SAKARYA UNIVERSITY JOURNAL OF COMPUTER AND INFORMATION SCIENCES
VOL. 5, NO. 2, AUGUST 2022
DOI: 10.35377/saucis.04.01. 1088304

*Research/Review Article*

# Sentiment Analysis on the Metaverse: Twitter Data

Gulsum Akkuzu Kaya[1]
[1]Corresponding Author; Kirsehir Ahi Evran Universitesi; gulsum.akkuzukaya@ahievran.edu.tr; 5432704681

Received 15 March 2022; Revised 06 Jun 2022, Accepted 07 Jun 2022; Published online 05 January 2019

## Abstract

In recent days, the metaverse which is defined as virtual-reality space in which people can interact with each other in a computer-generated environment, has attracted people's attention. People have posted their opinions about the metaverse on social media platforms. Twitter is one of those platforms in which people have tweeted about the metaverse. Tweets help researchers to understand public attitudes on a subject. This research focuses on two analysis: The first one used sentiment analysis on Turkish tweets about various alternative words of the metaverse, such as karma evren, misal evren, ote evren, sahte dunya, sanal evren and internet otesi. The second focus of our research was on an analysis of a questionnaire that aimed to understand whether people are aware of the metaverse and willing to experience it or not. The result of sentiment analysis showed that the most of the collected tweets were positive about the collected tweets. The questionnaire analysis showed that the majority of participants were aware of the metaverse and would like to experience that virtual space.

**Keywords:** metaverse, sentiment analysis, social network, virtual reality, twitter

## 1. Introduction

Recently, a new concept of the Internet has been taking people's attention; 'Metaverse'. It is a combination of various aspects of technology such as social media, augmented reality (AR), virtual reality (VR), cryptocurrencies, and online gaming. The word 'metaverse' was first coined in a piece of speculative fiction named Snow Crash, written by Neal Stephenson in 1992 [1]. Stephonson defined the metaverse as a virtual-reality space in which people can interact with each other in a computer-generated environment. The metaverse provides an environment to its users' where they live mentally in a virtual world while being any physical environment. The connection between the real world and the metaverse is done through the Internet, in other words the signals received from people's bodies from the real world with physical equipment and transferred to the virtual world.

In this virtual world (i.e. metaverse), people have their avatars to experience to alternate life in a virtuality that is a metaphor of people's real worlds. This point of the metaverse could be looked at from two perspectives. On the one hand, the metaverse is the next version of the Internet and it is a great development for humanity. On the other hand, the metaverse has a scary point because it might cause serious issues to the future life and might be the reason for ending humanity. Based on these two aspects of the metaverse, we construct our hypothesis;

- H1: We can analyze Twitter users' opinions on the alternative words of metaverse and can help us to understand what they feel and think about it.

Carrying out surveys is a traditional way to assess public opinions and attitudes; however, this method has limitations, such as closed questions, sample sizes in which restricted number of observations used for determining the estimations of a given population, and spatio-temporal granularity. In order to overcome these limitations social media data has increasingly been used for understanding and analysing the public's viewpoint [2]. Twitter is one of the most commonly utilised social media platforms with 206 million daily active users globally. It provides real-time public discussions, attitudes, and reflections of different opinions from all over the world [3]. It is a popular social media platform not only for its users to express their actual opinions but also widely drawn upon by researchers to analyze these data.

Agrali et al. have focused on analysing Twitter data related to the metaverse by capturing users' opinions using sentiment analysis[4]. They evaluated tweets before and after Mark Zuckerberg's speech about the metaverse. Their research showed that the negative and neutral tweets increased while the positive tweets decreased.

## 2. Related Works

An interaction technique in the metaverse was proposed by Young et al. [5], the technique made synchronised high five gestures between physical and virtual environments. Another interactive system for the metaverse and physical-world was proposed by Ariel et al. [6], use of tablets and smart-wearables was introduced. To customize virtual characters in the metaverse, user interfaces were made by Wei et al [7]. Orgaz et al. [8] used clustering approaches to understand virtual characters and their behaviors.

Above studies mainly focused on the techniques that introduce the ways to make the communication between the physical world and the virtual world (i.e. metaverse). To propose the above techniques, analysis of user feedback and user interactivity about the metaverse were used [9]. One of the analysis techniques to understand users' opinions on a subject is the sentiment analysis technique [10]. According to Cambria sentiment analysis are the key factors to develop Artificial Intelligence [3]. Because sentiment analysis incorporates not only the text but also visual contents [11]. Public opinions and sentiments are very relevant to our daily lives therefore it is a need to analyze users' opinions to understand public opinion and make decisions on a subject [12]. Twitter data is the most used data for sentiment analysis [13].

Agrali and Aydin carried out research to analyze metaverse related data in Twitter [14]. It is the only research that analyzes the metaverse related tweets. Their research showed that most of their collected tweets were classified into the positive sentiment class. They collected tweets which only include the text "metaverse" however Turkish citizens suggested words which could be alternative words to metaverse. We therefore collected tweets include the alternative words and provide a sentiment analysis on them.

## 3. Material and Method

### 3.1. Questionnaire Analysis

We disseminated a questionnaire over the internet. The questionnaire was designed to understand whether people are aware of the metaverse. Five hundred people respond to the questionnaire, two hundred twenty females and two hundred and two hundred eighty males. We gave a very general definition of the metaverse then we asked the respondents whether they heard about it or not. There were only fifteen of them who did not have an idea about the metaverse. Two questions were about willingness and feelings about the metaverse. We asked them how they would feel if they were able to visit distant locations in the metaverse. Seventy eight respondents found it scary while others chose the options happy or excited. The last question was about their willingness to have experiences in the metaverse. Four hundred two respondents answered these questions with the option "Yes".

The interesting point was respondents who chose "Scared" for the question "People will be able to 'visit' distant locations in The Metaverse. How would you feel about it? " and "No" for the question "Would you like to have experiences in the Metaverse? " were male.

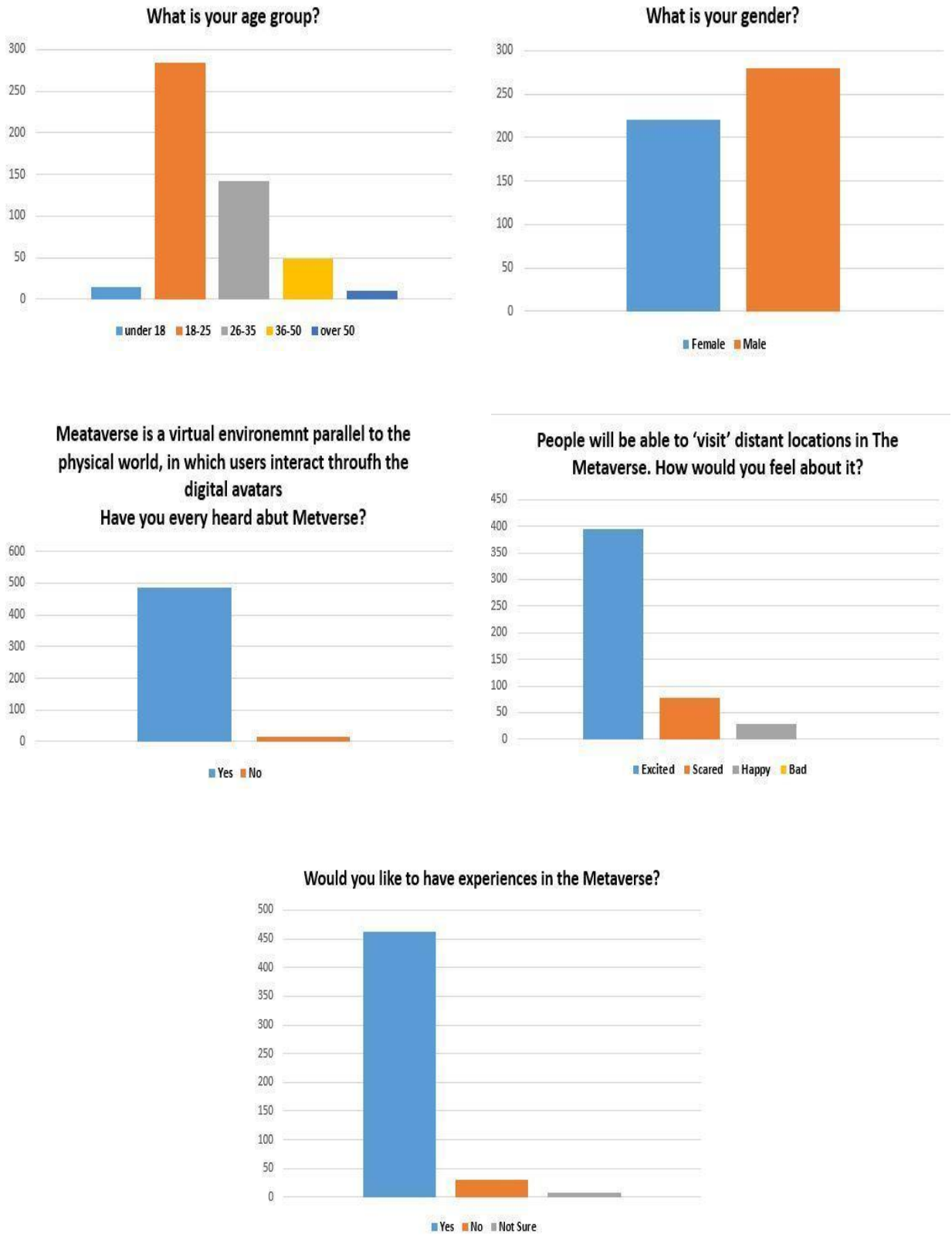



Figure 1. Results of the Questionnaire

### 3.2. Sentiment Analysis Method and Materials

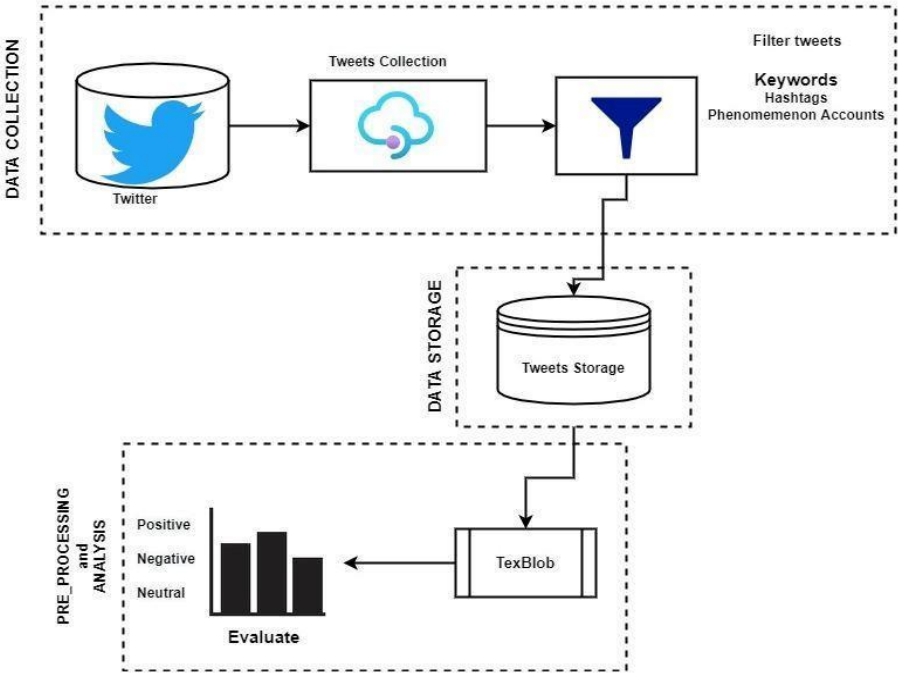



Figure 2. Structure of the methodological steps

#### Data Collection

Twitter API was used to collect metaverse related data. There were various words used to create our data set. Turkish citizens on the Twitter social media suggested words which could be alternatively used instead of metaverse. Words used to do our search on Twitter are given Table 1.

Table 1: Used Turkish words and English meanings

| **WORD** | **ENGLISH MEANING** |
|---|---|
| internet ötesi | |
| karma evren | mixed universe |
| meta evren | meta universe |
| misal evren | instance universe |
| öte evren | other universe |
| sahte dunya | fake world |
| sanal evren | virtual universe |

#### Pre-processing

Raw data are mostly redundant and consistent. This is because data may mean various expressions uploaded by different users on Twitter. We cleaned our data by taking following steps;

Customize pre-processing to recognise Turkish alphabet characters
Remove all URLs, hashtags, and targets
Remove all symbols, numbers, and punctuations
Remove stop words
Convert collected tweets to lower case
Remove repeated characters in a word if there is any
Perform the stemming and lemmatization processes.
Removal steps were not taken while world-clouds were created but the polarities of tweets were calculated. We used the Python library Textblob which uses Natural Language Processing (NLP) and also machine learning principles for analyzing every word in the dataset.

## 4. THE EXPERIMENTAL STUDY

Each tweet on the dataset was labelled with one of three values; positive, negative, and neutral.
We determined the sentiment polarity of each tweet by setting the threshold value at 0.6 which determined the direction of the sentiment. Figure 3 and Figure 4 illustrate the number of sentiments on each keyword

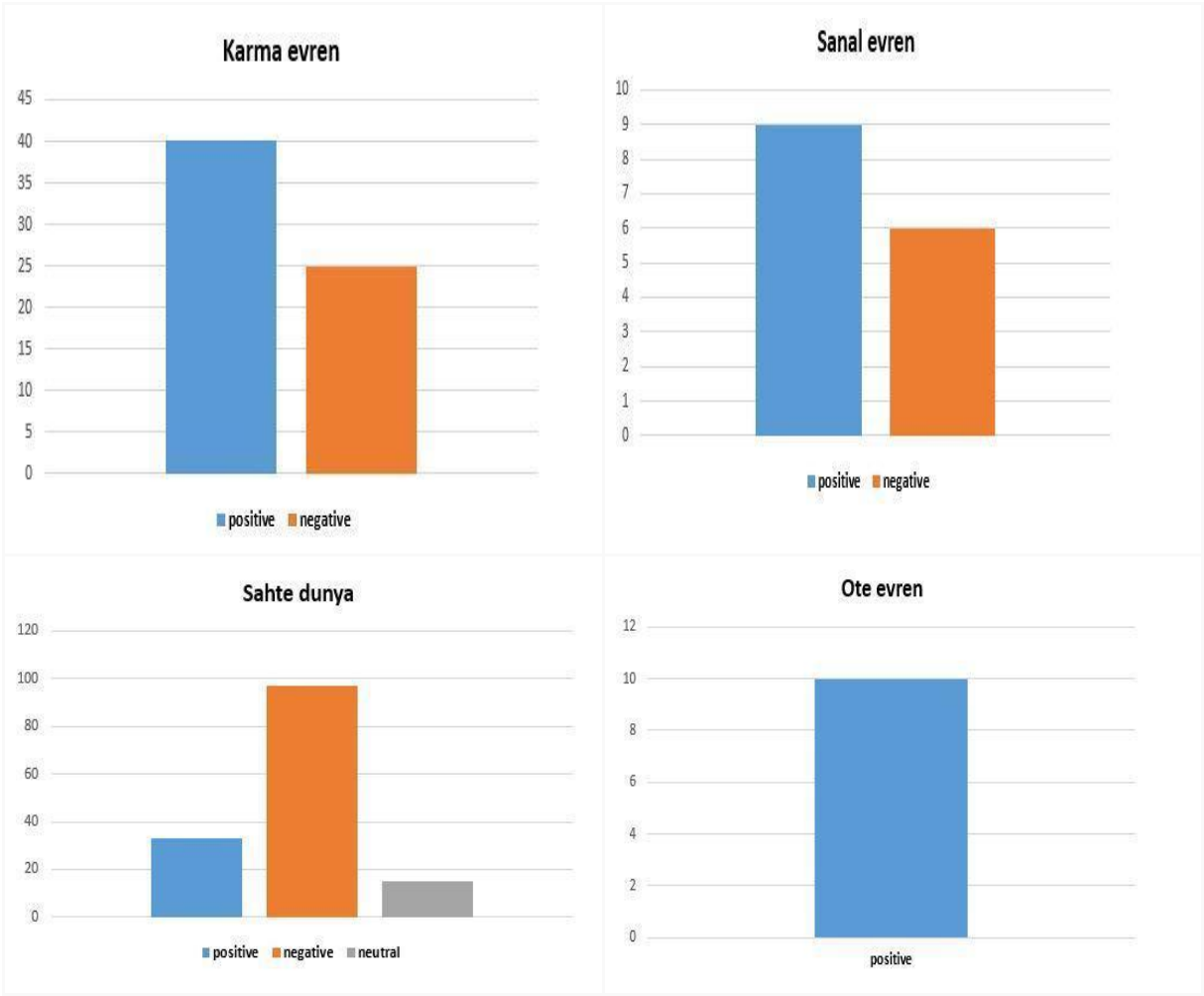



Figure 3. Sentiment analysis distribution of tweets on Karma evren and Sanal evren

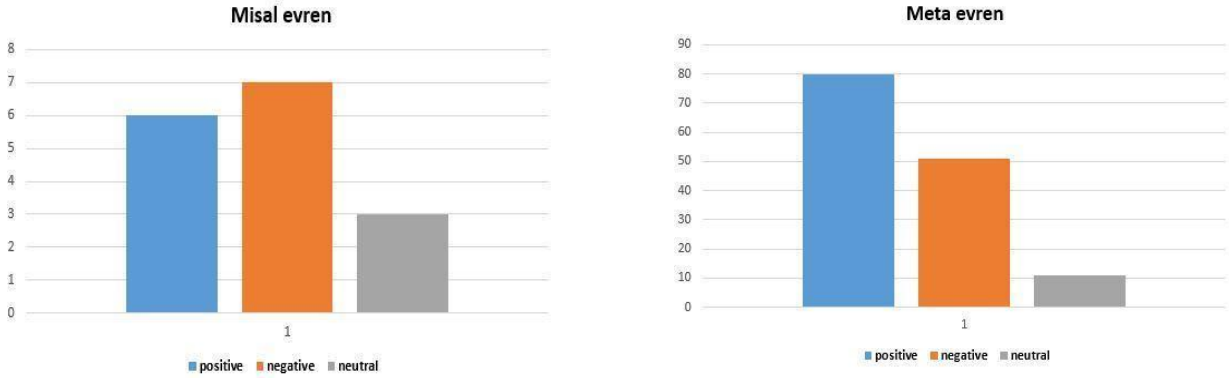



Figure 4. Sentiment analysis distribution of tweets on Sahte dunya, Ote evren, Misal evren, and MEta evren keywords

.

Figure 5 and Figure 6 depict the word distribution of the keywords.

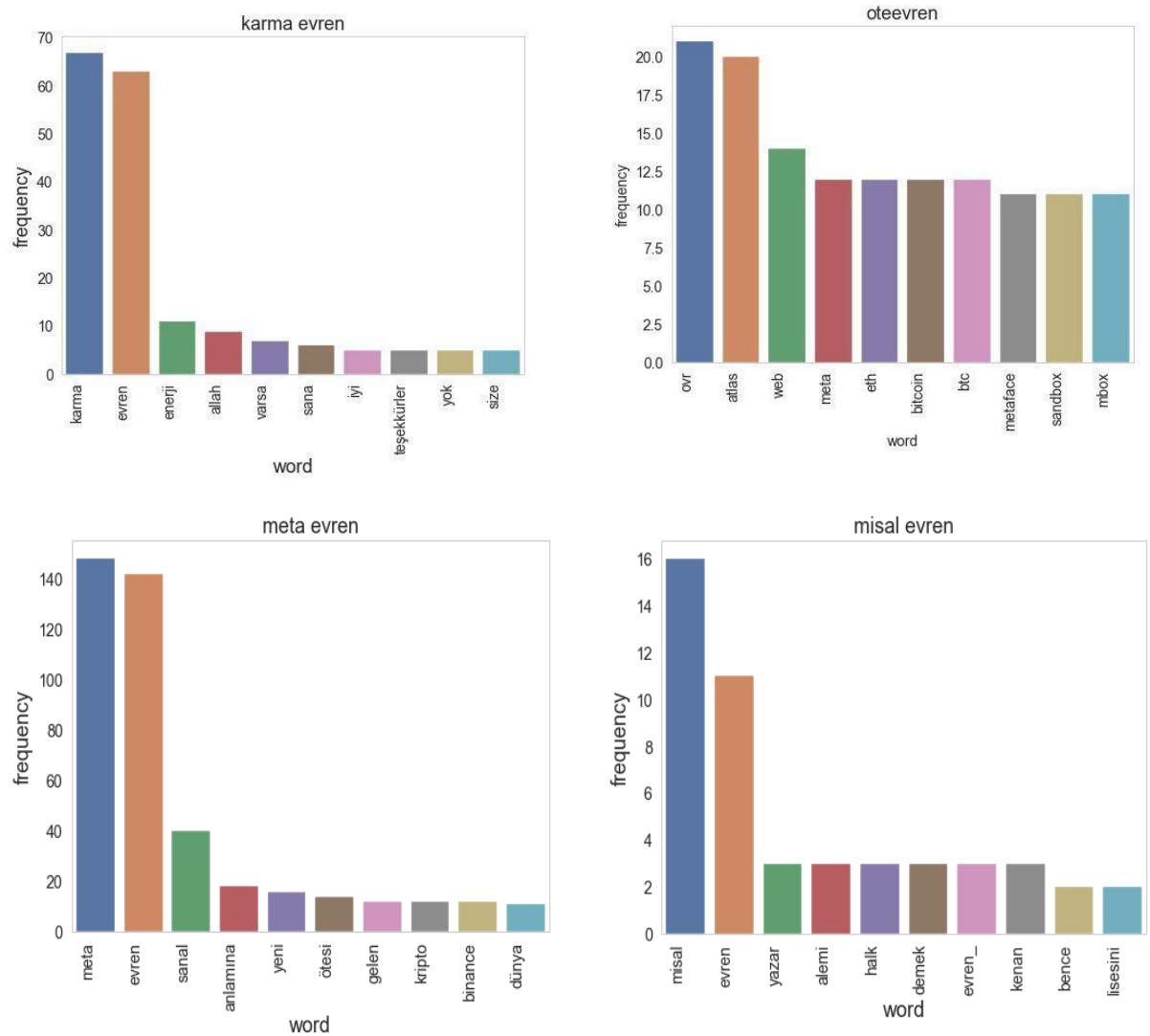



Figure 5. Word Distribution of karma evren and ote evren Keywords

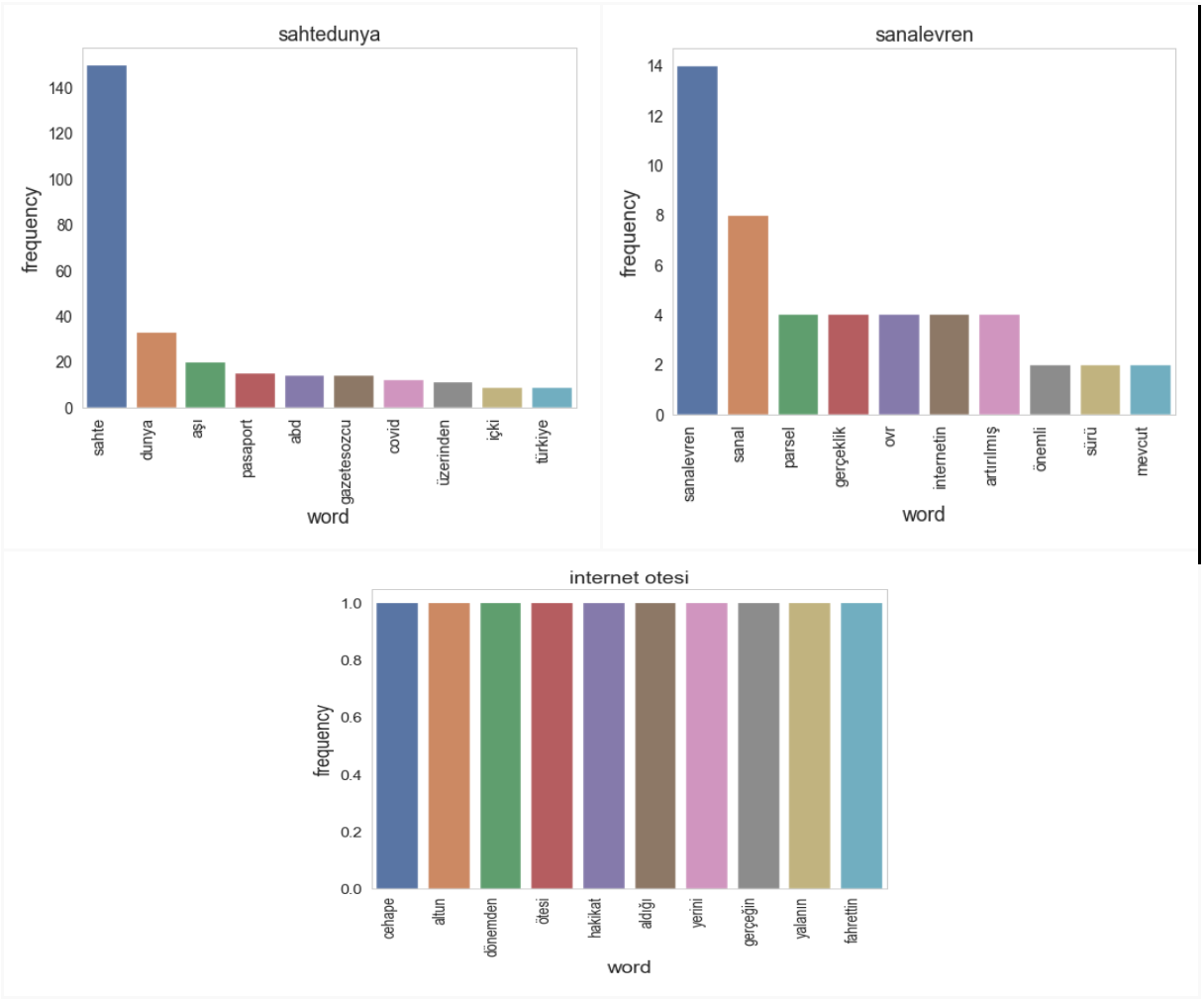
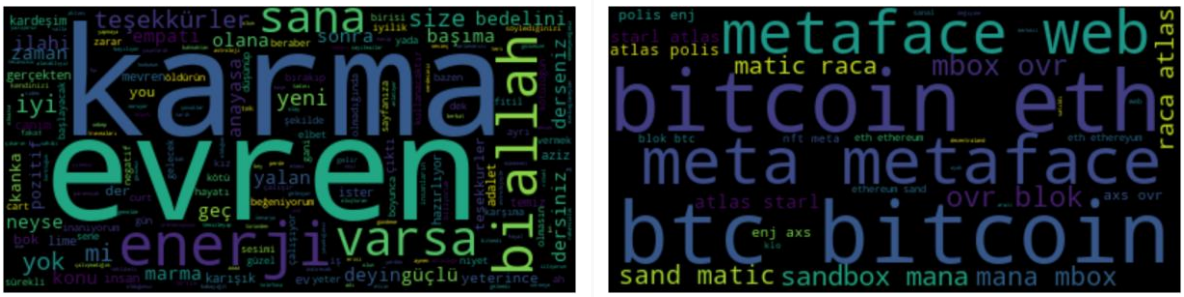



Figure 6. Word Distribution of meta evren, misal evren, sahte dunya, sanal dunya, and internet otesi Keywords

Word-Cloud of Keywords: In order to give a complete sentiment analysis, we generated word-clouds which shows the most representative words in the collected tweets data. Figure 4 shows the word-clouds exhibiting the most repeated words for each keywords dataset. Some of the keyword's word-cloud include come words related to cryptocurrency such as bitcoin, etherium, and crypto money. According to Jeon, metaverse needs cryptocurrency support [*15*]. Our word-clouds analysis showed that people post tweets related to not only metaverse but also cryptocurrency.




*karma evren* *ote evren*

Figure 7. Word Clouds for karma evren and ote evren Keywords


*meta evren*


*misal evren*


*sahte dunya*


*sanal evren*


*internet odesi*

Figure 8. Word Clouds for meta evren, misal evren, sahte dunya, sanal evren, and internet otesi Keywords

## 5. Discussion

This study provides the findings for sentiment and opinion analysis of tweets concerning the metaverse. Our research carried out on two different analysis; first one was on the questionnaire we disseminated to see whether they are aware of the metaverse and what people think about the metaverse. The second analysis was on the Twitter data related to the metaverse and its alternative words suggested by Turkish citizens. Our analysis focused on keywords given on Table 1.

From the questionnaire results shown on Figure 1, it can be deduced that many participants have been aware of the metaverse and most participants would like to have experiences. Although people want to have experiences, they have worries about the metaverse.

Table 2 illustrates some examples of the collected tweets and their polarity with scores based on our sentiment analysis. The table could be used as a proof of our results. For example, the tweet "gelecek zamanda hayatımızın kesin meta evren olacak teke tek bilim metaverse meta dünya" has a positive meaning in Turkish language and the polarity class of that tweet from our analysis was "positive". The same approach could be applied to the other texts.

Table 2: An example of Texts with Their Polarity and Polarity Score

| **Text** | **Polarity** | **Score** |
|---|---|---|
| sanal gerçeklik internetin geleceği metaverse metaverse sanal gerceklik sanal sanal evren dijitalleşme | positive | 0.70 |
| misal alemi tüm varlık için ayna görüntüsü taşıyan ve yansıtan alem maddi alemdeki evren gözle görünen her şeyin olayın şekillerini ve görüntülerini içeriyor insan hayal aracılığıyla orada gezinebiliyor | positive | 0.98 |
| gelecek zamanda hayatımızın kesin meta evren olacak teke tek bilim metaverse meta dünya | positive | 0.98 |
| gelecek zamanda hayatımızın kesin meta evren olacak teke tek bilim metaverse meta dünya | positive | 0.98 |
| infaz koruma cezaevi memuruna ek zam sanal evren olan metaverse kadar ses getirmedi | negative | 0.99 |
| alemi misal sanal evren olursa kadim alemi misal lafzı bence alemi ervah olmalı dersem bir ticaret liseli olarak haddimi aşmış olur muyum ortaksoz ducane | negative | 0.61 |
| insanlık yol ayrımına doğru gidiyor sanal evren kölesi mi olacak yoksa allah'ın kulu olarak mı kalacak metaverse meta sanal | negative | 0.82 |
| evren mevren enerji menerji karma marma ne varsa işte belki cidden işe yarıyordur diye ne kadar yurtdışıyla ilgili tweet varsa beğeniyorum belki bir şeyler olur kim bilir kötü bir şeyler olmasın diye de tweetleri seçiyorum ona göre beğeniyorum | negative | 0.66 |
| bu uygulamalar meta evren olmasa da bir dereceye kadar benzerdir meta evren henüz hayata geçmiş değildir | neutral | 0.58 |
| ayırt edemiyorlar meta evrende bunun olmayacağı ne malum anonim kullanıcıları söylemiyorum bile bu kullanıcı tacizleri nasıl engellenecek bi çok şüphe var ama görünen o ki bi matrix evreni yaratılmak isteniyor önce coin para sonra meta evren insanoğlu evrimini tamamlıyor | neutral | 0.59 |

## 6. Conclusion

This study presented two analysis about the metaverse. The first analysis was on the questionnaire that focused on understanding people's opinions about the metaverse and their willingness on having experiences on the metaverse events. The second analysis was on the tweets collected from Twitter. The second analysis mostly focused on using sentiment analysis methods on the Turkish tweets, which included the alternative words of the metaverse. Both analysis showed that people have positive thoughts about the metaverse. Besides that they also have concerns about it.

Whilst this work aimed at capturing Turkish people's opinions on the metaverse, it was subject to some limitations;

- The scope of keywords we defined in this study could be extended and this case, the results of analysis might well differ
- Not all Turkish people use the Twitter platform and hence the findings could differ if the same analysis was undertaken with different datasets.
- The questionnaire did not have large scope for disseminating it to different people
- The approach taken by this study might have missed some posts. There might have been posts with different hashtags.

## References

[1] J. Judy. "Information Bodies: Computational Anxiety in Neal Stephenson's Snow Crash." *Interdisciplinary Literary Studies 19.1 (2017): 17-47.*

[2] S. Sumit, et al. "Health monitoring on social media over time." *IEEE transactions on Knowledge and Data Engineering* 30.8 (2018): 1467-1480.

[3] G. Akkuzu Kaya, "Sentiment Analysis of Users' Reactions to Deadly Disasters Posts in Turkey: Facebook Data" . *International Journal of Multidisciplinary Studies and Innovative Technologies , 5 (2) , 167-172 . (2021).*

[4] Ö. Agrali, & Ö. Aydin. "Tweet Classification and Sentiment Analysis on Metaverse Related Messages". *Journal of Metaverse, 1(1), 25-30. (2021).*

[5] K. Young Mary., J. J. Rieser, and B. Bodenheimer. "Dyadic interactions with avatars in immersive virtual environments: High fiving." *Proceedings of the ACM SIGGRAPH Symposium on Applied Perception*. 2015.

[6] A. Vernaza, V. Ivan Armuelles, and I. Ruiz. "Towards to an open and interoperable virtual learning enviroment using Metaverse at University of Panama". In 2012 Technologies Applied to Electronics Teaching (TAEE), pages 320–325. (2012).

[7] W., Yungang, et al. "The Design of a Visual Tool for the Quick Customization of Virtual Characters in OSSL." *2015 International Conference on Cyberworlds (CW). IEEE, 2015.*

[8] O., Gema Bello, et al. "Clustering avatars behaviors from virtual worlds interactions." *Proceedings of the 4th International Workshop on Web Intelligence & Communities. 2012.*

[9] D., Haihan, et al. "Metaverse for social good: A university campus prototype." *Proceedings of the 29th ACM International Conference on Multimedia*. 2021.

[10] C., Iti, et al. "Distinguishing between facts and opinions for sentiment analysis: Survey and challenges." *Information Fusion* 44 (2018): 65-77.

[11] S. Rada, J. Fernando, and C. A. Iglesias. "Social context in sentiment analysis: Formal definition, overview of current trends and framework for comparison." *Information Fusion* 52 (2019): 344-356.

[12] L., Lizhen, X. Nie, and H. Wang. "Toward a fuzzy domain sentiment ontology tree for sentiment analysis." *2012 5th International Congress on Image and Signal Processing*. IEEE, 2012.

[13] R., Abdur, M. Sadat, and S. Siddik. "Sentiment Analysis on Twitter Data: Comparative Study on Different Approaches." *International Journal of Intelligent Systems & Applications* 13.4 (2021).

[14] A., Waseem, et al. "Topics, Sentiments, and Emotions Triggered by COVID-19-Related Tweets from IRAN and Turkey Official News Agencies." *SN Computer Science* 2.5 (2021): 1-19.

[15] J., Hyun-joo, et al. "Blockchain and AI Meet in the Metaverse." *Advances in the Convergence of Blockchain and Artificial Intelligence* (2022): 73.