

Metaverse in Iran

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Abstract

This research examines the Iranian digital community's engagement with the Metaverse, analyzing 14,724 tweets (expanding to 48,620 with retweets) from 23,571 unique users. Interest in the Metaverse among Iranians surged in the seven months following Facebook's rebranding but has since waned. A significant link between digital currency discussions and Metaverse topics was observed. Economic activists in the cryptocurrency market, forming the primary content creators, generally portray the Metaverse positively, focusing on earning opportunities. Another active group includes technology enthusiasts who share the latest Metaverse developments. Moreover, some users integrate Iran's socio-political context into their discussions, often contrasting Iran's technological stance with global giants like Facebook and addressing internet censorship. A distinct perspective comes from users wary of potential colonialist uses of technologies like the Metaverse, expressing apprehension about human subjugation. This sentiment forms the basis of most negative views on the Metaverse's development within the Iranian digital sphere.

Keywords: cryptocurrency, digital community, Metaverse; Iran, technology perception, Twitter analysis.

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Introduction

The advent of the Metaverse, a term coined to describe a collective virtual shared space, has ignited global interest and diverse interpretations. This study, focused on the Iranian digital community's perspective, employs data-mining techniques to analyze Twitter data, revealing how the Metaverse is perceived within this unique cultural context.

The concept of the Metaverse, originally a science fiction notion, has rapidly evolved with technological advancements in virtual reality (VR), augmented reality (AR), and blockchain technology. It presents a future where digital and physical realities merge, offering new dimensions of interaction and economic activity. This global phenomenon's reception, however, is deeply influenced by cultural, social, and political contexts, which vary significantly across regions.

Iran, with its distinct socio-cultural landscape, provides a rich context for examining the reception of such global digital phenomena. The country's unique position, characterized by a young, tech-savvy population (Mousavi, 2020; Shahghasemi, 2021; Ververis et al., 2020; Khazaie et al., 2023) and a complex socio-political environment, makes it an ideal case for studying the perception of emerging digital trends. Twitter, a platform known for its vibrant public discourse, serves as a fertile ground for gauging public opinion and social commentary in Iran.

This research employs data-mining algorithms to analyze tweets, hashtags, and user interactions related to the Metaverse from Iranian Twitter users. The methodology involves collecting a substantial dataset of tweets, applying natural language processing techniques to filter and categorize data, and employing sentiment analysis to gauge the emotional tone of the discourse. This approach allows for a detailed and nuanced understanding of the prevalent attitudes and perspectives toward the Metaverse in the Iranian online community.

Metaverse: A new real world?

The Metaverse, a term initially coined by Neal Stephenson (1992) in his science fiction novel *Snow Crash*, represents a collective virtual shared space, created by the convergence of virtually enhanced physical reality and physically persistent virtual spaces, including the sum of all virtual worlds, augmented reality, and the internet. In the early stages, the concept of virtual worlds, primarily in the form of Multi-User Dungeons (MUDs) and later Massively Multiplayer Online Role-Playing Games (MMORPGs), laid the groundwork for the Metaverse. These platforms, emerging in the late 1980s and early 1990s, were primitive by today's standards but essential in shaping online social interactions and virtual

economies. Games like “Ultima Online” and “World of Warcraft” offered glimpses into persistent virtual worlds where players could interact in ways that transcended traditional gaming (Silva et al., 2023). These games fostered communities and social structures within their digital realms, illustrating the potential of virtual worlds as social platforms.

The 2000s marked significant technological advancements that propelled the development of the Metaverse. The rise of social media platforms like Facebook, Twitter, and LinkedIn revolutionized how people connect and share information (Auxier & Anderson, 2021), bridging geographical divides and creating digital social networks. Concurrently, advancements in hardware, such as more powerful graphics processing units (GPUs), faster internet speeds, and the advent of smartphones, made digital content more accessible and immersive. This period also saw the emergence of Second Life, a virtual world that allowed users to create avatars, socialize, and participate in a digital economy, further blurring the lines between virtual and physical realities.

The next significant leap towards the Metaverse came with the resurgence of interest in virtual reality (VR) and augmented reality (AR) technologies. Pioneers like Oculus Rift, acquired by Facebook in 2014, brought VR into the mainstream consciousness (Egliston & Carter, 2022). The release of consumer-friendly VR headsets and AR platforms like Pokémon GO showcased the potential of immersive, interactive virtual experiences. These technologies provided the building blocks for a more integrated and immersive Metaverse, where physical and digital realities could coexist and interact seamlessly. The concept of the Metaverse gained further traction during the COVID-19 pandemic (Kim & Kim, 2023). As physical distancing measures were implemented worldwide, individuals and organizations turned to digital solutions for work, education, and socialization. This shift highlighted the importance of digital spaces for maintaining social connections and conducting business, accelerating interest and investment in Metaverse-related technologies. Companies like Facebook, rebranding itself as Meta in 2021, signaled a strong commitment to developing this new digital frontier.

Currently, the Metaverse is in a nascent stage, with various interpretations and implementations. It encompasses a range of technologies, including VR and AR, blockchain, and artificial intelligence (AI). The blockchain and cryptocurrencies introduce a decentralized economic system for digital assets, while AI enhances the interactivity and responsiveness of virtual environments. As these technologies continue to evolve and converge, the Metaverse is poised to transform how we interact, work, and play, creating a seamlessly integrated digital-physical ecosystem, yet its “real” nature has been questioned by many critics.

In recent years, metaverse initiatives, notably Decentraland and the Sandbox, have garnered significant interest from venture capital firms, positioning themselves as central platforms in the burgeoning NFT-based economy. Despite these entities attaining substantial market valuations, their actual market penetration remains limited. For instance, Decentraland's claim of an average of 8,000 daily active users, a figure presented in response to a third-party report alleging only 38 active users on a given day, underscores the platform's relatively minor reach in the broader digital landscape (Knibbs, 2022).

This context raises questions about the strategic decision-making of major tech figures, particularly Mark Zuckerberg, who has notably pivoted his company's focus towards this seemingly unstable and nascent sector. Zuckerberg's articulation of the metaverse as "an embodied internet" in a 2021 video provides insight into his vision. He posits that the metaverse will create a more immersive and present experience, transcending the limitations of traditional screens and enabling users to feel as though they are physically part of remote experiences.

Yet, this vision confronts a historical backdrop where virtual reality (VR) technology, despite its potential and significant advancements, has continually struggled to achieve mainstream adoption. In an essay for WIRED, David Karpf, a writer and academic, highlighted the repetitive cycle of anticipation and unfulfilled promise in VR's evolution. He noted that while VR technology has been on the brink of revolutionizing various sectors, from gaming to medicine, it has yet to establish itself as a transformative medium in daily life (Knibbs, 2022). Karpf's criticism echoes Baudrillard's criticism of the virtual reality three decades ago. Jean Baudrillard's criticism of virtual life is rooted in his concepts of simulation, simulacra, and hyperreality, which he developed to analyze the postmodern condition. His work, though predating the widespread adoption of the internet and virtual reality, offers a prophetic insight into the digital age (Baudrillard, 1994).

One of Baudrillard's primary concerns was the loss of distinction between reality and simulation. He proposed that in a society saturated with simulacra- copies or simulations that do not have an original or genuine counterpart (Metaverse? What would he say about Metaverse if he lived among us today?)- the line between reality and representation becomes increasingly blurred. This theory is particularly relevant to virtual life. As we engage with online worlds and digital interactions, the experiences within these virtual spaces can become as significant, or sometimes more so, than those in the physical world. This blurring of boundaries leads to a detachment from the 'real' and an immersion in a world of hyperreality, where the distinction between what is real and what is simulated collapses.

Baudrillard was also critical of the impact of this hyperreal world (what some technophiles boast about when referring to Metaverse) on human experiences and relationships. He argued that in a world dominated by simulations, experiences become shallower and more mediated. In the context of virtual life, this translates to a concern that relationships and interactions in online environments lack the depth and authenticity of those in the physical world. The virtual life, in Baudrillard's view, could lead to a form of alienation, where people are increasingly disconnected from the tangible, physical aspects of existence and engrossed in a world where experiences are curated, controlled, and devoid of natural spontaneity (Baudrillard, 1994).

Additionally, Baudrillard was wary of the consumerist implications of virtual life. He saw the rise of the digital and virtual as an extension of the consumerist culture, where even human experiences and interactions become commodified. In virtual spaces, every action, interaction, and even identity can be commodified and packaged for consumption. This commodification of virtually every aspect of life echoes Baudrillard's broader critique of a society that values signs and symbols (like wealth, status, and now, digital avatars or online personas) over substantial, authentic experiences.

Specific challenges to the realization of Zuckerberg's metaverse vision include the current technological limitations, such as the need for cumbersome headsets and frequent charging, which detract from the promised sense of immersion and presence. Moreover, there are broader societal questions about whether there is genuine desire and readiness for such a shift in how people interact with digital spaces and whether they are willing to substitute significant portions of their physical experiences for those in a corporate-controlled virtual environment (Knibbs, 2022).

The optimism of tech leaders, especially Zuckerberg, in investing heavily in the metaverse concept does not inherently translate to consumer demand or acceptance. The ambition of Meta (formerly Facebook) extends far beyond creating a gaming platform, aiming to create a comprehensive digital world encompassing work, social interaction, entertainment, and commerce. This expansive vision contrasts sharply with the more focused and currently successful digital environments like Roblox and Fortnite. However, the assumption that consumers will willingly transition to such an all-encompassing virtual existence remains speculative, and the journey towards this vision is fraught with both technological and philosophical challenges (ibid).

In Iran, the advent and expansion of the Metaverse bring a unique set of challenges and opportunities, shaped by the country's distinct cultural,

political, and technological landscape. On the one hand, the Metaverse presents an opportunity for cultural and educational enrichment. It offers a platform for Iranians to engage in global cultural exchanges, access diverse educational resources, and participate in international markets, potentially driving innovation and economic growth. This virtual environment could also provide a space for creative expression and social interaction, allowing Iranians to connect with communities and ideas worldwide in ways that might be restricted in the physical realm due to cultural or political constraints.

However, these opportunities come with significant challenges. The Iranian government's stance on internet freedom and digital surveillance raises concerns about privacy and censorship within the Metaverse. The potential for governmental control and monitoring of virtual spaces could limit the free exchange of ideas and expression, a cornerstone of the Metaverse's appeal. Additionally, technological infrastructure and access disparities pose substantial hurdles. Ensuring equitable access to the necessary technology and high-speed internet to fully participate in the Metaverse is another critical issue, particularly in more rural or economically disadvantaged areas. Balancing these challenges with the potential benefits will be crucial for Iran as it navigates its path in the evolving digital landscape. How Iranian authorities, people, social media users and tech communities see Metaverse and its benefits and challenges? More specifically, how Iranian Twitter users see Metaverse?

Methodology

The data used in this article was obtained using the Twitter crawler, based on the keyword "Metaverse" and its English writing style used by Persian users. A Twitter crawler is a type of software that systematically browses and collects data from Twitter. It works by accessing Twitter's API (Application Programming Interface), which allows it to request and receive data. The crawler sends queries to the API, specifying the type of data needed, such as tweets, user profiles, or hashtags. The API then returns the requested data, which the crawler processes and stores for analysis. This data can include tweet content, metadata, user information, and more. Twitter crawlers are often used in data mining and research to analyze trends, sentiments, and public opinions on various topics. According to the chart of the publication trend of the content of this data, this issue has been considered since the end of Mordad 1400 (August 2021). "Metaverse" has had a significant volume of daily content production until about a year after that date. 14,724 tweets have been published in this period of time, and if retweets are taken into account,

this number reaches 48,620. Overall, 23571 users have tweeted at least once with this keyword or reposted tweets from others.

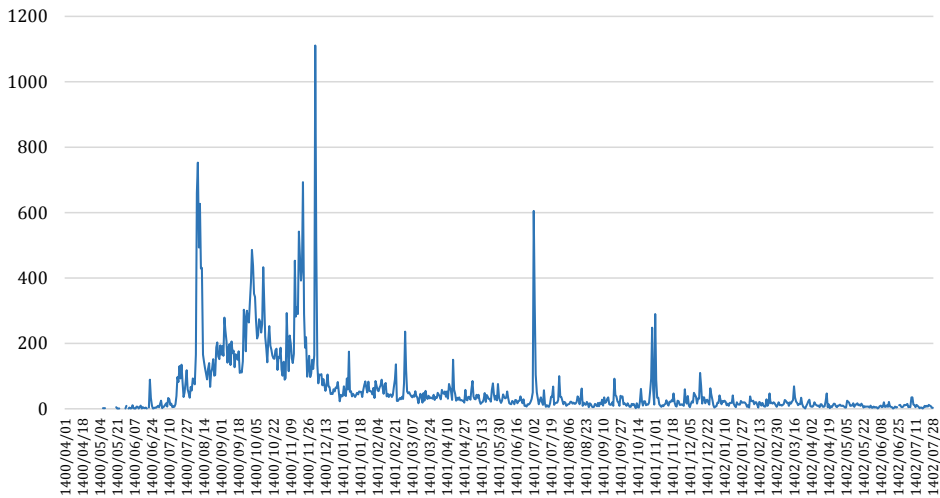


Figure 1. Tweet counts

Content analysis

We have used three methods to identify the topics that users have raised about Metaverse. In the first method, using sampling rules, we randomly selected a number of tweets. Then, the topics of these tweets were coded to get a glimpse on the topics of interest to users. Also, the approach of these tweets to Metaverse was coded at this stage. In the second method, we used hashtag network analysis to get a bigger view of the content in these tweets. The third method is to use the Named-Entity Recognition (NER) counter. In this method, the number of repetitions of words in the text of the tweets were counted and the most frequent attributes mentioned for Metaverse technology were extracted. Also, by using the analysis of the users' network, various groups that published about the subject of Metaverse were identified and the content of their interest was studied. In the following, we describe the method of operation and the results obtained.

Data sampling

Previous studies show that the use of a simple random sampling method is usually effective in analyzing the topics of tweets (Kim et al., 2018). Based on this, the number of 378 was obtained for the sample size. For the sake of convenience, 500 tweets were coded as samples. Figure 2 shows the themes obtained from the tweet coding process.

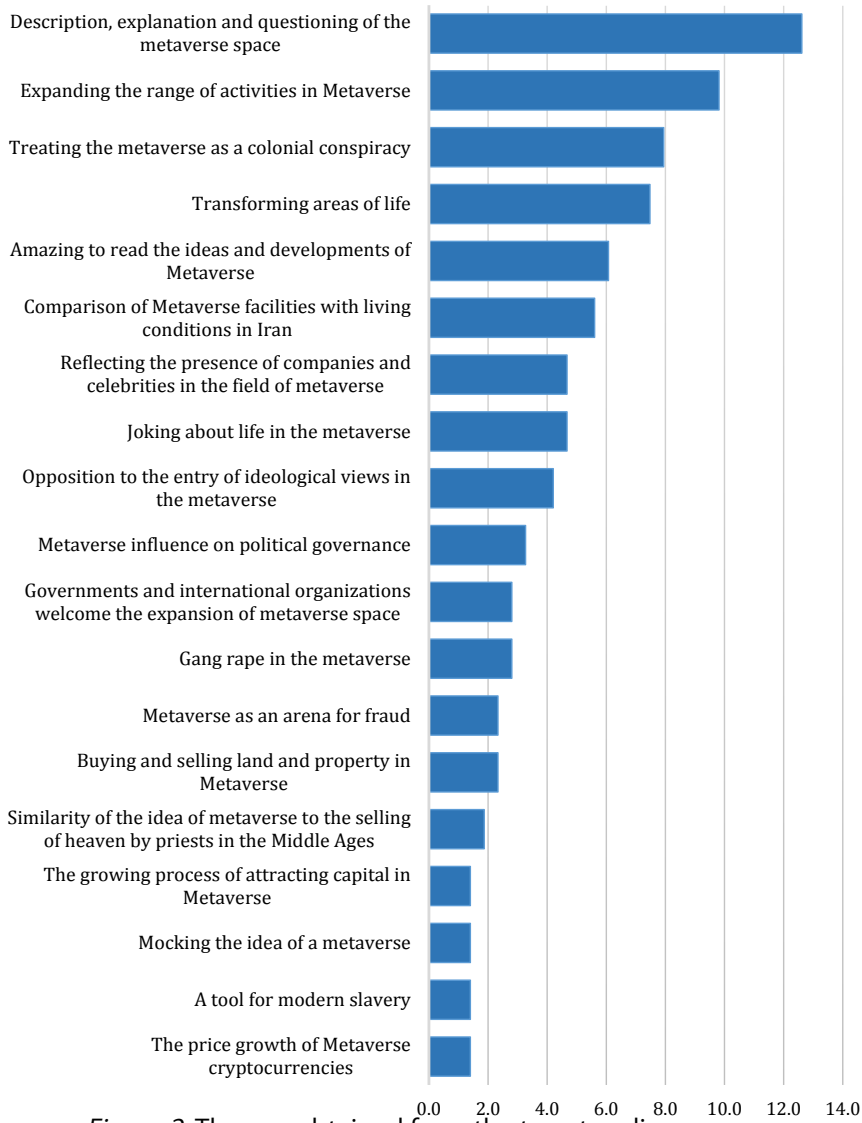


Figure 2. Themes obtained from the tweet coding process

As can be seen, 20 different topics were found among these tweets. In the following, we will describe the content that users have discussed on these topics.

Findings

Description and questions about the Metaverse space

As mentioned above, one of the most serious challenges for users at the moment is the question about what Metaverse is. Some users have

also tried to provide explanations in this case, which can be summed up in the general axis of description, explanation and questioning of the Metaverse space. Some users with a positive attitude (6%), some with a neutral attitude (4%) and others with a negative attitude (2%) have created content under this category.

Expanding the range of activities in Metaverse

The Metaverse has expanded our reach in several ways. It provides immersive virtual environments that transcend physical boundaries, allowing for global interaction and collaboration in a shared digital space. This expansion is evident in various fields, including education, where virtual classrooms offer interactive learning experiences, in entertainment through enhanced gaming and virtual events, and in business with virtual workplaces and meetings. Moreover, the Metaverse's integration of technologies like VR, AR, and AI creates opportunities for innovative applications and experiences, reshaping how we interact, learn, and conduct business in a digitally connected world.

Iranian Twitter users seem to be curious about these possibilities. The attitude of tweets in this matter has been more positive. Tweets about this topic were produced by mainly non-political users, specifically users and media in the fields of information technology and virtual space. These users were mainly active in sectors such as cryptocurrency, programming, artificial intelligence, technology news and the media. These users discussed the news related to the developments and achievements of Metaverse. Cases such as how Metaverse enters fields such as science, law, sports, business, medicine and politics were raised by users under this axis. About 10% of the total production content was carried out under this axis.

Treating the Metaverse as a colonial conspiracy

The issue of conspiracy theories about Metaverse have been picked up by some studies (Singh & Rajput, 2022; Paganopoulos, 2022; Yao et al., 2022; Khader, 2022). Some users considered the Metaverse to be a conspiracy to control the world, which is being launched in the world under the guidance of Zionists, Globalists or similar forces. Some of them considered the arrival of Metaverse to be related to Corona and vaccination, attacks on schools in Iran, 2022 protests and even the war between Ukraine and Russia.

Transforming areas of life

The Metaverse is fundamentally changing our lives by reshaping how we interact, learn, and engage in various activities. It offers an immersive

virtual world where geographical boundaries are irrelevant, enabling people to connect and interact in ways previously limited to the physical world. This transformative technology is impacting education by providing interactive, 3D learning environments, revolutionizing the workplace with virtual collaboration spaces, and creating new entertainment experiences with immersive gaming and virtual events. Furthermore, the Metaverse is influencing commerce with digital marketplaces and virtual goods, while also offering novel approaches in healthcare through telemedicine and virtual therapies. By integrating advanced technologies such as VR, AR, and AI, the Metaverse is not just a new digital realm but a platform that is redefining our daily experiences and interactions, presenting new opportunities and challenges in a digitally connected world.

The tweets about the capability of Metaverse in changing our lives were mostly based on the surprising and positive effects of the Metaverse on life. About 8% of all tweets were produced under this axis. The feeling of most of the users under this axis had them talking about the changes before us in the Metaverse world. The main genre of this axis was something like speculation in which users were focused on the surprising changes ahead.

Reflecting the presence of companies in the field of Metaverse

Many prominent companies in the world are moving towards Metaverse. Automobile companies such as Nissan and software companies such as Microsoft have announced their entry in different periods. This content is mainly republished by the official accounts of companies active in the virtual media. About 9% of the total tweets produced were dedicated to this issue.

It is good to read the ideas and developments of Metaverse

The reaction of users to the developments of Metaverse was very diverse, but many of them have entered this issue with a kind of amazement and delight. Of course, this type of emotional reaction can also be traced in other axes, but it is very prominent on this axis.

Allegation of gang rape in Metaverse

One of the negative production axes about Metaverse was the claim of one of the female users about being gang-raped. Nina Jane, a 43-year-old English mother, claimed that after using the glasses to enter the Metaverse space, she was gang-raped by several other virtual male characters, and this incident caused anxiety and frustration in her. This content had humorous feedback both among Iranian and foreign users. However, Metaverse took some measures to increase the security of users and in response to this incident.

Tools of modern slavery

Many users of the virtual space have considered Metaverse as an objective example of controlling people's lives (Bibri, 2022). Shoshana Zuboff (2019) critically addresses the impact of digital technologies, including artificial intelligence, on society, focusing on the concept of surveillance capitalism. She argues that many tech companies operate by harvesting and analyzing personal data to predict and influence behavior, a process in which AI is a key tool. This business model, according to Zuboff, leads to a subtle form of behavioral modification, eroding individual autonomy and privacy, particularly in Iran in which privacy concerns are stricter in comparison with Western cultures (see for example Nosrati et al., 2023; Aris et al., 2023; Aeini et al., 2023). Zuboff emphasizes the risks such practices pose to democratic values, highlighting that the commodification of personal data and the potential for manipulation threaten fundamental freedoms and democratic processes. While her critique encompasses the broader digital economy, AI's role as a powerful enabler of these surveillance practices is a central concern, raising ethical and societal questions about the technology's impact on human life and liberty. According to this group of users, humans have no power of choice in the Metaverse, and the final winners of this space will be world powers and companies like Facebook. These criticisms are not limited to fundamentalists, and many domestic and foreign critics and philosophers in the field of technology have a similar view of the threats posed by Metaverse. In fact, despite the political load, this axis raises very serious and important ethical and political considerations around Metaverse.

A field for fraud

Critics of the Metaverse highlight significant risks of fraud, stemming from its nascent and loosely regulated nature. Concerns center around the anonymity it offers, which could lead to identity theft and impersonation. The increasing value of virtual assets, like digital real estate and NFTs, opens doors to asset scams and market manipulations. Additionally, users face risks similar to the broader internet, such as phishing and security breaches, particularly concerning given the Metaverse's reliance on cryptocurrencies and complex technologies like VR and AI. These environments, rich in personal data, also raise serious privacy concerns. The lack of consumer awareness about these risks further exacerbates the potential for fraud, underscoring the need for improved regulation, security, and public education to safeguard users in these emerging digital realms (Qamar et al., 2023). In our study, some users considered buying land and property in Metaverse to be

equivalent to buying Bitcoin years ago. At the same time, according to many users, buying land or any kind of investment in Metaverse is equal to the absolute risk of falling into the trap of fraudsters. Unfamiliarity and logical ambiguity about Metaverse, as well as the sharp reduction in the price of Metaverse lands in some periods, are the most important reasons for these users.

Mocking the idea of a Metaverse

Among the other negative axes produced by the users who tweeted about Metaverse is the mockery of the idea of the Metaverse in serious. The publication of some unbelievable and sometimes exaggerated statements about Metaverse and things like Zuckerberg's rape incident or huge financial loss in this project has led to reactions around the above headline.

Criticism of Iranian government's policies regarding new technological developments

One of the themes produced, which accounted for about 5% of the total content produced on the subject, was the comparison of the functions of the government and governance with the developments of the Metaverse. Of course, this axis was produced mainly by those people who were attached somehow to the Iranian government. Things like the protection plan, guided tours or the hijab bill are among the things mentioned by these users.

Analysis of users approach to Metaverse

Figure 3 shows the general view of users on Metaverse based on coding.

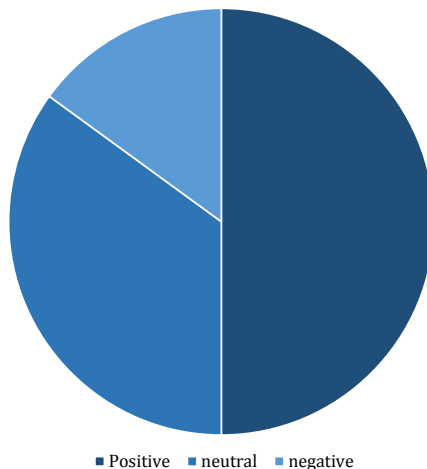


Figure 3. The general view of Iranian users on Metaverse

Table 1. The group of hashtags identified in the groups

Cluster number	Hashtags	Description
1	بلاکچین nft worldoftether رمز_ارز متامسک	This group of tweets refers to the role of the Metaverse in addition to the topic of cryptocurrencies.
2	ایران کوینکس coinex gamefi	This group of tweets refers to the role of the Metaverse in addition to the topic of cryptocurrencies.
3	ارزدیجیتال بیتکوین اتریوم ارز_دیجیتال کریپتوکارنسی	This group of tweets refers to the role of the Metaverse in addition to the topic of cryptocurrencies.
4	کریپتو رمزارز bitcoin crypto cryptocurrency	This group of tweets refers to the role of the Metaverse in addition to the topic of cryptocurrencies.
5	معماری شهرسازی معمار architecture اخبار_معماری	This group of tweets refers to the impact of Metaverse technology on architecture and urban planning.
6	پول ثروت سرمایه آموزش کسب_درآمد	This group of tweets refers to the issue of making money from Metaverse.

Cluster number	Hashtags	Description
7	<p>متا meta فیسبوک aronanniversary واقعت_مجازی هوش_مصنوعی</p>	This category of tweets is dedicated to news and information related to the Meta Company.
8	<p>برده_داری_نوبین کرونا ai نظم_نوبین_شیطانی</p>	This group of tweets addresses the Metaverse from a political point of view and presents it as a colonial conspiracy.
9	<p>جام_جهانی قرعه_کشی متاورسیزاسیون</p>	This group of tweets refers to the World Cup draw in the Metaverse environment.
10	<p>عصر جهل حکومت_اختیاری نبوغ_سیاسی مهسا_امینی opiran اعتصابات_سراسری نه_به_جمهوری_اسلامی</p>	This group of tweets was published by the opposition of the Iranian government. These tweets generally refer to the limitations of the Internet in Iran, along with the growth of technology in other countries. Metaverse's capacity for political protests has also been addressed.
11	<p>تیشرت طراح_پارچه طراحی_تیشرت نقاشی_مدرن</p>	This category refers to clothing design in the Metaverse.
12	<p>طرح_صیانت نه_به_طرح_صیانت صیانت طرح_صیانت_خیانت_است</p>	This group of tweets refers to the topic of a "protection plan for cyberspace users" in Iran. Users have opposed Internet restrictions in Iran by proposing new technologies such as Metaverse.

As can be seen, using this method, other topics have been extracted from these 14724 tweets. Some of these topics are similar to those extracted from sampling, but new topics are also visible among them.

Adjectives applied to the Metaverse

Many messages and content produced about the Metaverse contained special adjectives that have been used to describe the Metaverse. Accordingly, some messages needed no recognizable attributes. These adjectives could be divided into three groups of positive, negative and neutral adjectives. 'Neutral' refers to an attribute such as complexity that has no value. In applying this adjective, for example, the users called the Metaverse world 'complicated' and 'difficult' to understand.

The method we used to detect the attributes used for Metaverse in tweets is word count. First, we obtained a list of attributes used for referring Metaverse in tweets by sampling. We also used some existing datasets of positive and negative traits in the Persian language.¹ Then, using the Orange² software, we obtained the number of repetitions of these words in all the texts (Figure 5).

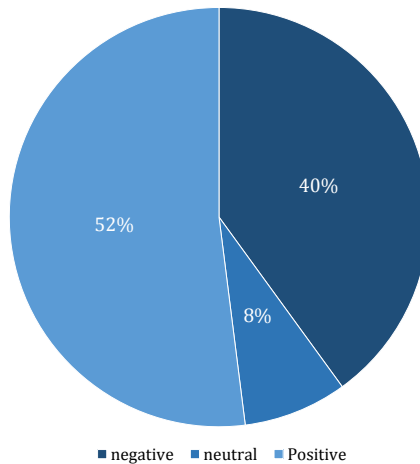


Figure 5. Adjectives produced about Metaverse

As can be seen from the diagram above, 40% of the adjectives produced about Metaverse were negative. Meanwhile, according to Figure 3, only 15% of the total content produced was negative. The difference in these two ratios shows the severity of expressions and judgments used by users who have a negative attitude towards the

¹ <https://ece.ut.ac.ir/404>

² <https://orangedatamining.com/>

Metaverse. In other words, although only 15% of the total produced tweets was negative, the mentioned 15% have more clearly produced the desired content. This is despite the fact that the users who had a positive attitude towards the topic did not use much frankness and intensity of expression to express their position, and for this reason their content did not have enough transparency to understand all kinds of adjectives.

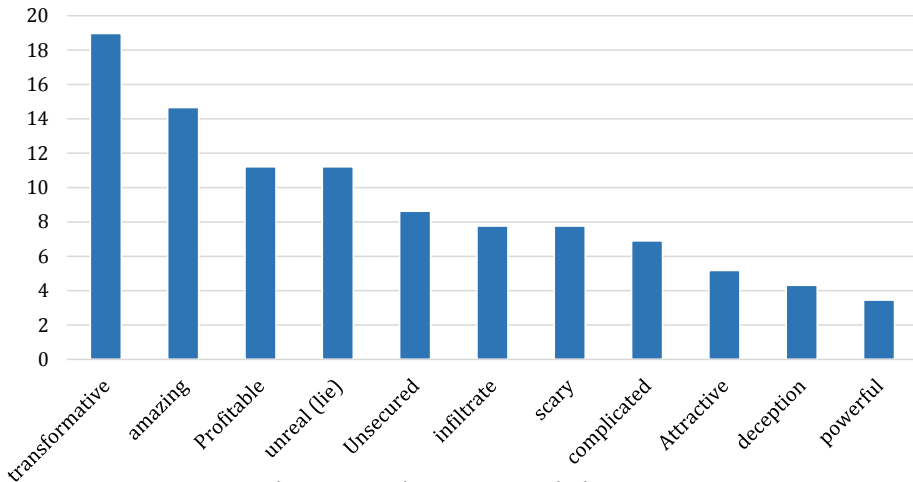


Figure 6. The main adjectives used about Metaverse

Figure 6 shows the main adjectives used about Metaverse from the perspective of Twitter users. As can be seen from the diagram, the most used adjective with 19% share of total tweets is transformational adjective. This means that out of 100% of adjectives that can be taken from the messages generated on the Twitter platform, 19% of them believe in the transformation of the Metaverse, or this adjective can be taken from their message. In this way, users described the Metaverse with expressions such as being futuristic, changing the world, and creating transformations in all kinds of social relationships. In total, 5 transformative, amazing, profitable, attractive and powerful adjectives are the positive adjectives given to Metaverse, and some other users have welcomed the embodied internet with 5 adjectives: lie, insecurity, influence, fear and deception.

Analysis of the network of users who publish Tweets

Analyzing retweets in network analysis is pivotal for comprehending the dynamics of information spread on social media platforms (Sabbar & Matheson, 2019). It serves as a key indicator of how information, ideas, or news travels through a network. When a user retweets content, they are not only endorsing or interacting with it, but also amplifying its reach to their

followers. This act creates a chain of information dissemination that can be meticulously mapped through network analysis. This mapping allows researchers to identify influential nodes within the network- individuals or accounts that are central to spreading information. By studying these nodes, one can understand the structure of the network and the role of key players in influencing the spread of content. Additionally, analyzing retweets helps in identifying the virality of content. Certain posts might spread more rapidly and widely, and understanding the characteristics of such content can provide insights into user behavior and preferences.

Moreover, retweet analysis is instrumental in sentiment analysis and public opinion mining. It helps in gauging the public response to various topics, events, or campaigns. By examining the patterns and frequency of retweets, analysts can infer the popularity and reach of different viewpoints, aiding in a more nuanced understanding of public discourse on social media platforms (Sabbar & Hyun, 2016). A retweet network is a directed weighted graph where nodes represent Twitter users and edges represent retweet relationships. The direction of an edge corresponds to the direction of information propagation or penetration. Edge weight is the number of times a user retweets another user.

The retweet network is a collection of tweets related to this project as Figure 7.

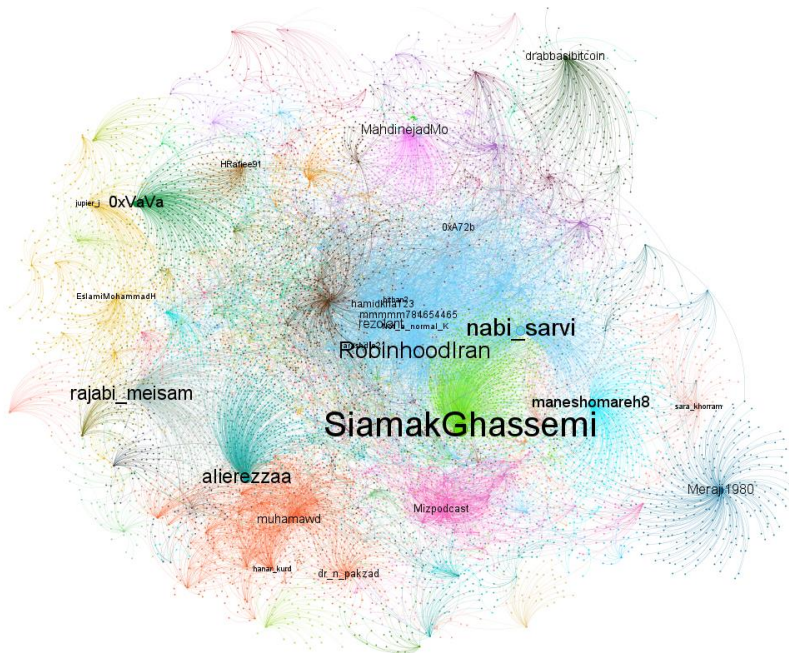


Figure 7. Users' tweets that attracted the highest level of attention

This network shows the content of which Twitter users have received the highest level of attention among other users. Communities or clusters that have retweeted more than others have also been identified. In order to achieve more accuracy, users who had a lower weight in the network were removed in order to better define the main community of Persian users who were active on Metaverse.

This network has 45 different communities, 12 of which have more than 300 members. In the following, we tried to show the common characteristics of the users of this category and which category of content they published the most by observing the tweets of users with high centrality in these communities. Also, the hashtags used by the members of each group have been checked to determine which content categories they are most active in.

Table 2. The common characteristics of the users

Cluster number	Main users	Description
1	monasfreeworld manne_ai muhammadrezahgh vahidbaghi95 sinamomeni4	Startup activists and businesses related to digital currency. These users have mostly used hashtags of categories 1, 2, 3 and 4, which are related to the cryptocurrency market.
2	DanialDaraei sa_mahdavizadeh mehraa_af AliMalekli	This group of users are startup ecosystem activists and have been active mostly in content cluster 12 (criticism of filtering policies).
3	maneshomareh8 SaeedDeh Samii25310992 Physics79639781	Most of the tweets in this category do not use various hashtags, and the content published by them is diverse and mostly different.
4	jomidvar Saman15216939 bitpinmarket samooeil ArzdigitalB	This group of users are also active in the field of digital currency and work in the field of digital currency and cryptocurrencies.
5	drabbasibitcoin navidshokriyan i3ehr0uz pishwallstreet drabbasibitcoin	This category of users are analysts of financial markets, especially digital currency.
6	ChosgholeAzam coiniran BabakJalilvand MahdeyAsadi Mizpodcast	These users are mostly IT and blockchain technology activists. Content category 1, centered on blockchain, has the largest share of production of this group.
7	montazeremahdi2 A_hadjiashtafy Himo_1363 HzamaniM2	This group of users are fans of conspiracy theories. Content group 8 is mostly produced by this group of users.

Cluster number	Main users	Description
8	Digiato s_saffarianpour ziaeparvar saeed_arkan	Media and technology journalists are influential users of this category. Content group 7 means news related to the former Facebook company, most of the products in this category.
9	nabi_sarvi RobinhoodIran rezolant mmmmm784654465 0xA72b	This group of users produces and follows most of the content related to cryptocurrencies.
10	SiamakGhassemi IranIntl indypersian NewshaSaremi t_megalion	This category of users mainly includes people and media opposing the Islamic Republic of Iran. News in the field of digital currency and new technologies are among their products. Also, content group 10 is more affected by the activities of this group.
11	poolmool jadi CryptoLadyir dolfininsea	The users of this category are mostly programmers and cryptocurrency market activists.
12	EslamiMohammadH jupier_j hooor197 the_mrKarl	This group of users are fans of conspiracy theories. Content group 8 is mostly produced by this group of users.
13	rajabi_meisam Naftaalin mehrun9897 mhnajmi64 studiofarzi	This category consists mostly of political users with an opposing approach to the Islamic Republic of Iran who operate inside the country (domestic opposition). Most of the content published in this group is content category 12, which means opposition to filtering policies.

Conclusion

The engagement of Iranian users with the Metaverse peaked in the seven months following Facebook's rebranding. Subsequently, the level of attention from Twitter users to this topic has declined. There is a notable correlation between discussions on digital currencies and the Metaverse. The primary content creators on Twitter regarding the Metaverse are economic activists in the cryptocurrency market. This group generally views this technology positively and shares information about earning opportunities within the Metaverse. Another significant user segment includes those interested in emerging technologies. They actively track and disseminate the latest developments in this field to their followers. Additionally, some users, influenced by Iran's current political and social events, discuss the Metaverse in their context. They often compare Iran's

technological and economic progress with that of major companies like Facebook, highlighting Iran's perceived lag in these areas. Issues such as internet censorship policies in Iran also attract attention from this user group. There is also a contingent of Iranian users focused on the Metaverse who are alert to potential colonialist agendas. They view technologies like the Metaverse as possible tools for human subjugation, and most of the negative perspectives on the development of this technology emanate from this group.

The engagement of Iranian users with the Metaverse, as reflected in the surge of activity following Facebook's rebranding, indicates a burgeoning interest in this burgeoning digital realm. However, the subsequent decline in Twitter discussions suggests an evolving relationship with this technology. The intersection of the Metaverse with digital currencies, as evidenced by the active participation of economic activists in the cryptocurrency market of Iran, underscores the Metaverse's potential as a new frontier for economic opportunities. This is further complemented by the contributions of tech enthusiasts who keep the discourse vibrant with updates on emerging technologies.

Yet, this enthusiasm is tempered by a critical perspective from those who contextualize the Metaverse within Iran's unique political and social landscape. Comparisons with global tech giants reveal a perceived technological and economic disparity, while concerns about internet censorship highlight broader issues of digital freedom and access.

Ethical considerations

The authors have completely considered ethical issues, including informed consent, plagiarism, data fabrication, misconduct, and/or falsification, double publication and/or redundancy, submission, etc.

Conflicts of interests

The authors declare that there is no conflict of interests.

Data availability

The dataset generated and analyzed during the current study is available from the corresponding author on reasonable request.

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