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Original Research

Sentiment Analysis in the AI-Based Social Networks

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Abstract

Recent developments in emerging technologies have enabled users to interact with social networks. Nowadays, one of the ways of interaction is to understand the real feelings of people at the moment, the outcome of which, based on the people's reaction and attitude, appears in analyzing feelings like facial features, type of speech, or the people's jobs such as video, photograph, voice, and text. In this research, through deep learning and machine learning in the AI, the sentiment analysis has been studied and evaluated using AI and deep learning algorithms like motion detection, body language recognition, image processing, sound and text processing, computer vision, natural language processing and different network techniques. The paper, providing a new conceptual model design, has provided more details about sentiment analysis in social networks by incorporating AI techniques in social networks with high speed and accuracy.

Keywords: Sentiment Analysis, Social Media, Artificial Intelligence, Deep Learning.

Introduction

Information and knowledge analysis in the third millennium has become the main wealth of organizations. Commercial enterprises and production centers are looking for benefit analysis of this wealth in their serious decisions in dynamic environments as much as possible to take a competitive advantage (Babu & Kanaga, 2022). As the primary media, social media is leading in the emerging technologies to introduce favorites, emotions, desires, and behaviors of all societies (Wang, Kou, Sugumaran, Luo & Zhang, 2020). In these times, sentiment analysis is introduced as an important issue in most areas of innovative business, including manufacturing, business, medicine, agriculture academy, and so on (Tumasjan, Sprenger, Sandner & Welpe, 2010). The term sentiment analysis was first considered by Yi, Nasukawa,

Bunescu, and Niblack in 2003 and meant to use ways to study the beliefs, feelings, evaluations, and tendencies of people about different issues such as products, events, political and social problems (Williams, Bannister, Arribas-Ayllon, Preece & Spasić, 2015). In the last years of the 20th century, we witnessed the emergence of a new kind of social scientist, i.e., non-verbal behavior specialists, in the direction of emotion analysis (Appel, Chiclana, Carter & Fujita, 2016). Non-verbal aspects of communication have been seriously studied since the 1700s. Public awareness of these studies increased significantly when Julius Fast published a book about body language. The book summarized behavioral scientists' work on non-verbal communication until then (Yang, McEwen, Ong & Zihayat, 2020). The sentiment analysis based on deep learning in the AI field, at the moment, is considered a globally significant research topic, and many researchers in large business and internet companies are working in the field mentioned (Chen, Zhang, Liao, Luo, Shen & Feng, 2022). Currently, providing methods that increase accuracy and efficiency in the field of sentiment analysis in social networks, has been considered very important (Tao, Dharmalingam, Zhang, Zhou, Li & Gururajan, 2019; Atmaja & Sasou, 2022) and will have tremendous effects on E-commerce, marketing, sale, politics, economy, psychology and health cares, stock sales forecast (Arora & Arora, 2019; Kumar, Sharma & Arora, 2019).

Many deep learning architectures are used to increase accuracy with different machine learning algorithms including motion detection, detecting gestures, movement, and body language by the use of image processing algorithms, pattern detection, sound processing, text processing, machine vision, and different types of artificial neural networks, building robots and computer games, financial issues and so on (Wang et al., 2020; Poria, Cambria, Howard, Huang & Hussain, 2016). All the machine learning-based sentiment analysis methods have weaknesses and strengths that will be studied and overviewed in the following. About what has been introduced, the present paper will review the previous literature on recognizing and analyzing feelings in social networks based on AI (Schouten & Frasincar, 2015). The research results indicate the importance and necessity of the emerging technologies of AI, machine learning, and the algorithms of image processing, machine vision, motion detection, sound processing, text processing, and so on (Yang, Na & Yu, 2022; Yang, Liu, Lin & Lin, 2016). This paper builds on previous research by providing conditions where other researchers can collect results, assess the advantages and disadvantages of different algorithms, and enhance their knowledge through a methodological approach. This paper also aims to promote innovative ideas by utilizing the literature on the subject. Therefore, from a theoretical point of view and as one of the efficient tools in the decision-making process, employing sentiment analysis in social media for any large organization should be a prospective method. If people are aware of these behaviors, they can be used efficiently and effectively in making intelligent decisions, leading to a higher success rate. The present research tries to 1- answer the question of what role sentiment analysis plays in AI-based social media and also 2- achieve a new technique and algorithm by comparing the deep learning algorithms in social media and provide a conceptual model that can analyze and present the details of feelings in social media more accurately and in less time.

Literature Review

Due to the process of recognition and detection, understanding the relationship between people, groups, and internet organizations, and collecting accurate information towards

development and satisfaction with businesses, sentiment analysis in social networks is essential (Li et al., 2021). Analyzing behavioral emotions and classifying all types of texts, pictures, sounds, and micro videos based on whether the content is positive, negative, or neutral is called sentiment analysis (Babu & Kanaga, 2022). The primary purpose of sentiment analysis is to process users' and customers' behaviors and interests in a way that helps develop the businesses (Tanna, Dudhane, Sardar, Deshpande & Deshmukh, 2020; Yue, Chen, Zuo & Yin, 2019). Figure 1 illustrates the steps of the sentiment analysis.

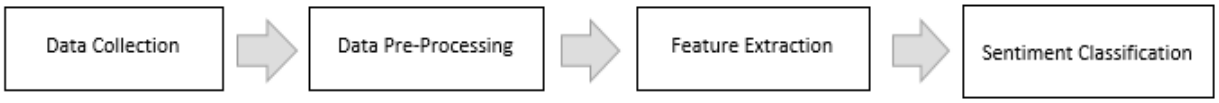

Figure 1: The Steps of the Sentiment Analysis (Babu & Kanaga, 2022)

Two crucial techniques are employed in sentiment analysis: a) law-based sentiment analysis based on that uses a set of rules, and b) machine learning-based sentiment analysis, including teaching a machine learning model (Akhtar, Gupta, Ekbal & Bhattacharyya, 2017; Uddin, Bapery & Arif, 2019; Cheng & Tsai, 2019). The two-dimensional psychological model of Watson and Telgen is provided in Figure 2.

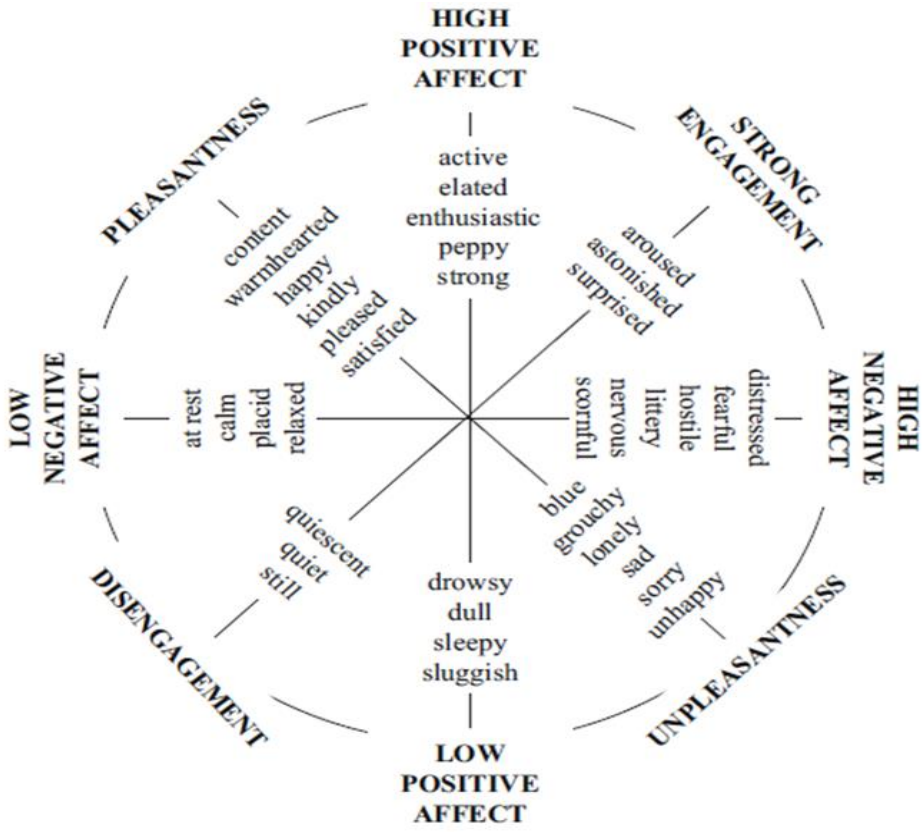

Figure 2: The Psychological Model of the Sentiment Analysis (Yue et al, 2019)

To better understand the data, the related information is categorized as binary and bipolar according to classified feelings and by machine learning and deep learning methods

(Tanna et al, 2020; Tajuddin, Kabeer & Misbahuddin, 2020). The importance of the sentiment analysis is evaluated and categorized from different aspects (Figure 3).

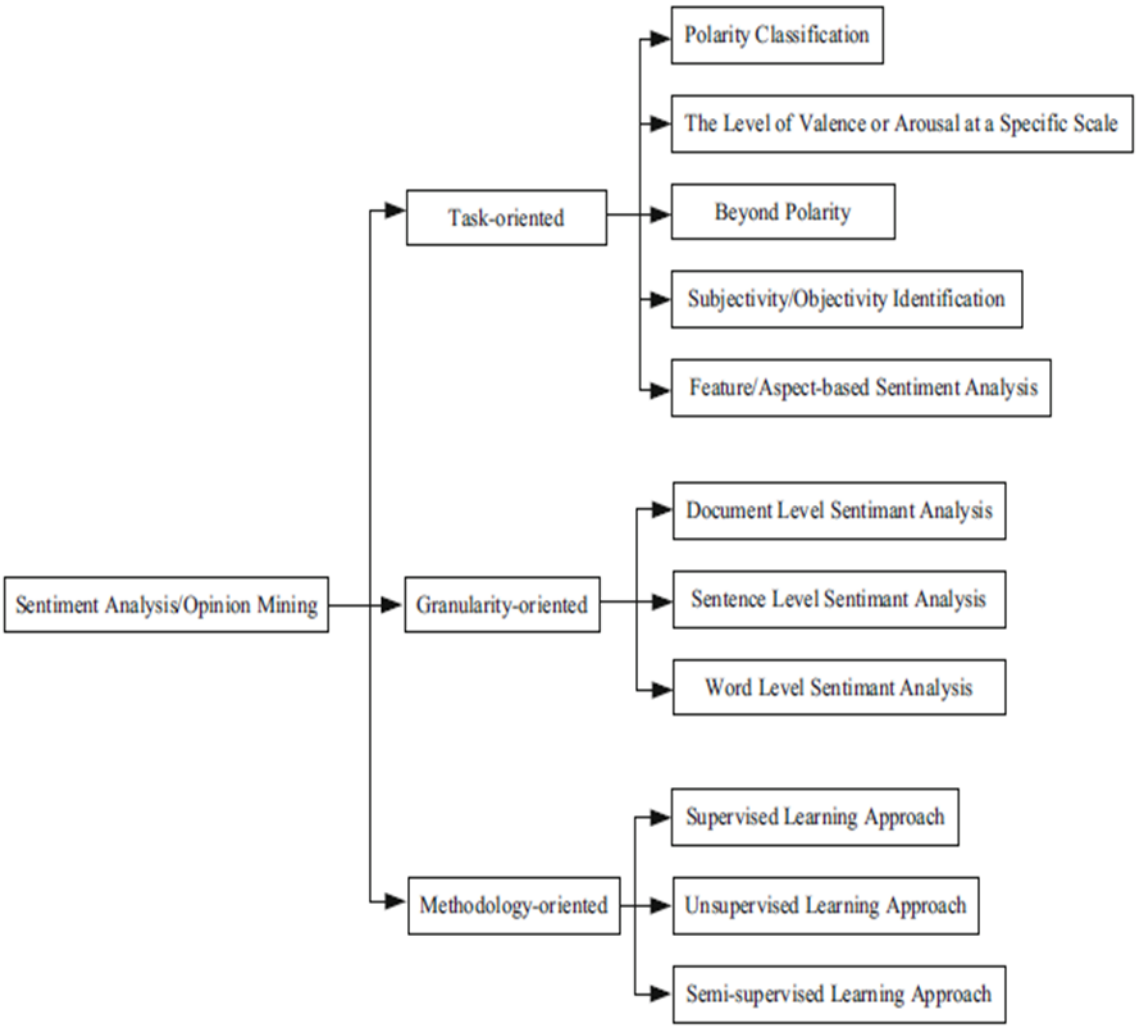

Figure 3: The Evaluation of Different Dimensions of Sentiment Analysis (Yue et al., 2019)

One of the benefits of using AI in sentiment analysis, which, due to developing computer systems in doing responsibilities like those of human intelligence, is very important, can be to increase process efficiency and speed improvement or service stability in the social networks and also use the method of customer decision making to discover the new ways of marketing and advertisement and to discover opportunities for new services with the help of the AI-based sentiment analysis algorithms (Babu & Kanaga, 2022). The AI algorithms accelerate sentiment analysis and access to quick and accurate decision-making dealing with artificial neural networks and machine and deep learning (Kundale & Kulkarni, 2019).

Artificial neural networks

Theoretically, artificial neural networks as information processing models that are inspired by the method of Information processing of neurobiological devices of the brain try to imitate and repeat the main functions of the brain (Bu, 2020; Poria, Cambria, Howard, Huang & Hussain, 2016)**.** The artificial neural network follows similar changes with the capability of inferring meaning from complex or incomplete data in pattern extraction or identifying trends

that are complicated for human beings (Ali, Samara, Alhaddad, Ware & Saraereh, 2022). Operationally, the neural networks can be employed in new computing methods for machine learning, presenting knowledge and eventually applying the resulting knowledge to predict the output responses from complicated systems. The critical element of this notion is to create new structures for the information processing system (Sivanandam & Deepa, 2007).

Artificial neural networks (ANNs) are a set of mathematical algorithms designed to simulate the human brain function (Chen, Huang, Chen, Cheng & Chen, 2018; Luo, 2017). These networks are composed of several layers of neurons and can recognize the patterns and discover the hidden relationships in big data using learning algorithms (Abid & Alam, 2020; Ligthart, Catal & Tekinerdogan, 2021). The ANNS are employed in several scientific and industrial fields, including face recognition, voice recognition, text recognition, image processing, natural language processing, and prognostication modeling. (Moreno & Redondo, 2016). The main algorithms of the ANNS include:

- Perceptron Algorithm
- Backpropagation Algorithm
- Hopfield Network Algorithm
- Kohonen Self-Organizing Map Algorithm
- Radial Basis Function Network Algorithm
- Long Short-Term Memory Algorithm
- Convolutional Neural Network Algorithm
- Generative Adversarial Network Algorithm
- Deep Belief Network Algorithm
- Recurrent Neural Network Algorithm

All the algorithms of the mentioned ANN are used in sentiment analysis, but some are more commonly used (Luo, 2017). For example, the algorithms perception, backpropagation, Radial Basis Function Network, Convolutional neural network, and Recurrent Neural Network are used for sentiment analysis (Poria, Cambria & Gelbukh, 2016; Hammou, Lahcen & Mouline, 2020).

Deep learning

This kind of learning is one of the crucial elements in data science, including statistics and forecast modeling (Peng et al., 2022). Deep learning has many uses for data scientists responsible for collecting, analyzing, and interpreting large amounts of data. It makes analyzing and interpreting data faster and easier (Nalinde & Shinde, 2019). In a way, it can be said that deep learning is machine learning, so at the level of complex tasks, representation, or abstraction, it performs the learning process for an artificial intelligence system. In this way, the machine better understands the realities of existence and can identify different patterns (Alm, Roth & Sproat, 2005). This type of learning, indeed, is like learning through neural networks that have several hidden layers, and the further you go into this process, the more complex and complete models you get (Wang et al., 2020; Yadav & Vishwakarma, 2020; Kumar, Yadava & Roy, 2019; Wan, 2008).

Machine learning

In the science of machine learning, the focus is on using algorithms to design a machine so that without explicitly dictating any planning and every action, it can learn and act. In machine learning, data is fed into a generic algorithm instead of explicitly programming the logic. The algorithm then builds its logic based on the given data (Tariq et al, 2019; Nalinde & Shinde, 2019). Machine learning includes different methods, which are mentioned below, of which the most important algorithms are divided into three categories: supervised learning, unsupervised learning, and reinforcement learning (Islam, Kabir, Ahmed, Kamal, Wang & Ulhaq, 2018; Balahur & Turchi, 2014).

Different methods of machine learning include:

- Supervised learning: In this method, the model is trained with labeled training data so that it can predict new data labels.
- Unsupervised learning: In this method, the model is trained without labeled training data so that it can detect hidden patterns in the data.
- Reinforcement learning: In this method, the model is trained by interacting with an environment and receiving rewards for its actions so that it can achieve the best behavior in the environment.
- Semi-Supervised Learning: in this one, the model is trained by using labeled and unlabeled data to predict new data labels.
- Multimodal learning: the model is trained using multi-source data (such as images and text) to get information from multiple sources (Wan, 2008).

In sentiment analysis of social networks, the reinforcement learning method can be used in two different ways. The first is to train emotion prediction models. In this method, some models are trained to predict users' feelings in social networks using positive and negative rewards. The method, therefore, can analyze and predict users' feelings on social networks (Hartmann, Huppertz, Schamp & Heitmann, 2019).

The second way is to use the method to improve the performance of the sentiment analysis algorithms. The sentiment analysis algorithms can be improved and enhance the accuracy of emotion prediction by using positive and negative rewards. For instance, the accuracy of emotion prediction can be significantly enhanced by applying some changes in sentiment analysis and examining positive and negative rewards. In such a way, using Reinforcement Learning can help improve the performance of the sentiment analysis algorithms in social networks (Mohanty, Swain & Mahapatra, 2020).

Also, in the sentiment analysis, the Supervised Learning method is employed to classify texts. This way, the model is trained with labeled training data to predict whether the new data has positive or negative feelings (Lyu, Chow & Hwang, 2020). For example, to analyze feelings in social networks, the supervised learning method by using algorithms such as SVM, Naïve Bayes, and complex neural networks is used (Al Asad, Pranto, Afreen & Islam, 2019; Yadav & Vishwakarma, 2020). In past years, many efforts have been made to improve the efficiency of sentiment analysis in AI. This section will provide an overview of the solutions provided (Manikandan, Patidar, Walia & Roy, 2018). At the end, a summarized table of the research is presented. Many efforts have been made in developing algorithms for artificial neural networks, aiming to establish an optimal connection between deep learning and machine learning. (Chen, Zhou, Zhang, Gong & Sun, 2018; Syarif, Ningtias & Badriyah, 2019). This section will review

the techniques, algorithms, solutions, and a summary of the research done on the subject and the results in the field of sentiment analysis and social networks. Finally, an abstraction of the studies done and the theoretical framework and research background are provided in Table 1.

Ligthart et al. (2021) have identified 112 sentiment analysis articles based on deep learning and categorized them according to applied deep learning algorithms. The features, algorithms, and datasets used in the sentiment analysis models have been written. According to this analysis, long short-term memory neural network algorithms and Complex convolutional neural networks have been introduced as the most usable deep learning algorithms for sentiment analysis. The main task of this article is to recognize body language and human movement and behavior analysis. Research in the field of human motion detection by the use of the frames and sequences obtained from videos has achieved certain results and has progressed by using image data of human movement status to analyze and extract information and finally improve human quality (Bu, 2020; Zhao, Cong, Yuan & Zhu, 2015).

For the first time, a paper has proposed a new method to create features of movement status and describe human behavior, which is presented based on the map of the Convolutional neural network feature, the existing strategy of teaching images, to overcome the interference caused by a change in the scale of object and deformation (Chen et al., 2022; Shen et al., 2017). In research, high time has been allocated to feature extraction by making some changes in body status through the extraction of skeleton or joint features at the level of the human body and by reconfiguring the deep convolutional neural network through training images on datasets in the neural network that will be very complicated in voluminous data and high convolution layers (Zhao, Mao & Chen, 2019; Yang et al., 2016). Compared to the classical traditional methods, combining and integrating the convolutional neural network features have improved the detection rate between 5 and 6 percent (Zhao et al, 2019; Zhao et al, 2015).

Mohanty et al. (2020) have tried to provide a solution based on natural language processing technology and a sign language interpreter by using the artificial neural network to analyze one's pose and movement status that shows human behavior. Feelings have been predicted with high matching accuracy for detecting the shape and model of movements for the disabled and people with visual, hearing, and speech disabilities in interaction with the environment of life, business, and industry which has provided fruitful results to researchers (Hartman et al., 2019). In research with the help of deep learning and Deep Convolutional Neural Network Algorithms besides the K- Nearest Neighbor Random Forest Algorithm- and the Simple Bayes classifier algorithm, dictionary-based methods were used, and the movement mode of certain people has become the text and accuracy in recognizing their body language show (Yadav & Vishwakarma, 2020; Mohammad, 2016).

Didekhani and Adib (2017) assessed the mediating role of feelings and moral virtues. The results show that paying attention to emotions and moral virtues, which will detect, resolve, and improve irresponsible corporate behavior, will be a practical step in creating, maintaining, and improving customers' responses and satisfaction. Bu (2020) and Li et al (2021) focused on behavioral sentiment analysis and objectifying thoughts, analyzing Effective video content analysis, and optimizing users', consumers', and customers' feelings in different fields of business and social networks which ultimately leads to problem diagnosis. With the help of recognizing feelings based on the bulk data of available videos and images, the research has been compiled as a set of voice information, movie sequences, consecutive frames, and

calculating the optical flow. In the following, content analysis of photos, images, and texts have been used, and finally, the model and framework for converting data into sentiment analysis have been presented (Wang et al., 2020).

In the present research, by providing a set of data with multi-dimensional information to deepen the work in the field of sentiment analysis, the video data and text information related to the video are collected and based on the frame sequence, the sound sequences, and frame extracted from the footage calculate optical flow sequence (Bu, 2022; Zhao et al, 2015). Jalloul (2018) conducted a qualitative study and a prototype for tweet classification using a set of sentiment classifiers. The results show that the prototype can provide an overview of the user's experiences with an application, a product, or another service. The prototype is public sentiment analysis and can be applied to classify the related tweets for customer satisfaction. In the research done, the results obtained in the field of sentiment analysis are presented only in two positive and negative groups, and the text mining field is only for behavioral analysis, which has been compiled based on different movements of disabled people (Jalloul, 2018; Mohanty et al., 2020). Finally, an abstraction of the studies done in the field of sentiment analysis and a comparison of research background documents are in Table 1.

Table 1

A Summary of Results of Comparison of Thematic Literature Documents of the Sentiment Analysis with Different Algorithms

	Experimental Results							**Artificial Intelligence methods**					
Authors	**High Cost**	**Low Accuracy**	**Making Noise**	**Delay in Implementation**	**Algorithm complexity**	**Video content analysis**	**Text Mining**	**Natural Language Processing**	**Computer Vision**	**Movement Detection**	**Gesture Recognition**	**Movement Detection**	**Neural Network**
Babu and Kanaga (2022)		✓					✓			✓			✓
Xue et al (2022)						✓							
Peng et al (2022)				✓			✓						
Atmaja and Sasou (2022)		✓					✓					✓	
Ashraf et al (2022)				✓	✓						✓		✓
Liu (2021)		✓										✓	✓
Mohanty et al (2020)	✓	✓						✓			✓		
X Bu (2020)		✓		✓								✓	✓
Sharma et al (2020)		✓								✓			✓
Mohammad (2016)		✓					✓						
Hu et al (2020)		✓											✓
Xia et al. (2020)				✓									✓

Authors	Experimental Results							Artificial Intelligence methods					
	High Cost	Low Accuracy	Making Noise	Delay in Implementation	Algorithm complexity	Video content analysis	Text Mining	Natural Language Processing	Computer Vision	Movement Detection	Gesture Recognition	Movement Detection	Neural Network
Yue et al (2019)		✓					✓						
Kumar, Sharma & Arora (2019)								✓					
Elmahmudi and Ugail (2019)			✓								✓	✓	
Kusuma et al.)2019(				✓	✓								✓
Jiang et al. (2018)		✓			✓								✓
Li et al,)2018(		✓										✓	✓
Manikandan et al) 2018(							✓				✓	✓	
Jiang et al. (2018)		✓									✓		✓
Kanokoda et al.(2018)		✓				✓					✓	✓	✓
Arunnehrua et al (2018)		✓										✓	✓
Shao et al.)2017(			✓										✓
Kim et al. (2017)						✓			✓				✓
Zhang and Cao (2017)		✓											✓
Zemblys (2016)											✓		✓
Jiao et al (2014)		✓									✓	✓	
Amendola et al (2014)				✓							✓	✓	✓
AL- Rahayfeh and faezipour)2013(		✓										✓	
Yee Yong et al (2011)		✓										✓	
Kuo Yang et al (2006)				✓									✓

Problem Statement

The present research with a scientific approach is of an analytical descriptive type that is presented to evaluate, recognize, and analyze emotions, focusing on social networks and people's internet interaction in the framework of artificial intelligence and machine learning. The tools used for collecting library information and managing an archive of books, articles, and research background related to the subject are crucial. These tools are employed within the content analysis framework, following a scientific approach and providing the necessary evidence to answer the main research question, sentiment analysis in AI-based social networks. This research attempted to provide a conceptual model and machine learning techniques and

algorithms by comparing previous studies and research examining the role of empowerment in the relationship between sentiment analysis and the deep learning algorithms that have proceeded more precisely and deeply toward behavioral and sentiment analysis.

The subject literature and the algorithms introduced in the research background were evaluated. In Table 1, the comparison of results from 28 papers studied regarding sentiment analysis and the introduced algorithms indicated that among all the subject literature reviewed in the table below, the integration technique presented in this research in a conceptual model should have been addressed. Some weaknesses were seen in the papers reviewed, and with the help of the algorithm and conceptual model provided in this paper, the gaps in the previous research can be covered. It is worth mentioning that after a lot of research and revealing the weaknesses in this field, in this research, a scientific pattern is presented having a knowledge framework and providing a conceptual model as a support for increasing knowledge to understand deeply the details of sentiment analysis in the field of AI and deep learning and machine learning in the social networks. Social networks are among the most powerful and essential tools for observing innovative business, marketing, and sales issues, and nowadays, considering their popularity, they have become more prominent; therefore, to create brand awareness and increase sales, we need sentiment analysis technology in these networks. Considering these explanations, the necessity for designing and providing the conceptual model to promote profitability in business intelligence is evident (Figure 4).

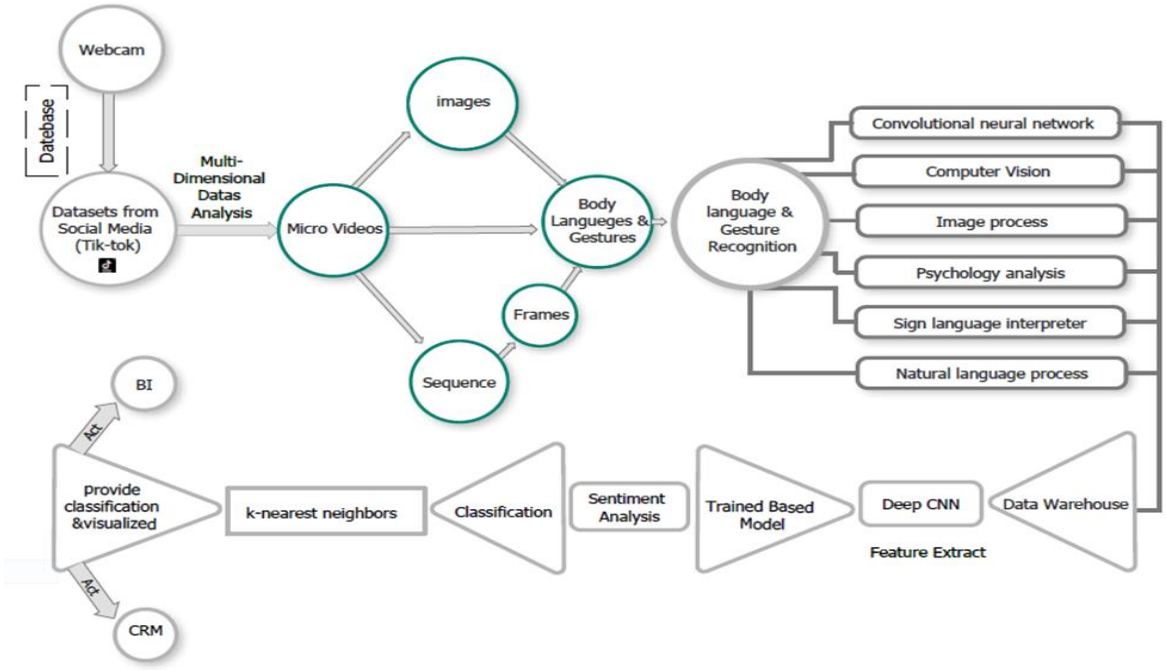

Figure 4: The Conceptual Model of the Research

In the first step of the conceptual model, data will be gathered from social media like TikTok, Facebook, and Instagram; in the second step, data will be subjected to two different preprocessing methods, including converting videos to a set of frames. Then, textual, visual, and auditory data will be applied to their corresponding machine learning algorithms to create a uniform data set of inferences of said algorithms. Refined data will be stored in a data warehouse. After accumulating data in warehouses, data will be subjected to feature extraction, and finally, the sentiment analysis model will draw insightful inferences from

extracted features. At this stage, data is ready for clustering, visualization, and anomaly detection to be presented as CRM and BI to stakeholders.

Materials and Methods

Since the present research is a review, this paper's approach and review method include three phases: A) searching and selecting subject literature, B) data extraction, C) comparing and combining the data, and providing an efficient conceptual model. The methodology used in this paper is Reinforcement Learning with the special algorithm presented in the research has evaluated the best performance and achieved fruitful results to solve the main problem of the study, which is to answer the two main and necessary issues: 1)the effectiveness of the sentiment analysis on the AI-based social networks and 2) to achieve and provide an efficient conceptual model by comparing several types of deep learning algorithms and different AI techniques in the social media so that the details of feelings and behavioral emotions can be analyzed and provided in the social media more deeply and accurately and in a short time. Reinforcement learning, as one of the machine learning methods that use direct interaction with the environment, trains the actor to learn, make decisions, and have a better performance when faced with specific tasks, and its purpose is to improve performance in decision-making (Trotzek, Koitka & Friedrich, 2020; Akhtar et al., 2017; Tao et al., 2019; Tumasjan et al, 2010). Therefore, it plays an essential role in reinforcing and analyzing feelings. We reviewed and analyzed the papers from Scopus and Web of Science published between 2010 and 2022 based on definitions, titles, and also indicators and collected data and then divided them in this way to identify the possible comparison between the reviewed research and the AI algorithms used in the social networks, identify and determine the percentage of accuracy in the sentiment analysis in them and consequently it is possible for the researcher to draw a conclusion and comparative comparison from related or unrelated researches. Finally, the results were summarized, and the algorithms used in sentiment analysis of the social networks were determined, using the error percentage and accuracy rate in behavioral analysis in Table 2. This comparison demonstrates the more accurate results of the algorithm provided in this research, including higher than 96% of the detailed sentiment analysis output.

Table 2

Comparison of Machine Learning Techniques Accuracy Extracted from the Original Paper, the Percentage Was Calculated on Test Fold of Mentioned Dataset

Paper	Classifier	Accuracy (%)	Dataset
Bohang Chen et al.	LSTM	74.18	Twitter
	CNN	75.97	
	CNN—LSTM	74.70	
Li Chen Cheng et al.	LSTM	80.83	Twitter
	BiLSTM	87.17	
	GRU	64.92	
Fazeel Abid et al.	CNN	82.73	Multi-source
	FastText—CNN	83.97	
	Random—	80.11	

Paper	Classifier	Accuracy (%)	Dataset
	CNN		
Kantinee Katchapakirin et al.	LSTM	85.0	Facebook
	CNN	77.7	
Shakeel Ahmed et al.	layer LSTM	85.07	Twitter
	LSTM + CNN	92.0	
	CNN—RNN	87.0	
Li Yang et al.	CNN	90.9	Book Reviews
Mehmet Umut Salur et al.	CNN	68.48	Twitter
Ali Shariq Imran et al.	DNN	64.5	Twitter, Kaggle
	LSTM	66.0	
Yue Han et al.	LSTM	71.15	SentiDrugs
Reneta L. Rosa et al.	CNN—RNN	89.0	KBRS
Govin Gaikwad et al.	SVM	82.0	Twitter
	Naive Bayes	64.0	
	KNN	73.0	
Georgios S. Solakidis et al.	Naive Bayes	92.2	Twitter
	SVM	93.1	
Mandar Despande et al.	Naive Bayes	83.0	Twitter
	SVM	79.0	
Rinki Chatterjee et al.	Naive Bayes	76.6	Facebook
Rincy Jose et al.	SentiWordNet	21.05	Twitter
	Naive Bayes	69.92	
Gonzalo A Ruz et al.	Naive Bayes	74.2	Twitter
	SVM	81.2	
	Random Forest	72.5	
Priyanka Arora and Parul Arora	Naive Bayes	78.0	Twitter
	SVM	79.7	
Kantinee Katchapakirin et al.	SVM	68.57	Facebook
	Naive Bayes	71	
Akshi Kumara et al.	Naive Bayes	77.89	Twitter
	Random Forest	81.04	
Shakeel Ahmed et al.	KNN	72.0	Twitter

Result

Considering the machine learning algorithms and the AI techniques reviewed in this paper and also discussed in the subject literature and considering the documents reviewed in this research (Hussain et al., 2020; Katchapakirin, Wongpatikaseree, Yomaboot & Kaewpitakkun, 2018; Ruz, Henríquez & Mascareño, 2020; Sethi, Pandey, Trar & Soni, 2020; Uddin et al, 2019; Mohammad, 2016), the reasons for selecting some special social networks to analyze feelings with the algorithms of the day, are identifies and categorized in Figure 5 comparatively. In this graphical analysis, different social networks used by the users are compared technically. Finally, Instagram has taken the first place in behavioral analysis and analysis of users' emotions with different artificial neural network algorithms. After that, in analyzing the users' behavioral emotions, Twitter, FaceBook, CentiDrugs, Linkedin, and YouTube can be referred to.

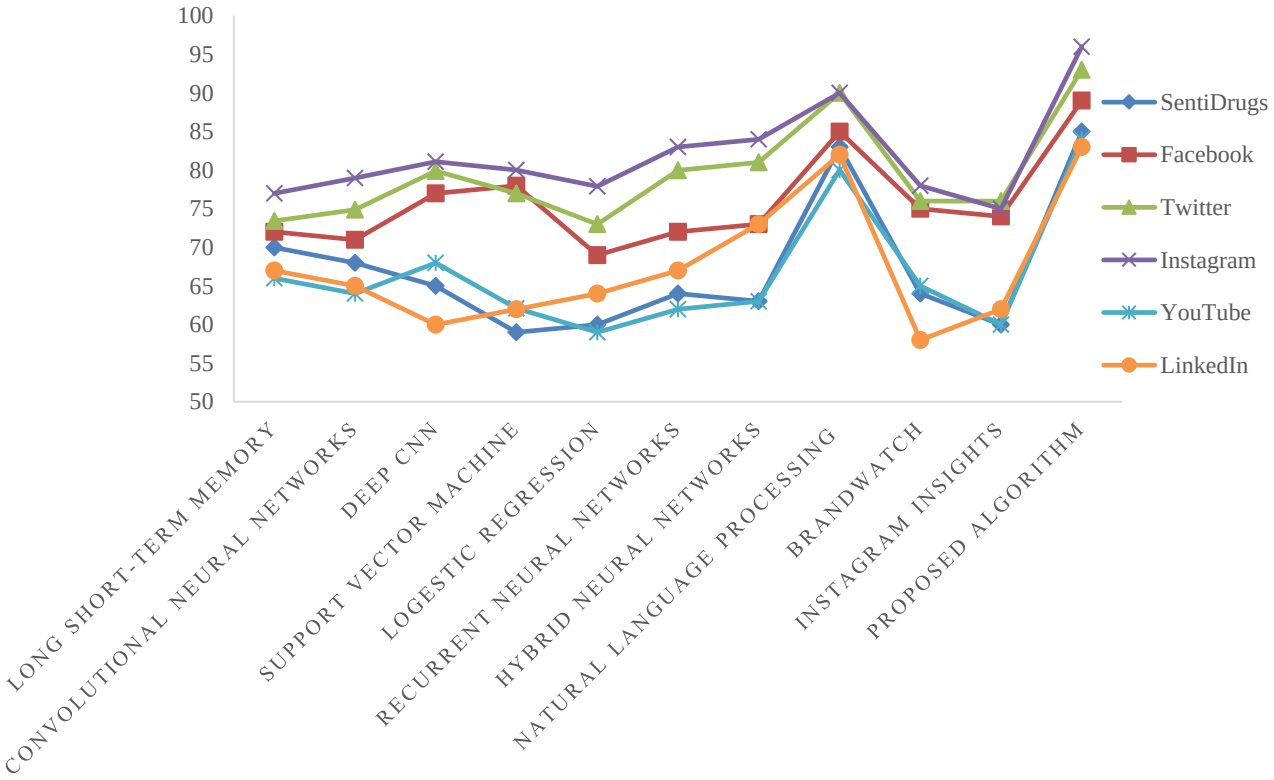

Figure 5: The Accuracy of Artificial Intelligence Algorithms in Sentiment Analysis Conducted over Different Types of Social Networks Extracted from Review Papers to Make a Comprehensive Comparison of the Efficiency of The Algorithms on Different Datasets. The Proposed Algorithm Refers to the Conceptual Model from Figure 4

According to Figure 5. and the result, Instagram has taken first place in sentiment analysis; therefore, concerning the more effective efficiency of the social network Instagram in sentiment analysis, we attempted to develop the study of behavioral emotions in Instagram by adding some other AI algorithms to take a step to access more details and percent accuracy of the social network. Figure 6 shows the relationship between the algorithms used in Instagram to analyze feelings and the accuracy percentage of analyzing details.

To analyze feelings on Instagram, different methods are employed below some sentiment analysis methods on Instagram:

- Using sentiment analysis tools: Some sentiment analysis tools, such as Hootsuite Insights and Brand Watch, help you evaluate comments and get their sentiment analysis.
- Using relevant hashtags: using hashtags related to the desired topic, you can find the post containing users' comments and analyze their feelings.
- Checking users' comments: by studying the users' comments in the posts related to the considered topic, you can get their sentiment analysis. To do this, you can use some tools like Instagram Insights.

● Using computational methods: you can get the users' sentiment analysis using computational methods such as factor analysis and regression. To do so, you need big data that you can get using data analysis tools. Instagram functions based on machine learning techniques such as neural networks and categorization algorithms. These help Instagram identify and display posts related to users' favorites and needs. Also, Instagram analyzes the users' emotions using machine learning algorithms.

In Figure 6, the algorithm presented in this research was assigned the highest accuracy percentage of Instagram sentiment analysis.

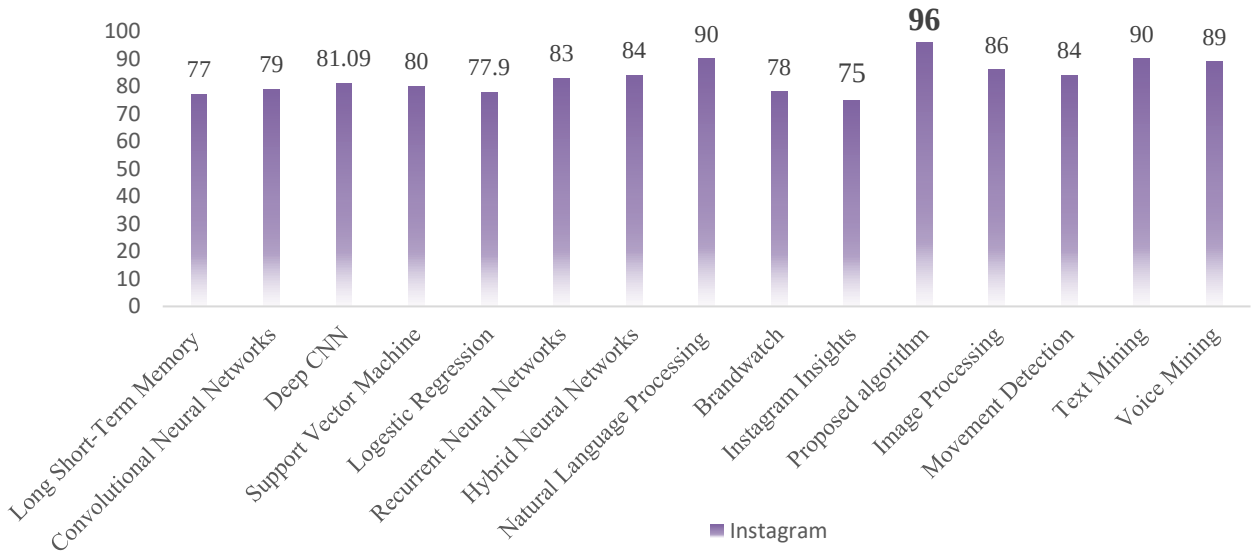

Figure 6: Accuracy Percentage of Algorithms in Instagram Sentiment Analysis. The Proposed Algorithm Refers to the Conceptual Model from Figure 4

Considering the stable accuracy results from Figure 5, which show an accuracy above 70% for all reviewed algorithms, combined with the amount of publicly available data from Instagram, the author investigated more algorithms operating on data gathered from Instagram. As for the algorithm that works best with data from Instagram, it is visible in Figure 6 that the accuracy of different algorithms reaches no more than 90%. However, the proposed method, which uses some machine learning algorithms, can break this limit and get an accuracy of 96%, a considerable improvement compared to using other algorithms as standalone machines. As for the algorithm that works best with data from Instagram, it is visible in Figure 6 that the accuracy of different algorithms reaches no more than 90%; however, the proposed method, which uses some machine learning algorithms, can break the limit and reach the accuracy of 96% which a considerable improvement to using other algorithms as standalone machines.

Discussion

Although in the research conducted, the highest accuracy percentage of sentiment analysis of the Instagram social network was assigned to the algorithm presented in the study, the most crucial sentiment analysis algorithm on Instagram, which has the highest percentage of sentiment analysis, includes text mining by Natural language processing (NLP) algorithms and the neural networks (Friedman, Rindflesch & Corn, 2013; Tajuddin et al., 2020). These algorithms help Instagram evaluate the users' comments and recognize their positive, negative, and neutral emotions. This algorithm, by using linguistic models and deep learning algorithms,

helps recognize the users' emotions in Instagram posts. Instagram, with the help of these algorithms, can improve its users' experience. Since each algorithm is used for sentiment analysis, it is updated continuously to improve performance and accuracy—low-value algorithms in the field of sentiment analysis, therefore, usually become obsolete quickly on Instagram.

On the other hand, we achieved the following significant results while researching artificial neural network algorithms. There are several neural networks for sentiment analysis on Instagram, but some of the most important ones are:

- Recurrent Neural Networks: due to the ability to process data sequentially, these networks effectively analyze text sentiments.
- Convolutional Neural Networks: because of the ability to extract different features from image data, these networks are very effective in analyzing image sentiments such as profile pictures and image posts.
- Hybrid Neural Networks: these networks use a combination of Recurrent Neural Networks and Convolutional Neural Networks and effectively analyze different emotions like text, image, and sound.

It is not possible to say which artificial neural network plays a more critical role in analyzing Instagram users' sentiments, because this depends on the type of input data and the analysis purpose (Shen et al, 2017; Ali et al, 2022). Recurrent neural networks play a more important role when using image data, such as the data of this research. Convolutional Neural Networks are more effective (Yazdavar et al, 2020). So, selecting the right neural network for each mode depends on the data type and the research purpose. In this study, after considering the conceptual model and integrating machine learning algorithms and neural networks, the proposed technique showed the highest accuracy percentage in sentiment analysis. Following that, text mining with the help of NLP, sound exploration, image processing, and motion detection may be considered. Among the neural network algorithms, the highest accuracy in sentiment analysis related to image processing in the research is achieved with convolutional neural networks (CNNs). (Friedman et al, 2013; Tadesse, Lin, Xu & Yang, 2019).

As we look at the findings from the results, we realize that achieving an algorithm accuracy above 90% on the test fold of datasets points to a vast potential for commercializing sentiment analysis on large-scale, data-driven businesses. With that in mind, a systematic approach like the proposed conceptual model has a great capacity to supply stakeholders with accurate inferences from data gathered from social media and supporting insights. This can affect sectors like government, advertisement, education, and the labor market. On the other hand, this paper does not address the ever-growing concern about data protection, privacy, and ownership. Current policies and strategies concerning the integrity and privacy preservation of social media communities exhibit significant gaps. For further work, designing privacy-preserving data collection methods would be an incremental improvement to this work.

Conclusion

Despite the vast exchange of information and the massive volume of data shared daily across global news and social networks, the potential for utilizing this data in various domains still needs to be explored. Analysts can harness this information for business, politics, economics, psychology, marketing, sales, stock market predictions, and sentiment tracking with

artificial intelligence algorithms in sentiment analysis. Health analysts, in particular, could leverage these technologies for early and accurate diagnosis of medical conditions, such as depression, especially in the technologically advanced age.

However, the primary limitation of sentiment analysis lies in its simplistic categorization into positive, negative, or neutral sentiments. Previous research has not delved deeply into the nuances of emotions expressed on social networks. Our paper aims to address this gap by developing a solution that captures the intensity and details of user emotions more comprehensively and swiftly. This advancement promises significant profitability in brilliant business production, trade, and global societies' medical and financial systems. The enhancements in sentiment analysis accuracy and efficiency through our proposed conceptual model architecture are paramount. Beyond precision, our paper strives to improve sentiment analysis algorithms' overall efficiency. By integrating image processing techniques, computer vision, and reinforcement learning, machine learning methods that enhance decision-making through direct environmental interactions-we aim to elevate the performance of sentiment analysis in social networks.

Suggestions for future research

- It is recommended that sentiment analysis be considered not only a technological tool but also an organizational architecture.
- Using picture recognition technology to identify or better track hands or other body organs, even when not physically connected to a screen.
- Using voice control to write text or visually impaired.
- Using emotion tracking technology (inventing machines that anticipate something before they are asked).

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