International Journal of Multiphysics
Volume 19, No. 1, 2025
ISSN: 1750-9548

Analyzing and Identifying Narcissistic Traits in Instagram Reels Through the Application of Machine Learning Algorithms

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Abstract

The objective of this research was to investigate and identify narcissism in Instagram Reels content through the use of machine learning algorithms. The research methodology includes data collection, processing, analysis, and the application of machine learning algorithms. Machine learning methods and text analysis are employed to examine the data. The data is classified using the Support Vector Machine (SVM) algorithm, and the outcomes are assessed based on F1, accuracy, and recall metrics. These metrics assist in evaluating the model's performance and accuracy in detecting narcissism and in comparing the model's results with actual data. The findings indicate a strong correlation between narcissism and user behavior on social networks, particularly Instagram.

Keywords: Narcissism, Instagram Reels, Machine Learning Algorithms

Introduction

Narcissism, as a personality trait, is defined by self-centeredness, a desire for admiration and attention, and a tendency to feel superior to others. Narcissistic individuals seek validation and praise from others but are unable to return the same. They employ behavioral strategies such as exhibitionism and attention-seeking actions [1]. Due to their intense desire to protect their ego and attract attention, narcissists tend to be more engaged with social media [2]. Research has shown that narcissistic individuals in social networks often fulfill their need for social approval by increasing their number of friends, followers, and interactions. For instance, a study by Bergman et al. in 2011 [3] revealed that narcissistic users on Facebook had more friends than non-narcissistic users, and this was directly tied to their need for social validation. These individuals are perpetually seeking attention, and their actions are often tailored to gain the most positive responses from others. As a result, Facebook, being one of the most widely used social media platforms, has become a prime environment for such behaviors due to its interactive nature [4].

Numerous studies have indicated that media platforms like Instagram and Twitter, due to their ability to share personal images and videos, offer an ideal space for narcissistic users to showcase themselves and receive feedback from others. For instance, Menon [5] concluded in a study that Instagram, with its Reels feature, has created an ideal environment for narcissistic users because of the short and captivating nature of its videos. Social networks, particularly Instagram, Facebook, and Twitter, have increasingly contributed to amplifying narcissistic traits as tools for gaining attention. A study by McCain and Campbell [6] demonstrated that the time spent on these platforms, the number of status updates, the number of friends or followers, and even the number of selfies posted by users are all directly linked to their level of narcissism.

Narcissistic individuals use social media as a means to enhance their self-esteem. Due to their constant desire for validation and admiration from others, they are continually seeking attention and utilizing tools such as likes,

comments, and follower counts to satisfy this need. In other words, narcissists are highly reliant on positive feedback from others to uphold their sense of worth and self-esteem. This dependency on social feedback can provide a temporary boost to their self-esteem, but the long-term effects of such behavior are often detrimental [7].

Self-esteem in the virtual world is heavily influenced by social networks. Instagram and Facebook users, due to frequent interactions with others and the desire to be noticed, become highly dependent on social approval. This is particularly true for narcissistic individuals who have an ongoing need for admiration. They use various tools on social media to attract attention and aim to present an idealized version of themselves. Specifically, selfies and posts that highlight personal successes and accomplishments are strategies narcissistic users employ to enhance their self-esteem. Rather than relying on authentic self-confidence, these individuals depend on feedback from others to feel valued [7].

A study by Bergman et al. (2011) explored narcissistic behaviors on social media and found that narcissistic individuals tend to use platforms like Facebook to draw attention. The study revealed a direct link between narcissism and online interactions, particularly the number of friends and posts. These individuals are continuously seeking admiration and use social networks as tools for self-presentation. The findings of this study indicated that social networks serve as an ideal platform for self-display, reinforcing narcissistic traits [3]. In Menon's (2022) study, the connection between the use of Instagram Reels and narcissistic behaviors was examined. This research demonstrated that the visual and interactive features of Reels, due to the brief and engaging nature of the videos, offer an ideal opportunity for narcissistic users to capture others' attention. By using Reels, these users aim to present content that makes them more visible and garners more admiration. The frequent use of this feature was found to correlate with a higher level of narcissism [2]. Zhang et al. (2018), using machine learning techniques, investigated the relationship between the popularity of Instagram posts and narcissistic behaviors. The study revealed that narcissistic users quickly gain popularity on social media by posting personal and engaging content. The researchers found that these users rely on likes and comments to seek social approval, which further amplifies their narcissism [8].

Paramboukis et al. (2016) studied the relationship between narcissism and self-esteem among Instagram users. The study found that narcissistic users seek social approval through personal posts and images. Specifically, the research showed that these individuals depend on positive feedback to boost their self-esteem; however, this dependence over time can lead to a decline in their true self-esteem. Narcissistic users assess their self-esteem based on the number of likes and followers they receive [9]. A study by Jin and Moghaddam (2018) examined whether narcissists are more likely to follow other narcissists. The results of this research showed that narcissistic users, due to similar personality traits, tend to engage with other narcissistic users. This behavior was especially evident on Instagram, where narcissistic users reinforce their traits by following one another. Additionally, popularity on this platform exacerbates narcissistic behaviors [1]. In another study, Menon (2022) also explored the impact of Instagram on user narcissism. The research showed that the visual features of this platform, particularly Reels, enable users to quickly attract attention by posting short and engaging content. Narcissistic users employ this tool to seek admiration and social approval, and this behavior gradually strengthens their narcissism [2].

Balci and Karaman (2020), in a comparative study, investigated cultural differences in the use of Instagram and its impact on narcissism and self-esteem. The research found that in all cultures, narcissistic users seek to attract more attention through personal posts and their images. However, the results indicated that continuous use of this platform can result in a decline in self-esteem, as narcissistic users become increasingly dependent on feedback from others. This dependence over time has negative effects on their psychological well-being [7].

Kotler et al. (2021), using machine learning algorithms, successfully detected narcissism from textual content published on social media. The study demonstrated that artificial intelligence tools can identify signs of narcissism by analyzing the content of posts and comments. The researchers discovered that machine learning models, such as LIWC, can effectively detect narcissistic traits in the texts of social media users [11].

Grouda et al. (2021), using machine learning algorithms, analyzed narcissistic behaviors on Twitter. The study revealed that narcissistic users on this platform tend to publish self-centered content and seek attention and

approval from others. Neural network algorithms were able to uncover hidden patterns of narcissistic behaviors among Twitter users, demonstrating that these individuals are constantly pursuing self-display and attention [12]. Huang et al. (2016) explored the relationship between narcissism and brand impact management on Instagram. The study found that narcissistic users attempt to attract more attention by presenting themselves as brand representatives. These users utilize Instagram as a tool to showcase a luxurious lifestyle and personal accomplishments, reinforcing their narcissism through such behavior [13]. Ramadhani and Hadi (2021), using a Support Vector Machine (SVM) algorithm, classified the textual content published in Instagram captions. The research revealed that narcissistic users have distinctive features in their writing that can be detected by this algorithm. The study highlights the potential of artificial intelligence in identifying narcissistic behaviors in textual content [14].

Karait et al. (2021), using neural networks, identified offensive comments and narcissistic behaviors on Instagram. The results of the study indicated that deep learning algorithms can accurately detect narcissistic behaviors in comments and user interactions. These users tend to seek attention through provocative and self-centered language [15]. Brieliani et al. (2019) employed the K-nearest neighbor algorithm to identify hate speech in Instagram comments. The study found that narcissistic users are more likely to post negative and provocative content to attract attention. Machine learning algorithms were able to accurately identify these behaviors [16]. Rahman (2021) examined the impact of social networks like Instagram and TikTok on expanding students' vocabulary. Although the primary focus of the study was on language learning, the results revealed that narcissistic users utilize these platforms to attract attention and present themselves [17].

Tersi Ryan, in their article [4], explored the unprecedented popularity of the Facebook social network in promoting narcissism. While research has begun to identify the types of people who use Facebook, this line of study has largely focused on the student population. The study included 1,324 Australian internet users (1,158 Facebook users and 166 non-Facebook users) aged between 18 and 44. Participants were asked to complete an online questionnaire that assessed five factors. The results revealed that Facebook users tend to be more extroverted and narcissistic than non-users, but are less socially conscientious. Additionally, Facebook users displayed specific traits such as irritability, jealousy, isolation, shyness, and narcissism.

From a psychological perspective, narcissists have a strong tendency towards admiration and self-presentation. One study found a significant connection between narcissism and reward-seeking behavior. Article [18] introduces a complex adaptive mental network model for understanding narcissists. Media platforms like Facebook, Twitter, or Instagram can serve as new channels for self-promotion for narcissists. This article explores how popularity can influence an individual's behavior adaptively. To analyze this behavior, the article examines the relationship between popularity and narcissism on 30 Instagram profiles, using text analysis and various artificial intelligence techniques to detect narcissism.

Social media networks function as platforms for content dissemination and tools for accessing information. Article [7] draws on existing literature regarding the relationship between potential mental health disorders and the performance of these platforms to understand their impacts on factors such as self-esteem and emotions.

The relationship between narcissism and the use of social media has been a topic of study since the emergence of the first social media websites. Article [6] presents two potential models to explain narcissistic patterns. This article considers the following four parameters for assessing narcissism: (a) time spent on social media, (b) frequency of status updates/tweets on social media, (c) number of friends/followers on social media, and (d) frequency of posting selfies on social media. Social media inherently involves self-presentation to audiences and the potential for feedback from them. Two perspectives exist regarding the relationship between narcissism and social media behavior: (a) social media as an opportunity for magnification and gaining desirable attention, and (b) social media as a catalyst for increasing narcissism [19].

Article [20] examines whether collective narcissism is linked to the frequency of use of popular social media sites such as Instagram, Reddit, and Twitter. The regression analysis in this article revealed that collective narcissism is associated with increased use of Instagram and Twitter. Study [21] investigates how narcissism manifests, collecting reports of narcissistic personalities from social media profile owners. The aim of the study [22] was to

explore the relationship between empathy and narcissism in adults. The findings indicated that certain Facebook activities, such as chatting, are associated with empathetic aspects in men.

In recent years, the study of online behaviors, particularly narcissistic behaviors on social media, has gained significant importance from both psychological and computer science perspectives. Alongside psychological and sociological analyses that have sought to explain narcissistic behaviors in virtual spaces, artificial intelligence techniques have also played a crucial role in analyzing and identifying these behaviors. The use of machine learning algorithms and neural networks to analyze large and complex social media data has enabled researchers to identify hidden patterns in narcissistic behaviors and predict them with greater accuracy.

One of the main applications of artificial intelligence in this field is the analysis of the textual and visual content posted by users. For example, a study conducted by Jabin et al. [18] explored the relationship between narcissism and online popularity. This research employed AI algorithms to analyze Instagram profiles. Machine learning algorithms and advanced data analysis techniques, particularly in the field of Natural Language Processing (NLP), enable precise analysis of textual content posted on social media platforms. For instance, a study by Kotler et al. [11] demonstrated that natural language processing tools, such as LIWC (Linguistic Inquiry and Word Count), along with machine learning algorithms, can identify the level of narcissism in users by analyzing their written content.

Additionally, other studies have shown that the use of neural network algorithms and supervised learning models can help identify and predict narcissistic behaviors on social media platforms. For example, a study by Geroda et al. [12] explored the relationship between narcissistic behaviors and user interactions on Twitter, utilizing neural network algorithms for data analysis. In addition to the negative impacts on social relationships, narcissism on social media can have widespread effects on individuals' mental health. People who are constantly seeking validation and attention through social media may, over time, experience issues such as anxiety, depression, and a decline in self-esteem.

The importance of studying narcissism on social media can be examined from several perspectives. The first and most crucial aspect is the harmful effects this trait can have on individuals' social relationships and collective psychology. Narcissists tend to engage in behaviors that attract attention and validation from others, but these actions are often accompanied by a disregard for the needs and feelings of others. As a result, narcissistic behaviors can lead to the breakdown of human relationships and a decrease in empathy. Investigating narcissism on social media from this perspective can help identify these behaviors and prevent their negative consequences. From a scientific and research standpoint, studying narcissism on social media, especially in Instagram Reels, can further our understanding of the relationship between human behavior and digital technologies.

In conclusion, artificial intelligence techniques play a crucial role in analyzing and identifying narcissistic behaviors on social media platforms. Machine learning algorithms, neural networks, and decision-support models have helped researchers uncover hidden patterns in users' online behaviors and accurately predict narcissism on these platforms. These techniques not only enable the identification of narcissism but also assist researchers in forecasting future trends in narcissistic behaviors and analyzing their impact on users' social interactions. Given the increasing use of social media and the significance of analyzing user behaviors in these spaces, the use of AI techniques for identifying and predicting narcissism has become a key topic in scientific research. Therefore, this study aims to investigate and detect narcissism in Instagram Reels using machine learning algorithms.

Research Methodology

The data sources for this research consist of two main sections: data extracted from Instagram Reels content and supplementary data from credible scientific sources. For this study, content from 1,500 Instagram Reels videos with the highest views and interactions (likes, comments, and shares) within a specific time frame has been collected. The Reel data includes the following information:

- Title and accompanying text: Including brief text descriptions provided by users alongside their videos.
- Number of likes and comments: Used to measure user interaction with the published content.

- Number of views and shares: Indicating the popularity of the video content.
- Hashtags used: Hashtags serve as thematic keywords that help categorize the content.
- **Time of Reel Posting:** Temporal information for examining patterns of user interaction.

To select appropriate samples from the millions of videos published on Instagram, a purposive sampling method was employed. The criteria for sample selection were as follows: videos with a higher-than-average number of likes, comments, or views; videos in which narcissistic behaviors (such as self-display or attention-seeking) were observed; textual content and hashtags in various languages (such as English, Persian, and Spanish) were chosen to ensure broader analysis; and samples were selected from accounts with different geographical locations to increase the generalizability of the research results.

The data were split into a 70% training set and a 30% test set. A 5-fold cross-validation method was used to assess the models. Evaluation metrics included Accuracy, Recall, and the F1 score. The selected models were chosen for their high ability to analyze complex data and their strong performance in similar studies.

The data analysis process was step-by-step, including data preprocessing, feature extraction, and the implementation of machine learning models to detect narcissistic behaviors in Instagram Reels content. Machine learning techniques and text analysis were used for data analysis in this research. The data were classified using a Support Vector Machine algorithm, and their results were evaluated using F1, accuracy, and recall metrics. These metrics help identify the efficiency and accuracy of the model in detecting narcissism and compare the model's results with actual data.

Findings

Table (1) shows the main statistical information related to the data.

Table 1: Descriptive Statistics of the Data Features

Feature	Mean	Median	Standard Deviation	Minimum Value	Maximum Value
Number of likes	12,500	10,300	8,750	500	98,000
Number of comments	1,200	950	850	10	12,000
Number of shares	1,500	1,200	1,050	20	15,000
Length of text (words)	15	12	8	1	75
Number of hashtags	7	6	3	1	30
Time between posts (days)	2.5	2	1.5	0.5	10

Table (1) indicates that the average number of likes is 12,500, reflecting high user engagement with the selected videos. Furthermore, the number of comments and shares exceeds the average for typical Instagram content, confirming the careful sample selection based on high interaction levels. Regarding textual features, the average text length is 15 words, showing that the captions are concise. The use of hashtags, averaging 7 per Reel, has also significantly contributed to enhancing the visibility and accessibility of the content.

Table 2: Percentage of Cleaned Data at Each Stage

Stage	Number of Initial Data	Number of Deleted Data	Number of Deleted Data	Number of Remaining Data
Initial Data	1,500	-	-	1,500
Removal of Irrelevant Data	1,500	200	13.3%	1,300
Removal of Duplicate Data	1,300	150	11.5%	1,150
Handling Imbalance	1,150	150	13%	1,000

In the preprocessing process, approximately 33.8% of the initial data were deleted. A significant portion of this data consisted of irrelevant or duplicate videos that could not provide meaningful information for analysis. These actions contributed to a more uniform and higher-quality dataset (Table 2).

Next, key features for analyzing narcissistic behaviors in Instagram Reels were identified and extracted (Table 3).

Table 3: Selected Features and the Reason for Selection

Feature	Type	Reason for Selection
Number of likes	Interactive	Indicates the level of user attention to the content
Number of comments	Interactive	Reflects the attractiveness and engagement stimulation
Text sentiment	Textual	Sentiment analysis to identify narcissism in content
Number of hashtags	Hashtag	A high number of hashtags may indicate attention-seeking behavior
Time interval between posts	Temporal	Examining temporal patterns for narcissistic behaviors

Table 4: Model Performance in Detecting Narcissism

Model	Accuracy (%)	Recall (%)	F1 Score (%)
Support Vector Machine (SVM)	87.5	84.3	85.9
Artificial Neural Network (ANN)	91.2	89.8	90.5
Random Forest	88.7	85.6	87.1

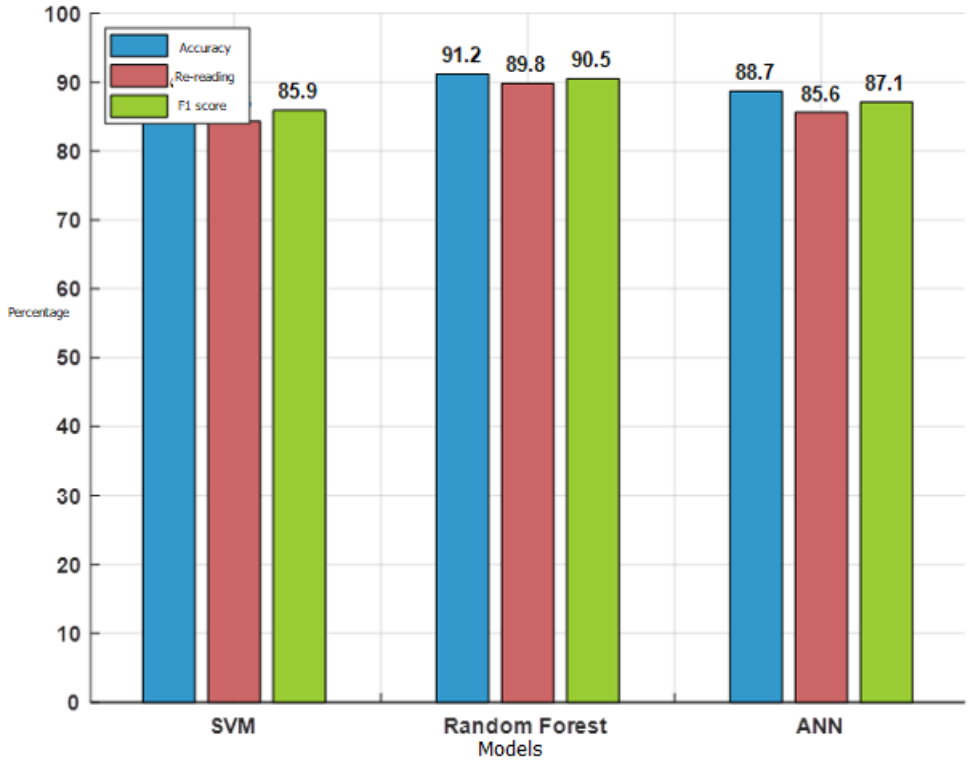

Figure 1: Comparison of Model Metrics

According to Table (4) and Figure (1), the Artificial Neural Network (ANN) achieved the highest performance among the models, with an accuracy of 91.2%, recall of 89.8%, and an F1 score of 90.5%. This superior performance is attributed to ANN's capability to detect complex patterns and capture non-linear relationships between features. The SVM model also delivered acceptable results but was slightly less effective than ANN in

detecting positive samples, as shown by its lower recall score. The Random Forest model demonstrated consistent performance due to its interpretability, though its overall accuracy was lower compared to the ANN.

To examine the impact of different features on narcissism prediction, the model coefficients and feature importance analysis methods were used.

Table 5: Importance of Different Features Based on Model Coefficients

Feature	Importance (%)	**Feature Type**
Number of likes	28.4	Interactive
Text sentiment	23.1	Textual
Number of hashtags	19.7	Hashtag
Number of comments	14.5	Interactive
Time interval between posts	9.6	Temporal
Type of text vocabulary	4.7	Textual

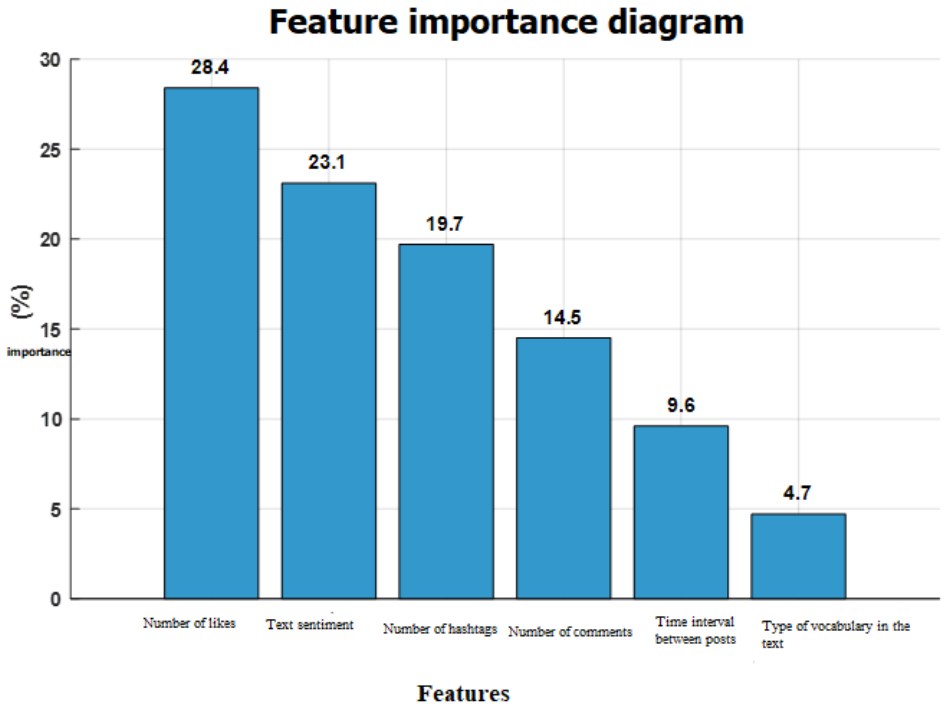

Figure 2: Feature Importance Chart

The feature "number of likes," with an importance score of 28.4%, had the strongest influence on predicting narcissism. This finding suggests that videos receiving higher attention are more likely to include narcissistic content. Text sentiment, with an importance of 23.1%, indicates that overly positive or attention-seeking language can be a sign of narcissistic behavior. The feature "number of hashtags" also showed a notable impact, as it directly relates to content visibility and the potential to draw attention (see Table 5 and Figure 2).

Table 6: User Behavioral Patterns Related to Narcissism

Feature	**Average Narcissistic Users**	Average Normal Users	Difference (%)
Average number of likes	15,200	8,500	+78.8
Average number of comments	1,500	850	+76.5
Average number of hashtags	12	5	+140.0

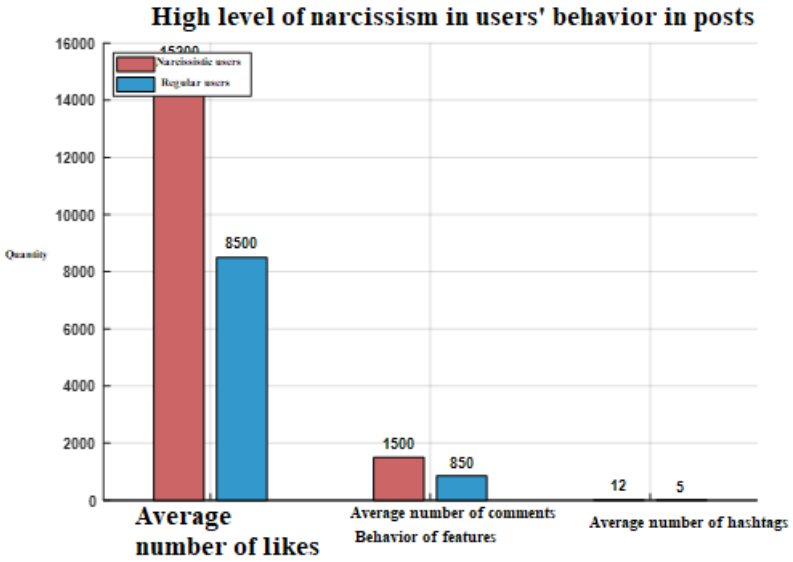

Figure 3: User Behavior in Posts with High Narcissism Levels

Based on Table (4) and Figure (3), narcissistic users have significantly more engagement with their posts compared to normal users. The average number of likes and comments is considerably higher in narcissistic posts, indicating that these users likely display behaviors that lead to increased interactions. Additionally, the excessive use of hashtags (+140%) indicates these users' efforts to attract attention and gain more visibility.

Conclusion

The findings of this research showed that high user engagement with narcissistic content—such as a large number of likes, comments, and shares—reflects users' tendency to focus on such content. Machine learning analysis confirmed that factors like the number of likes, text sentiment, and hashtag count have the greatest impact on predicting narcissistic behavior. Among the algorithms used, the ANN model performed best, with an accuracy of 91.2%, recall of 89.8%, and an F1 score of 90.5%, demonstrating its strong capability in handling complex data. Narcissistic users received more interactions than typical users and frequently used hashtags to gain more attention. These findings support a strong connection between narcissism and user behavior on social media, particularly on Instagram.

The results of this study align with several elements of previous research. As highlighted in related studies (e.g., studies [10] and [11]), interactive elements such as the number of likes, comments, and shares are important for identifying narcissistic behavior. This research also found that likes and comments, as main indicators of user engagement, play a key role in predicting narcissism. Consistent with the findings in the study [12], this research showed that positive and attention-seeking sentiments in reel captions significantly contribute to the emergence of narcissistic traits. The frequent use of hashtags by narcissistic users also aligns with prior studies. Study [13] confirmed that hashtags serve as effective tools for attracting attention and increasing visibility on social platforms. Overall, the findings of this research regarding indicators like user interaction, sentiment in text, and hashtag use are in agreement with earlier research, reinforcing the validation of results within the current scientific framework.

Nonetheless, this research also highlighted some distinctions from earlier studies. In this study, factors like the time gap between posts and specific posting times were found to be influential, which most previous research did not consider. This variation likely results from this study’s emphasis on analyzing temporal trends. While many earlier works relied on one or two algorithms, this research employed a combination of advanced methods such as SVM, ANN, and Random Forest. This strategy led to improved accuracy and more thorough data analysis. The data for this study were collected from Instagram reels featuring both geographical and linguistic diversity, unlike many past studies that focused on limited communities. This variation could enhance the generalizability of the results.

One limitation of the research is that sampling from 1,500 Instagram reels may not be sufficient to generalize the results to the entire user base. The textual data used were selected from a few limited languages, which may not provide a comprehensive perspective.

Brands can use this model to spot influencers with narcissistic traits. Although such individuals may attract a larger following, their narcissistic behavior could damage the brand's image. Understanding these traits more deeply allows brands to craft content that better engages audiences and boosts interaction. By examining users' reels, behavioral patterns tied to narcissism can be identified and applied to refine marketing strategies.

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