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Soul-Surveyor: Mental Health monitoring using Business Intelligence and Sentiment Analysis

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Abstract: *Mental health is a critical concern worldwide, with a growing need for effective assessment and support systems. This project focuses on utilizing business intelligence techniques to perform sentiment analysis on mental health-related data. The goal is to gain valuable insights into the emotional well-being of individuals by analyzing their text-based interactions, such as social media posts, forums, or chat logs. Sentiment analysis models are employed to classify text into categories such as positive, negative, or neutral sentiments. Additionally, the project explores the use of emotion detection algorithms to identify specific emotions expressed in the text, such as sadness, happiness, or anxiety. Business intelligence tools and dashboards are employed to visualize and present the sentiment analysis results. These tools enable stakeholders, including mental health professionals, policymakers, and researchers, to monitor and gain insights from the sentiments expressed online in real-time. In order to support early intervention and resource allocation, the project also entails the construction of predictive models that, using sentiment analysis data, can predict future trends in mental health. By leveraging business intelligence techniques for sentiment analysis of mental health data, this project aims to contribute to a better understanding of mental health trends, facilitate timely interventions, and promote overall well-being. The insights gained from this analysis can empower individuals, healthcare providers, and policymakers to make informed decisions and provide more targeted support for mental health challenges.*

Keywords – *Business Intelligence, Data Analytics, Mental Health Monitoring, Natural Language Processing, Sentimental Analysis.*

I. INTRODUCTION

Mental health is an integral component of overall well-being, and its significance has gained increasing recognition in recent years. In the digital age, people share their thoughts, feelings, and experiences online, providing a wealth of data that can be harnessed to understand and support mental health. The "Sentiment Analysis of Mental Health Using Business Intelligence" project seeks to leverage advanced analytics and Business Intelligence (BI) tools to gain valuable insights into the emotional well-being of individuals through the analysis of text-based data related to mental health. Mental health challenges affect millions of people globally, and the stigma associated with discussing these issues often leads individuals to express their emotions, concerns, and experiences anonymously or through digital platforms. This provides a unique opportunity to use sentiment analysis, a subset of natural language processing (NLP), to evaluate the sentiments, emotions, and trends surrounding mental health topics in online conversations. Sentiment analysis means to utilize NLP techniques to perform sentiment analysis on text data from various sources, such as social media posts, forums, chat logs, and mental health support platforms. This analysis will classify the sentiments expressed as positive, negative, or neutral, providing insights into the emotional state of individuals. Emotion Detection is extend sentiment analysis to identify specific emotions expressed in the text, such as sadness, happiness, anxiety, or stress. Understanding the underlying emotions can offer a more nuanced view of mental health-

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related discussions. Business Intelligence Integration is Employ BI tools and dashboards to visualize sentiment analysis results. In order to support evidence-based decision-making, these interactive dashboards will allow researchers, policymakers, and mental health practitioners to examine data trends, patterns, and correlations. The "Sentiment Analysis of Mental Health Using Business Intelligence" project recognizes the potential of data analytics and BI to improve mental health awareness, support, and services. This research looks at how people communicate their sentiments and emotions in digital chats in an effort to make mental health concerns more sympathetic and knowledgeable while dealing with society.

II.   REVIEW OF LITERATURE SURVEY

The upcoming section provides a comprehensive review of existing literature, focusing on prior studies and research endeavors. It offers an in-depth analysis of the preceding system, including its merits and demerits.

Kamil Zeberga, Muhammad Attique, Babar Shah, Farman Ali, Yalew Zelalem Jembre, Tae-Sun Chung, et al [1]. There is a growing need for sophisticated systems that can identify health issues, such anxiety and depression, on social media. Semantic and syntactic meaning can be extracted from unstructured and unpredictable text using machine learning techniques. However, because deep learning strategies are not properly exploited and there are no long-term dependencies, these systems only offer a limited amount of information. This research uses a knowledge distillation technique in conjunction with bidirectional encoder representations from transformers (BERT) to provide a unique framework for effectively identifying postings linked to depression and anxiety. By applying the knowledge distillation technique, the system attains a 98% accuracy rate.

Rohan Dixit, Geetika Chawla, Ishaan Bajaj, et al [2] Research shows mental health is crucial for overall physical, psychological, and communal welfare. Personalized sensing technologies like smartphones and smartwatches can track and gather data, allowing for sentimental analysis to predict user information. This survey proposes a methodology and model using Lambda Architecture to study social media presence and mental state, while maintaining user confidentiality and data privacy.

Ferdaous Benrouba, Rachid Boudour, et al [3] Sentiment analysis (SA) serves as a valuable tool for evaluating the mood and emotions of authors across diverse domains such as stock market forecasting, product reviews, psychology, and agriculture. Scholars have gained valuable insights to aid users in comprehending overall trends and mitigating the negative impact of posts on social media platforms. This research proposes the utilization of both the Twitter API and the natural language understanding API tool to filter out emotionally harmful content on social media. The objective is to enhance the quality of content presented to users, promoting their comfort and satisfaction with their online experiences.

Hyona Yu, Jihyun Bae, Jiyeon Choi, Hyungseok Kim, et al [4] This paper proposed the Sentiment Analysis for its growing importance for Mental Health and given smart mirror AI device for mental comfort, and also given LUX for Korean Text analysis with deep learning which examines GRU, LSTM, CNN, Bi-LSTM, and Bi-GRU and also provided reinforcement learning (RL) as a recommender system for a user's emotion and the actions that correspond to it using Deep Q Network (DQN)

Shuo Yang , et al [5] A study on social media, Sina-Weibo, reveals that the COVID-19 outbreak in China has influenced sentiment. Three crucial dimensions were identified from the examination of 110,000 Weibo texts between February 2020 and October 2022: time, space, and topic. The majority of discussions focused on the "Impact of COVID-19," "Obstacles to work," and "Life stress." The study suggests that governments should adjust their epidemic prevention policies to address changes in sentiment intensity and local concerns. Additionally, targeted response measures and mental health resources should be implemented.

Imamah, Fika Hastarita Rachman, et al [6] This study uses sentiment analysis on Twitter to understand mental health impacts of Covid-19, using dataset which consisted of 355384 tweets from April 30, 2020. The Logistic Regression method was used for classification which classifies the tweets, achieving an accuracy of 94.71%.

Dhiaa A. Musleh, Taef A. Alkhales, Reem A. Almakki, Shahad E. Alnajim, Shaden K. Almarshad, Rana S. Alhasaniah, Sumayh S. Aljameel and Abdullah A. Almuqhim, et al [7] The research underscores the widespread impact of depression globally, which disrupts everyday functioning and social interactions. In Arabic culture, there is a notable lack of awareness concerning mental health issues. Social media platforms like Twitter offer users a platform to openly express their feelings; nevertheless, there is a scarcity of research focused on Arabic tweets. The primary objective of this study was to devise a framework for analyzing tweets from Arabic users to identify indications of depression, utilizing machine learning classifiers and natural language processing methods such as Support Vector Machine (SVM),

Random Forest (RF), Logistic Regression (LR), K-nearest Neighbors (KNN), AdaBoost, and Naïve Bayes (NB). Notably, the RF classifier demonstrated superior performance, achieving an accuracy rate of 82.39%.

Bharati Sanjay Ainapure, Reshma Nitin Pise, Prathiba Reddy, Bhargav Appasani, Avireni Srinivasulu, Mohammad S. Khan Nicu Bizon, et al [8] This research investigates the feelings expressed by Indian citizens regarding the COVID-19 pandemic and vaccination efforts using Twitter data analysis. It utilizes a combination of deep learning and lexicon-based techniques for sentiment analysis. Notably, the recurrent neural network achieved high accuracy rates, scoring 92.48% and 93.03% respectively for classifying tweets related to vaccination. These models provide crucial assistance to healthcare practitioners and policymakers in making informed decisions during times of epidemic outbreaks.

Charlyn Villavicencio, Julio Jerison Macrohon, X. Alphonse Inbaraj, Jyh-Horng Jeng1and Jer-Guang Hsieh, et al [9] An examination was conducted to gauge the sentiment of Filipinos on Twitter regarding the delivery of COVID-19 vaccines by the Philippine government. This analysis employed natural language processing methods along with the Naïve Bayes model. The results revealed an accuracy rate of 81.77%, surpassing previous studies in sentiment analysis using Twitter data from the Philippines. This implies that the government's efforts were positively recognized by the populace.

Pranav Rane, Kashyap Bhansali, Prof. Sindhu Nair, et al [10] The project's objective is to influence user perspectives through Sentiment Analysis. It identifies the current mindset of users and addresses negative emotions by presenting suitable media content. The type of media response presented is tailored to individual users and may vary over time. This approach combines sentiment analysis with intelligent profile management, employing a model specifically crafted to understand user behavioral patterns.

Sonali Sharma, Manoj Diwakar, Kapil Joshi ,et al [11] Social media platforms offer individuals the opportunity to influence opinions and perspectives, presenting significant insights for businesses. Sentiment mining has been facilitated through the utilization of machine learning, deep learning, and natural language processing techniques. Deep learning has demonstrated strong performance, with transformer-based models notably transforming the landscape of natural language processing. There is a call for further investigation into pre-trained language models to enhance the analysis of both static and dynamic data.

Sudha Tushara Sadasivuni, Yanqing Zhang et al [12] Mental illness is a complex condition affecting an individual's thinking, emotions, and expression. Identifying mental illness is challenging, especially in the face of social networks. To measure an individual's mental health status, researchers have used the Word-Frequency method to analyze tweets and their relationship with mental health. This method has shown strong correlations with the SVD method results.

Chiara Zucco, Barbara Calabrese, Mario Cannataro, et al [13] The article explores how sentiment analysis and affective computing techniques can be used to detect and monitor depression. It presents an initial framework for a comprehensive multimodal system designed to monitor depression, incorporating both sentiment analysis and affective computing methods. Furthermore, it discusses the significant concerns and challenges involved in the development of such a system.

Maryam Mohammed Aldarwish, Hafiz Farooq Ahmed, et al [14] The growing prevalence of Social Network Sites (SNS) among younger demographics has prompted studies indicating that content generated by users can offer insights into mental health levels and the presence of depression. This study seeks to explore the classification of users based on their mental health statuses using artificial intelligence algorithms applied to SNS user profiles. Utilizing Support Vector Machine (SVM) and Naïve Bayes, a model is developed to classify user-generated content accordingly.

Jamil Hussain, Maqbool Ali, Hafiz Syed Muhammad Bilal, Muhammad Afzal, Hafiz Farooq Ahmad, Oresti Banos, Sungyoung Lee, et al [15] Mental disorders constitute a significant source of global disability, impacting millions annually. Social networking sites (SNS) have the potential to serve as a screening mechanism for identifying affective mental illnesses. By considering behavioral attributes like socialization, socioeconomics, and antidepressant treatments, a tool can provide prior alerts for Major Depression Disorder (MDD) diagnosis.

III.   ANALYSIS

Analysis table summarizes the research papers on the Mental Health Monitoring using Sentimental Analysis and Business Intelligence. Below is a detailed description of various algorithms used in research papers.
Table 1. Analysis Table

Title	Summary	Advantages	TechStack
A Novel Text Mining Approach for Mental Health Prediction Using Bi-LSTM and BERT Model [1]	The given work highlights the growing prevalence of mental health issues, especially among young people, and proposes a deep learning framework for real-time detection of such conditions.	Innovative Approach, Accurate Predictions, Textual Data Analysis, Comprehensive Study, Relevance to Computational Intelligence and Neuroscience	(BERT), deep learning, Bi-LSTM
Mental Health Monitoring using Sentiment Analysis [2]	This paper proposes a system for early recognition and intervention in addressing the problems faced in determining the mental state of a person.	Early Detection, Scalable and Efficient method, Practical Implications, Non-Intrusive Method	Natural Language Processing, Lambda Architecture
Emotional Sentiment Analysis of Social Media content for Mental Health Safety [3]	This study introduced a method to develop an emotion filter capable of identifying emotions conveyed in text from tweets and assessing their potential harm.	The article leverages artificial intelligence and natural language processing techniques to analyze social media content.	Natural Language Processing, CNN, RNN
LUX: Smart Mirror with Sentiment Analysis for Mental Comfort [4]	This paper introduced LUX, a novel smart mirror designed to offer sentiment analysis of human speech, enhancing daily living comfort.	The LUX smart mirror utilizes sentiment analysis techniques to analyze facial expressions and emotions. It can detect and interpret emotions such as happiness, sadness, and stress, providing real-time feedback and insights for mental well-being.	Deep learning, Raspberry Pi, Bidirectional-LSTM, Bi-GRU model
Sentiment Analysis of COVID-19 on Weibo text using optimized Bi- LSTM model [5]	China's government is adjusting strategies to mitigate negative sentiment on Sina-Weibo amid the COVID-19 crisis, despite blockages, using statistical analysis and supervised learning techniques.	It considers the observing and investigation of public opinion, and in this way gives suggestions and references to public administration and strategy oversight	Latent Dirichlet Allocation LDA model, Bi-LSTM, TS-LDA (Topic-Specific LDA), SS-LDA (Sentence Segment LDA)
Twitter Sentiment Analysis of Covid-19 Using Term Weighting TF-IDF And Logistic Regression [6]	The study utilizes Twitter data to analyze global public perceptions of Covid-19 and its impact on mental health using various machine learning techniques.	Insight into Public Perception, Data-Driven Decision Making system, Effectiveness of Techniques.	TF-IDF, logistic regression
Twitter Arabic Sentiment Analysis to Detect Depression Using Machine Learning [7]	Research suggests using natural language processing and machine learning to identify depression among Arabic Twitter users, despite challenges in translation due	The system is adaptable and incorporates cultural sensitivity, thereby making a valuable contribution to the expanding domain of mental health informatics. By	Support Vector Machine (SVM), Random Forest, Logistic Regression, K-nearest Neighbors

	to the complexity of Arabic language.	investigating novel methodologies and datasets, this paper has the potential to advance our comprehension of mental health detection.	
Sentiment Analysis of COVID-19 Tweets Using Deep Learning and Lexicon-Based Approaches [8]	The COVID19 pandemic has prompted a surge in social media usage, attracting academics and researchers, who are now using sentiment analysis to aid government officials in making informed decisions.	The combination of deep learning and lexicon-based approaches suggests a comprehensive analysis that leverages both automated machine learning techniques and established sentiment lexicons	Deep Learning techniques, Bi-LSTM and GRU techniques, tools VADER and NRCLex
Twitter Sentiment Analysis towards COVID-19 Vaccines in the Philippines Using Naïve Bayes [9]	A study on Twitter sentiment towards vaccines can inform government decisions, detect business accidents, and recommend healthcare treatments using Rapid Miner and Nave Bayes tools.	The findings can aid in the development of Effective communication strategies for promoting vaccination by addressing concerns and misconceptions highlighted in the sentiment analysis.	NLP Techniques, Naïve Bayes Classification
Sentiment Analysis to Improve Emotional Health of User [10]	A Twitter classifier trained to classify negative emotions improved with larger training sets, enhancing brand visibility and customer support in challenging work environments.	It is scalable, It has Improved User Experience, data-driven insights can inform the design of mental health interventions.	Naïve Bayes Classifier, Part of Speech Tagging
A Critical Review on Sentiment Analysis Techniques [11]	Sentiment analysis on social media helps organizations understand customer sentiment and improve brand image. Various algorithms and deep literacy approaches are used, including CNN and RNN. Sentiment analysis helps associations reach millions of guests and improves brand support	The article discusses evaluation metrics for sentiment analysis, enabling researchers to assess the performance of their models accurately	Machine learning method, lexicon-based method, Deep learning methods, Transformer methods.
Analyzing Tweets to Discover Twitter Users Mental Health Status by a Word-Frequency Method [12]	Researchers found that people tweeting with depression-related terms are more likely to post gloomy phrases. The study used the R 'tm' package and Singular Value Decomposition method to analyze word usage patterns.	Real-Time Monitoring, Cost-Effective, It is scalable, It has Potential for Early Intervention	Word Frequency method, SVD method

Sentiment Analysis and Affective Computing for depression monitoring [13]	A multimodal framework for observing sadness, using wearable gadgets, portable innovation, and lambda engineering, uses opinion investigation and profound processing to further develop medical care experts work and decrease costs.	It is scalable, Sentiment analysis and affective computing contribute to data driven healthcare, enhancing the precision and personalization of mental health services.	Affective Computing technique.
Predicting Depression Levels Using Social Media Posts [14]	Online entertainment predicts emotional wellness using Backing Vector Machine text classification. Nave Bayes model for sadness prediction, tested with 30 people, achieved best accuracy but had least precision and review.	The proposed system gives idea about the natural behaviour of the depressed patient and his/her way of thinking. It classifies the patient in one out of four levels of depression (Minimal, mild, Moderate, Severe). The system achieved better precision than SVM and Naïve Bayes Classifier.	Support Vector Machine (SVM), and Naïve Bayes.
SNS based Predictive Model for Depression[15]	A Tool has been developed to use Facebook as a reliable source for detecting depression patterns in individuals. The model analyzes a subject's Facebook activities and alerts onset alerts if abnormalities are detected	Efficient Technique, 9 Features were used while training which gave good results	PHP, Facebook Graph API, SVM, KNN, decision tree.

IV.   CONCLUSION

The culmination of this project exemplifies the transformative potential of harnessing social media and business intelligence to address mental health. In an age where digital platforms are central to our lives, they have proven to be powerful tools for promoting mental health awareness, enabling peer support networks, and disseminating critical information. By implementing business intelligence techniques, we've harnessed the immense data available on these platforms to gain deep insights into mental health trends, public sentiment, and user engagement. This data-driven approach not only helps us understand the evolving landscape of mental health challenges but also informs the design of more effective interventions and support mechanisms. It is now clear that, in a world where stigma surrounding mental health is diminishing, these technologies offer a scalable, cost-effective, and accessible means of fostering a global conversation on mental well-being. By harnessing the synergy of social media and business intelligence, we can drive meaningful change, reduce the burden of mental health issues, and ultimately contribute to a healthier and more informed society.

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