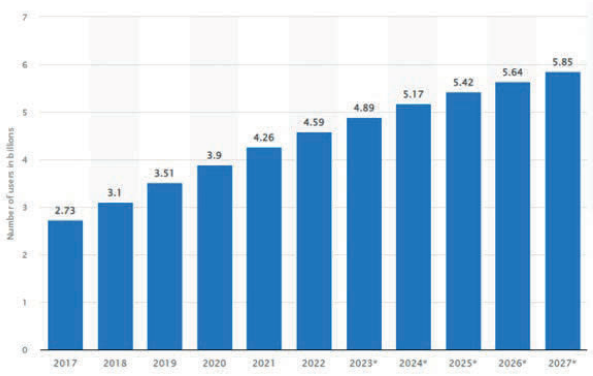


Fig. 1. Social media users (2017–2027) [17].

According to the Pew Research Centre's white paper on social media use in 2021 [18], Facebook and YouTube are generally popular among most Americans, whereas social media platforms like Instagram, Snapchat, and TikTok have a strong user base of adults under 30. The statistics presented by the report are shown in Fig. 2 below.

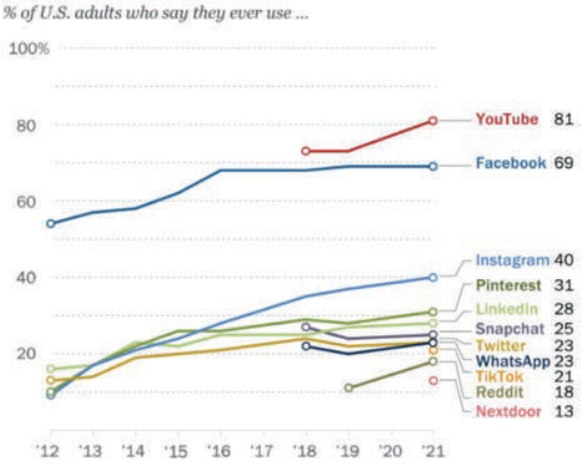


Fig. 2. Social media users us adults (2017–2025) [18].

With the billions of active user base of social media platforms, chances are enormous that the information a user is viewing is a piece of misinformation at least if not a campaign of disinformation. The following sections discuss the nature of information available on social media platforms regarding various sectors of life.

A. Business and Economy

Social media has its effects on every walk of life so do its positive and negative aspects depending on the use [19], [20]. On the good side, social media offers instant connectivity, and a vast audience for targeted marketing, but at the same time, it is a platform that is also open for cybercriminals to achieve their malicious desires and individual and entities that poses a serious threat to business with misinformation and disinformation [21]–[23]. One of the most prominent examples that depict the power of social media even in its early days is a Song, upload on YouTube on 7 July 2009, by Canadian musician Dave Carroll [24]. Dave Carroll took a flight on United Airline and saw from the window that the Airline Staff were throwing his guitars when he arrived at his destination, he found his guitar was broken. The singer Dave Carroll wrote in his book that he tried to convince the customer service of United Airline that he should be compensated for the damage, but none listened. Finally, Dave Carroll along with his team decided to make a song on this incident and uploaded it on YouTube. Surprisingly to the Singer himself, the video got 1 million views within the period of merely four days. The share value in the stock market of United Airlines declined by 10 % cumulating an approximate loss of 180 million dollars to shareholders [25]–[27]. If the incident is true and as accurate as mentioned by Singer in his Song and Book as well then, this piece of information will be considered as malinformation due to the fact the malinformation is true, but harmful to an individual, group, company, organisation, or a state.

B. Environment, Science, and Technology

According to the World Economic Forum's "The Global Risk Report 2022", one of the long-term threats faced by mankind is climate change. The globally speeding climate change demonstrates itself as an irrevocable result [28]. According to the BBC report [29], climate change is not merely a problem for developing countries but developed counties as well. Recent overwhelming and destructive floods in Pakistan are linked with climate change [30], [31]. The researchers [32] argue that there is a shortage of scholarly literature that explicitly uses the term "misinformation" when it comes to climate change. However, there is an academic debate among scholars on several means to discredit scientific discoveries and political discussions on climate change. In [33], the researcher argues that the individual or entities propagating disinformation regarding climate change are persuasive in convincing people like marketing campaigns of the tobacco industry to undermine the health hazard of smoking. When it comes to disinformation on climate change, it is not only done by the individual but by entities as well and in a well-organized manner with funding and lobbying [34]–[36]. Social media has exacerbated the effects of a disinformation campaign on global warming, but it is not a new thing. In August of the year 1980, the American Petroleum Institute (API) published a document that acknowledges that the consumption of fossil fuels increases environmental pollution. Fascinatingly, the document at the same time cast doubt upon the assertion that the avalanche of carbon dioxide might cause global warming [37].

C. Healthcare Sector

According to the researchers [38], the top source for the propagation of misinformation in the healthcare sector is the social media platforms, where the misinformation spreads like wildfire as compared with authentic and verified information [38], [39]. The researchers were concerned about the misinformation widely available on social media regarding common types of cancer and their negative effects on patients. They carried out a statistical test to check the accuracy of information regarding cancer treatments. The 200 articles were opted by picking 50 top articles for each cancer category and two cancer specialists for each category (i.e., breast, prostate, colorectal, and lung) were part of this research. Shockingly, the articles containing misinformation were enjoying more social media engagement from the audience than the articles having information [38]. Similar to misinformation regarding cancer treatments available on social media, social media is also full of misinformation and disinformation regarding Covid-19, its vaccine, and various companies producing its vaccines. Still, in the past year of 2021, Covid-19 was one of the leading causes of death in the United States. On the one hand, Covid-19 has deadly effects on the whole world making it a global pandemic and, on the other hand, misinformation and disinformation regarding Covid-19 created a man-made infodemic [40]. The World Health Organization describes an infodemic as "too much information including false or misleading information in

digital and physical environments during a disease outbreak" [41]. The researchers argue that the misinformation on social media created two other problems for Covid-19 itself. One is the vaccine hesitancy to intentionally delay in accepting the vaccination and the second is vaccine refusal [40].

D. News Media Sector

EU DisinfoLab (EUDL) is a Brussels-based non-governmental organisation. According to their official website, "EU DisinfoLab is a young independent NGO focused on researching and tackling sophisticated disinformation campaigns targeting the EU, its member states, core institutions, and core values". An extensive report was published by the EUDL in the year 2020 on their investigation of an enormous operation aiming for international institutions to accept and adopt policies that suits Indian interests [41]. The investigation reports concluding astonishing facts that a huge grid of more than 750 harmonized fake media outlets working in Europe alongside various suspicious think tanks and NGOs was initially unearthed by the EUDL. This propaganda system was covering 119 countries and had more than 550 domain names. This web of propaganda was designed to target European institutes and influence them to adopt policies that were in line with Indian interests and were anti-Pakistan and anti-China. The report summarises that this web of coordinated propaganda is live since 2005 and is still going on till the publication of the report. Also, several cases of identity theft were reported by the EUDL and that included government officials as well such as Martin Schulz, former president of the European Parliament or and James Purnell, a former UK Government minister. All the propaganda is not limited to fake media outlets impersonating regular media and press agencies such as the Voice of America, EU Observer, and the Economist, but also using social media as well to maximize the impact of disinformation campaigning [42].

E. Politics

According to Gallup's report, the public United States of America's trust in mainstream media to report the news with impartiality accurately and rightly went down to 36 % in the year 2021 [42]. Figure 3 depicts the Gallup statistics on Americans' trust in new media outlets.

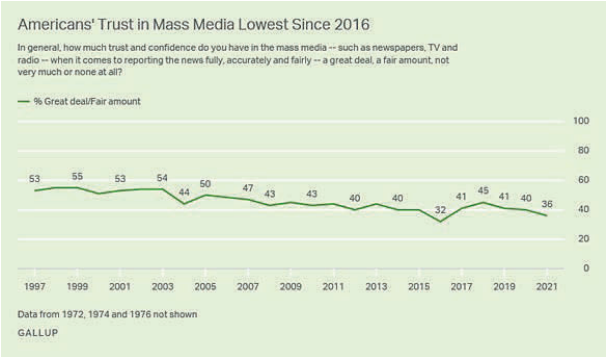


Fig. 3. Americans' trust in mass media [23].

Disinformation is neither limited to national politics nor confined to one country, tools like deep fake [43] can disorient people across the countries and continents. On the contrary, the furthermost hot topics of political debates in recent times are Russia Ukraine crisis in 2022, the British referendum in 2016, and the US presidential election in the same year [44]. The US Presidential Election of 2016 is remembered with enormous growth in disinformation or fake news. The researcher analysed 171 million tweets, posted by 11 million users, in five months before US Presidential Election Day of 2016 and opted for 30.7 million tweets that contain at least one Uniform Resource Locator (URL) and divided them into two categories. One category represents news generated from websites that have been marked as propagating misinformation and the other one depicts the traditional news outlet having different political alignments. Later the misinformation category was further subdivided into two which were fake news and tremendously partial news. Statistics of the researcher's analysis are very fascinating. Out of 30.7 million tweets, whopping 10 %, representing a little more than 3 million, tweets fall in the misinformation category. More interestingly there were tweets representing 16 %, 21 %, and 28 % of news outlets reporting political Right, Centre, and Left-wing opinions, respectively. Furthermore 15 % of tweets, or to put the matter in perspective 4.6 million tweets, were extremely biased collectively to Right- and Left-wing political opinions [45]. The researchers in [46] took the case of the 2019's Portuguese election as a topic for their research on the effects of disinformation on elections. The researcher asserted that using disinformation as a weapon to distort the truth to achieve political influence in favour of one candidate over the other is a global threat. Researchers argue that the two prime motives that lie behind the disinformation are either financial gain or a tool for propaganda. For their study and statistical analysis, the researchers opted 9 Facebook pages of Portuguese mainstream media, having 8.9 million followers, and 9 Fake Facebook Portuguese news pages, with a follower count of 1.5 million. The count of post shares on Fake News Facebook pages was 31 725, whereas the number of post shares on mainstream Portuguese Facebook pages was only 28 635 [46].

III. Way Forward

The falsification and the weaponization of the information i.e., misinformation, disinformation, and malinformation, pose a great threat to businesses and individuals. This is a desperate time for the establishment of a security policy and professional practices to manage these new challenges to mankind [23]. The report in [16] mentions that many online platforms are taking measures to curb and combat disinformation, such as detecting prohibited accounts, rating the reliability of content, suggesting content different from user preference to increase user accessibility, de-monetized fake content, and last but not the least collaboration with the third party, reliable, and independent information verification organisations. The researchers in [47] argue that the combat against disinformation is evolving and polymorphed problem for academia and industry as well. In their study, the researchers [47] opted for

various tools under four different categories, namely, (i) Fact Checking, (ii) Anti-Hoax, (ii) News Sources Control, and (iv) Disinformation Network detection. Various tools under each category were used by the researchers such as factcheck.org, Snopes.com, politifact.com, and ellinikahoaxes.gr, pointer.org/ifc, and various others.

Using these tools with the help of Graph Convolutional Networks the solution was proposed to identify fake news using Twitter data. Researchers in [48] have briefly explained many fake news detection techniques such as the Expert-crowdsource approach, Human-Machine approach, and recommendation system approach along with many others. The benefits and the disadvantages of any technology are that they both are evolving and the same is the case with misinformation, disinformation, and malinformation. To combat the weaponization of information, it is necessary to involve all the stockholders and not only users in social media platforms but also organisations at the government level. Keeping all the stockholders in mind and the thorough perusal of the literature above this study proposes the following recommendations, in Table III, for individuals, governments, and social media platforms.

TABLE III

RECOMMENDATIONS FOR INDIVIDUALS, GOVERNMENTS, AND SOCIAL MEDIA PLATFORMS TO COMBAT

	For individuals
1	Check the age of profile sharing information.
2	An individual should check the authenticity ratings of a post before sharing.
3	Individuals should reserve-search the piece of information on reliable news agencies' Websites before sharing.
4	Individuals should unfollow the pages and profiles that have low overall ratings and low authenticity ratings
5	Social media users should not believe everything they are watching or reading on various platforms.
	For governments
1	Proper legislation and penalization in case of violation of the law.
2	Promote industry and academia collaboration to jointly combat the threat.
3	Encourage varsities to offer more courses if not a dedicated program on this subject.
4	Governments should launch awareness campaigns not only at the university level but also at the pre-university level.
5	Facilitate research and development that are working on real-time information validation.
	For social media platforms
1	Device an algorithm that assigns a rating of authenticity for each profile and page.
2	Collaborate with third-party fact-checking organizations.
3	Reduced rating of pages and profiles if misinformation or disinformation is shared and verified by third-party fact-checkers.
4	Remove the pages and profiles that constantly share misinformation or disinformation.
5	Each post on each page and profile shall show an authenticity rating.
6	Organise international conferences to attract more research and development on countermeasures for disinformation.

IV. CONCLUSION AND FUTURE WORK

The Internet is the most crucial and ground-breaking technological advancement that was witnessed in the 20th century. It has not only revolutionized the communication paradigm but also disrupted the business models established for decades if not centuries. Marketing agencies moved from billboards to targeted online and social media marketing campaigns, taxi acclaiming mobile applications such as Uber and Careem have also replaced the old-fashioned taxis, content streaming platforms like Netflix and Amazon Prime have created tough competition in the entertainment industry and especially for cinemas. Within the Internet, social media platforms are the new form of news channels. Everyone uses various social media not only to interact with others and communicates with their social circle to get news and updates about their surroundings. The open nature of social media platforms offers comfort for individuals and entities to share whatever they want to millions of people all around the globe in a blink of a second. With the advancement of technology, mankind also faces new challenges and social media platforms are no exception here. The luxury and amenity that social media platforms offer to all have caused another problem for mankind that is no new to us, but the severity of the problem has increased enormously due to the ease of access to social media platforms. When social media users share anything, there is a high chance that the individual or an entity may share misinformation, disinformation, or malinformation. This study has discussed different types of information, and their nature, and took an in-depth preview of how it affects different walks of life. It discusses how misinformation is different from disinformation and how disinformation can be weaponized and used against other individuals or entities. It also talked about the most fascinating type of information which is malinformation, which is true but has the potential to damage an individual, group, entity, or nation. This study also has discussed all the types of information along with the recent event in our past such as the US Presidential election of 2016, the Covid-19 pandemic, Dave Carroll songs, news about healthcare, and fake news agencies networks, etc. Finally, the study is completed with recommendations for individuals, governments, and social media platforms to combat

disinformation. Recommendations include steps and actions that an individual, government, and social media platforms can take to reduce the impact and hinder the propagation of the misinformation and disinformation. One of the most curial actions an individual can take to combat misinformation and disinformation is not to believe what they see and read on social media and always ask a question on the authenticity of the content an individual is consuming and confirm its authenticity from a reputed news agency before sharing it.

The authors are working on an algorithm design for one of the popular social media platforms to generate a ranking for the content shared by the pages. The initial design of the algorithm may opt for social media APIs and generate ratings for the authenticity of the information shared in the posts on the social media platform. Hortonworks Hadoop Sandbox can be used to fetch social media data and data analytics techniques can be applied to analyse the data. The data analysis can surely help to identify disinformation that is being cleverly shared among various posts on social media platforms. The primary framework of the algorithm is based on the following factors:

- *Age of Account*: Algorithm will look for the creation date of the given account. Older accounts tend to have a higher factor score of being authentic compared to newer ones.
- *Completeness of Profile*: Algorithm estimates the completeness of the profile information. Unauthentic accounts generally do not have detailed profiles, such as, profile pictures, cover photos, bios, website links, and other relevant information.
- *Level of Activity*: Algorithm will explore the frequency and consistency of the account's activities, such as, posts, comments, likes, and/or shares. The fake accounts usually do not have a large history of regular activity, rather than resharing/forwarding specific contents and/or posts.
- *Quality of Content*: Algorithm will assess the quality and relevance of the content posted. Unauthentic accounts often do not have original and engaging content rather than solely sharing or reposting content from others.
- *Patterns of Engagement*: Algorithm will analyse the activity pattern, such as the number of followers, likes, comments, and shares for reasonable interaction levels.
- *Interactions with Users*: Algorithm will examine the interactions between the account and other users. It looks for authentic activities, such as conversations, replies, and mentions, that signal genuine engagement.
- *Badges for Verification*: Algorithm will check for badges verified/awarded by the social media platform.
- *Analysis of Network*: Algorithm will accomplish network analysis to detect the account's connections and relationships. Fake accounts often exhibit unusual network patterns, such as having an unusually high number of followers with low engagement.
- *Consistency of Cross-Platform*: Algorithm will measure the consistency of information and activities across multiple platforms. Genuine accounts typically maintain consistent profiles along with engagement levels across different social media platforms.
- *External Signals*: Algorithm will also consider external signals, such as news articles, public records, or other reliable and authentic sources, to verify the authenticity of the account.

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