Department of Computer Science and Engineering
Bangladesh University of Business and Technology (BUBT)

CSE 498: Literature Review Records

Student's Id and Name	**Name:** Nazrul Islam Tareq and **ID:** 19202103418
Capstone Project Title	Depression Detection using Machine Learning
Supervisor Name & Designation	**Name:** Khan Md. Hasib & **Designation:** Assistant Professor, Department of CSE, BUBT
Course Teacher's Name & Designation	**Name:** Khan Md. Hasib & **Designation:** Assistant Professor, Department of CSE, BUBT

Aspects	Paper # 2 (title)
Title / Question (What is problem statement?)	Real-time Acoustic based Depression Detection using Machine Learning Techniques
Objectives / Goal (What is looking for?)	The goal of the research is to develop a real-time acoustic-based depression detection system using machine learning techniques. The system aims to provide accurate results with more reachability, using fewer resources.
Methodology / Theory (How to find the solution?)	Acoustic features are used to train a classification model for depression detection, specifically the DIAC-WOZ database available with the AVEC2016 challenge. The COVAREP toolbox is used to extract prosodic, spectral, and voice control features, which are then fused together. SMOTE analysis is employed to overcome class imbalance, and the SVM algorithm is used for classification, resulting in the Depression Classification Model (DCM) with 93Data is collected from 50 individuals using the android application cured, and they are asked to fill out the PHQ-8 questionnaire and provide voice samples. The individuals are examined and classified by a professional psychiatrist using clinical assessment tools, interviews, and physical examination. The classification labels are determined based on the PHQ-8 scores, with scores greater than or equal to 10 labeled as depressed and scores less than 10 labeled as not depressed.
Software Tools (What program/software is used for design, coding and simulation?)	The COVAREP toolbox is used to extract prosodic, spectral, and voice control features for depression detection. The SVM algorithm is used for classification in the Depression Classification Model (DCM). The android application "cureD" is developed and deployed on the cloud for self-assessment of depression using the DCM and the PHQ-8 questionnaire. The application allows users to register and use the application, while doctors have a separate login to answer user queries and evaluate PHQ-8 results.
Test / Experiment How to test and characterize the design/prototype?	The research paper describes the use of acoustic features and machine learning techniques to develop a depression classification model (DCM) with 93The individuals were examined and classified by a professional psychiatrist using clinical assessment tools, interviews, and physical examination. The classification labels were determined based on the PHQ-8 scores, with scores greater than or equal to 10 labeled as depressed and scores less than 10 labeled as not depressed.
Simulation/Test Data (What parameters are determined?)	The research paper does not explicitly mention the use of simulation or test data in the development of the depression classification model (DCM) using acoustic features and machine learning techniques . The paper focuses on the use of the DIAC-WOZ database available with the AVEC2016 challenge for training the classifiers and real-time data from 50 subjects for testing the developed android application cureD. The evaluation metrics and accuracy of the DCM are calculated based on the validation data set using acoustic features. The paper does not mention the use of any simulated or test data specifically for the development or evaluation of the DCM.

Result / Conclusion (What was the final result?)	The research paper presents a depression classification model (DCM) with 93The DCM was trained using the DIAC-WOZ database available with the AVEC2016 challenge. An android application called cureD was developed to self-assess depression using the DCM and the PHQ-8 questionnaire. The application was tested on real-time data from 50 subjects under the supervision of a qualified psychiatrist, achieving an accuracy of 90The classification labels were determined based on the PHQ-8 scores, with scores greater than or equal to 10 labeled as depressed and scores less than 10 labeled as not depressed. Out of the 50 individuals tested, 41 were labeled as not depressed and 9 were labeled as depressed based on their PHQ-8 scores and professional psychiatrist assessment.
Obstacles/Challenges (List the methodological obstacles if authors mentioned in the article)	Reluctance of individuals or families to speak out or reach doctors about depression due to various social reasons. Time-consuming and demanding nature of traditional diagnosis methods for depression, which include interviews, clinical analysis, and questionnaires. Class imbalance in the training data, which was addressed using SMOTE analysis to overcome the imbalance. Subjectivity and dependence on patient openness and support in diagnosing depression using traditional methods. Limited reachability and feasibility of remote diagnosis using traditional methods. Confusion between depression and sadness/grief/bereavement, leading to misinterpretation of symptoms. Need for desire and honesty from patients as well as highly qualified and trained doctors for accurate diagnosis using traditional methods.
Terminology (List the common basic words frequently used in this research field)	Depression disorder, Machine learning, Acoustic features, PHQ-8 questionnaire.
Review Judgment (Briefly compare the objectives and results of all the articles you reviewed)	The provided sources do not contain any information or judgments related to reviewing the research paper or its findings.
Review Outcome (Make a decision how to use/refer the obtained knowledge to prepare a separate and new methodology for your own research project)	The provided sources do not contain any information or judgments related to reviewing the research paper or its findings.

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Aspects	Paper # 3 (title)
Title / Question (What is problem statement?)	Depression Detection Using Machine Learning Techniques on Twitter Data
Objectives / Goal (What is looking for?)	The goal of the research work is to detect depression in users based on their data shared on social media, specifically on Twitter. The researchers aim to use machine learning techniques, specifically Naïve Bayes and a hybrid model called NBTree, to classify the data into depressive and non-depressive groups.
Methodology / Theory (How to find the solution?)	The research work utilizes machine learning techniques, specifically Naïve Bayes and a hybrid model called NBTree, to detect depression in users based on their data shared on Twitter. The methodology involves data collection using Twitter scraper tools and storing the data in a .csv file. The raw data is then cleaned and pre-processed, including steps such as tokenization, stemming, and lemmatization to normalize the data. Sentiment analysis is performed on the data to obtain a score of words, which helps in analyzing the state of mind of the users. The data is then fed into the Naïve Bayes and NBTree classifiers to classify it into depressive and non-depressive groups. The accuracy results of both classifiers are compared to determine the best algorithm for detecting depression.
Software Tools (What program/software is used for design, coding and simulation?)	The research paper does not explicitly mention the software tools used in the study. However, it is mentioned that the data collection from Twitter was done using Twitter scraper tools, and the data was stored in a .csv file . Additionally, the hybrid model NBTree, which combines Naïve Bayes and Decision Tree, was introduced by Ron Khavi and applied in an open-source software named WEKA. It can be inferred that the researchers may have used WEKA, an open-source software, for implementing the NBTree algorithm. The specific software tools used for data cleaning, preprocessing, sentiment analysis, and classification are not mentioned in the provided sources.

Test / Experiment How to test and characterize the design/prototype?	The research work conducted experiments to detect depression using machine learning techniques on Twitter data. Two different classifiers, Naïve Bayes and NBTree, were used to classify the Twitter data into depressive and non-depressive groups. The accuracy of the classifiers was evaluated on two different datasets: one with 3000 tweets and another with 1000 tweets. The results showed that both Naïve Bayes and NBTree had the same accuracy values on both datasets, with Naïve Bayes showing 97.31 accuracy and NBTree showing 92.34 accuracy. The researchers compared the results to determine the best algorithm for detecting depression based on the highest accuracy value. The study acknowledged the limitation of focusing only on text data and suggested future work to target selective users and their tweets at certain times to determine the status of depression.
Simulation/Test Data (What parameters are determined?)	The provided sources do not mention the use of simulation or test data in the research work. The research focused on detecting depression using machine learning techniques on Twitter data. Two different classifiers, Naïve Bayes and NBTree, were used to classify the Twitter data into depressive and non-depressive groups. The accuracy of the classifiers was evaluated on two different datasets: one with 3000 tweets and another with 1000 tweets. The results showed that both Naïve Bayes and NBTree had the same accuracy values on both datasets. The study did not mention the use of simulated or test data for the experiments. The researchers collected real Twitter data and labeled it based on the polarity score to determine depressive and non-depressive sentences.
Result / Conclusion (What was the final result?)	The research work aimed to detect depression in users based on their data shared on social media, specifically Twitter. Two different classifiers, Naïve Bayes and NBTree, were used to classify the Twitter data into depressive and non-depressive groups. The results showed that both Naïve Bayes and NBTree performed equally, with the same accuracy level. The accuracy values obtained were 97.31
Obstacles/Challenges (List the methodological obstacles if authors mentioned in the article)	One of the challenges in detecting depression through social media data is the need for accurate data collection and preprocessing techniques. The researchers used Twitter scrapper tools to collect data, but the quality and relevance of the collected data can impact the accuracy of the results. Another challenge is the normalization and analysis of the collected data. The data needs to be cleaned, tokenized, and processed to obtain meaningful insights.
Terminology (List the common basic words frequently used in this research field)	Depression, Machine learning, Social Media, Naïve Bayes, NBTree.
Review Judgment (Briefly compare the objectives and results of all the articles you reviewed)	The research paper does not provide any information or findings related to review judgment.
Review Outcome (Make a decision how to use/refer the obtained knowledge to prepare a separate and new methodology for your own research project)	The provided sources do not mention any specific review outcome related to the research paper.

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Aspects	Paper # 4 (title)
Title / Question (What is problem statement?)	Explainable depression detection with multi-aspect features using a hybrid deep learning model on social media
Objectives / Goal (What is looking for?)	The goal of the research paper is to develop an explainable depression detection model using a hybrid deep learning approach on social media. The authors aim to address the lack of explainability in existing machine learning methods for depression prediction and provide insight into the model's predictions. They propose the Multi-Aspect Depression Detection with Hierarchical Attention Network (MDHAN) model, which combines deep learning with multi-aspect features extracted from user posts on Twitter. The objective is to improve the predictive performance of depression detection and ensure adequate evidence to explain the model's predictions.
Methodology / Theory (How to find the solution?)	The research paper proposes a hybrid deep learning model called Multi-Aspect Depression Detection with Hierarchical Attention Network (MDHAN) for automatic detection of depressed users on social media. The model utilizes two levels of attention mechanisms applied at the tweet-level and word-level to encode user posts and calculate the importance of each tweet and word. It captures semantic sequence features from user timelines (posts) and combines deep learning with multi-aspect features to improve predictive performance in depression detection.
Software Tools (What program/software is used for design, coding and simulation?)	The research paper does not explicitly mention the software tools used in the study. However, it does mention the use of Natural Language Processing Toolkit (NLTK) for text pre-processing, which is a widely used package for text preprocessing and removing common words from text.

Test / Experiment How to test and characterize the design/prototype?	The research paper presents an experimental evaluation to validate the performance of the MDHAN model for depression detection on social media. The authors preprocess the dataset by excluding users with less than ten posts, users with more than 5000 followers, and users who tweet in languages other than English. The dataset consists of 4208 users, with 51.30The authors compare the performance of the MDHAN model with different attributes and find that combining both multi-aspect features and hierarchical attention network (HAN) leads to improved performance. The number of tweets for each user is found to be a key parameter, with optimal performance achieved when using 200 tweets as the maximum number of tweets.
Simulation/Test Data (What parameters are determined?)	The research paper does not mention the use of simulation or test data in the study. The authors collected real-world data from social media platforms, specifically Twitter, for their experiments. They used different datasets, including a depression dataset, a non-depression dataset, and a depression-candidate dataset, which were labeled based on the content of user tweets. The dataset was preprocessed by excluding users with less than ten posts, users with more than 5000 followers, and users who tweeted in languages other than English. The dataset was randomly split into training and test sets, and the experimental results were reported after performing five-fold cross-validation. The performance of the MDHAN model was evaluated using traditional metrics such as precision, recall, F1, and accuracy based on the confusion matrix.
Result / Conclusion (What was the final result?)	The research paper proposes an explainable Multi-Aspect Depression Detection with Hierarchical Attention Network (MDHAN) model for automatic detection of depressed users on social media and explaining the model prediction .
Obstacles/Challenges (List the methodological obstacles if authors mentioned in the article)	Existing machine learning methods for automatic depression prediction often lack explainability, which is a concern in the medical domain. The lack of explainability in machine learning models for depression prediction leads to predictions that are obscure to humans. The challenge lies in developing a deep learning-based approach that is explainable and can provide insight into the model prediction for depression detection. Extracting multi-aspect features from user behavior and online timelines on social media platforms can be complex and challenging.
Terminology (List the common basic words frequently used in this research field)	Explainable Depression Detection, Multi-Aspect Features, Hierarchical Attention Network (HAN), Deep Learning, Latent Dirichlet Allocation (LDA).
Review Judgment (Briefly compare the objectives and results of all the articles you reviewed)	The research paper does not provide any information or findings related to review judgment.
Review Outcome (Make a decision how to use/refer the obtained knowledge to prepare a separate and new methodology for your own research project)	The provided sources do not mention any specific review outcome related to the research paper.

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Aspects	Paper # 5 (title)
Title / Question (What is problem statement?)	Sentiment Analysis in Social Media Data for Depression Detection Using Artificial Intelligence: A Review
Objectives / Goal (What is looking for?)	The objective of the paper is to review the use of sentiment analysis in social media data for the detection of apprehensiveness or dejection using artificial intelligence techniques.
Methodology / Theory (How to find the solution?)	The paper utilizes artificial intelligence techniques for sentiment analysis in social media data, specifically focusing on the detection of apprehensiveness or dejection. Machine learning and deep learning techniques are employed for the classification process, with multi-class classification being emphasized for more precise sentiment analysis. Emoticons and emojis in social media data are considered as significant sources of sentiments and can be used for sentiment analysis. Feature extraction techniques are used to extract features from pre-processed data, and sentiment scores associated with emoticons and emojis are considered for sentiment analysis.
Software Tools (What program/software is used for design, coding and simulation?)	The provided sources do not directly mention specific software tools used in the sentiment analysis for depression detection using artificial intelligence. However, the paper emphasizes the use of machine learning and deep learning techniques for the classification process, indicating that software tools commonly used in these domains, such as Python libraries like scikit-learn, TensorFlow, and Keras, could be utilized. Additionally, the paper mentions the use of NLP tools for pre-processing social media data, although it states that these tools cannot be used to pre-process reviews containing emoticons and slang.

Test / Experiment How to test and characterize the design/prototype?	The provided sources do not directly mention any specific test or experiment conducted in the context of sentiment analysis for depression detection using artificial intelligence. The sources primarily focus on the use of machine learning and deep learning techniques, data collection, feature extraction, and the comparison of different algorithms and models for sentiment analysis. While the sources provide information on the utilization of social media data, sentiment identification, and the use of various artificial intelligence techniques, they do not mention any specific test or experiment conducted in this particular context.
Simulation/Test Data (What parameters are determined?)	The provided sources do not directly mention the use of simulation or test data in the context of sentiment analysis for depression detection using artificial intelligence. The sources primarily focus on the utilization of social media data, sentiment identification, and the use of various artificial intelligence techniques for classification. While the sources discuss the use of machine learning and deep learning techniques, they do not specifically mention the use of simulation or test data for evaluating the performance of these techniques. Therefore, there is no specific information available in the provided sources regarding the use of simulation or test data in the context of sentiment analysis for depression detection using artificial intelligence.
Result / Conclusion (What was the final result?)	The reviewed sentiment analysis studies on social media data for depression detection using artificial intelligence techniques have shown that multi-class classification with deep learning algorithms achieves higher precision values during sentiment analysis.
Obstacles/Challenges (List the methodological obstacles if authors mentioned in the article)	One of the challenges in sentiment analysis for depression detection using social media data is the accurate classification of multi-class sentiments, as it requires dividing the data into multiple subclasses based on polarities.
Terminology (List the common basic words frequently used in this research field)	Sentiment Analysis, Social Media Data, Multi-class Classification, Machine Learning and Deep Learning Techniques, Feature Extraction.
Review Judgment (Briefly compare the objectives and results of all the articles you reviewed)	The research paper does not provide any information or findings related to review judgment.
Review Outcome (Make a decision how to use/refer the obtained knowledge to prepare a separate and new methodology for your own research project)	The provided sources do not mention any specific review outcome related to the research paper.

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Student's Id and Name	**Name:** Nazrul Islam Tareq and **ID:** 19202103418
Capstone Project Title	Depression Detection using Machine Learning
Supervisor Name & Designation	**Name:** Khan Md. Hasib & **Designation:** Assistant Professor, Department of CSE, BUBT
Course Teacher's Name & Designation	**Name:** Khan Md. Hasib & **Designation:** Assistant Professor, Department of CSE, BUBT

Aspects	Paper # 1 (title)
Title / Question (What is problem statement?)	A depression recognition method for college students using deep integrated support vector algorithm
Objectives / Goal (What is looking for?)	The goal of the research paper is to develop a depression recognition method for college students using a deep integrated support vector algorithm.
Methodology / Theory (How to find the solution?)	The researchers collect text information from college student users on Sina Weibo and use deep neural networks for feature extraction. They construct the text information into input data that can be used for machine learning. A deep integrated support vector machine (DISVM) algorithm is introduced to classify the input data and recognize depression. The DISVM algorithm improves the stability and accuracy of depression diagnosis. Simulation experiments are conducted to verify the effectiveness of the proposed depression recognition scheme using Sina Weibo data. The study also uses a classic deep neural network to extract features from the high-dimensional original data, making it more suitable for subsequent classifier processing.
Software Tools (What program/software is used for design, coding and simulation?)	The research paper does not specifically mention the software tools used in the study. However, it is mentioned that deep neural networks are used for feature extraction. The paper also introduces a deep integrated support vector machine (DISVM) algorithm for classification. It is possible that the researchers used programming languages such as Python or R, along with relevant libraries and frameworks for implementing the deep neural networks and DISVM algorithm.
Test / Experiment How to test and characterize the design/prototype?	The research paper does not provide specific information on how to test and characterize the design/prototype. However, it mentions that simulation experiments were conducted to verify the effectiveness of the proposed depression recognition scheme using Sina Weibo data. The paper also discusses the use of deep neural networks for feature extraction and a deep integrated support vector machine (DISVM) algorithm for classification. It is likely that the researchers evaluated the performance of the depression recognition model by measuring its accuracy, precision, recall, and F1 score using appropriate evaluation metrics. They may have also compared the results of their proposed method with existing methods or benchmarks to assess its effectiveness and performance. Further details on the specific testing and characterization methods used in the study are not provided in the available sources.
Simulation/Test Data (What parameters are determined?)	The research paper mentions that simulation experiments were conducted to verify the proposed depression recognition scheme using Sina Weibo data. The paper also discusses the use of different time dimensions for capturing Weibo data, ranging from 3 months to 36 months, to analyze the recognition efficiency of depression. However, specific details about the simulation/test data used in the study are not provided in the available sources. It can be inferred that the researchers collected text information of college student users in Sina Weibo and constructed it into input data for machine learning. The proposed depression recognition scheme was evaluated using this data, but the specific characteristics or size of the simulation/test data are not mentioned.

Result / Conclusion (What was the final result?)	The proposed depression recognition method using deep integrated support vector algorithm achieved the recognition of depression among college students using Sina Weibo data. Simulation experiments verified the effectiveness of the proposed depression recognition scheme, demonstrating its ability to detect potential depression patients in the college student population. The use of deep neural networks for feature extraction and the deep integrated support vector machine (DISVM) algorithm improved the stability and accuracy of depression diagnosis. The paper discusses the feasibility of detecting depression users based on Weibo text data and the differences between depressive users and normal users in language style, use of emojis, number of Weibo, followers, etc. The research paper does not provide specific quantitative results or performance metrics for the proposed depression recognition method.
Obstacles/Challenges (List the methodological obstacles if authors mentioned in the article)	The recognition rate of depression using social network data may decrease over time, as depression is an unstable psychological variable that changes over time. The correlation between network user data and mental health weakens with the growth of original data, making it difficult to predict mental health based on network behavior.
Terminology (List the common basic words frequently used in this research field)	Depression recognition, Social networks, Sina Weibo, Deep neural networks, Deep integrated support vector machine (DISVM), Feature extraction.
Review Judgment (Briefly compare the objectives and results of all the articles you reviewed)	The provided sources discuss the challenges and methods related to depression recognition using social network data, feature extraction, and the use of deep neural networks for classification. They also mention the limitations of traditional diagnostic tools for depression recognition. However, they do not provide any specific review judgments or evaluations of the methods or findings presented in the papers.
Review Outcome (Make a decision how to use/refer the obtained knowledge to prepare a separate and new methodology for your own research project)	The provided sources do not contain any specific review judgments or evaluations of the methods or findings presented in the papers. The sources primarily focus on discussing the challenges and methods related to depression recognition using social network data, feature extraction, and the use of deep neural networks for classification. They also mention the limitations of traditional diagnostic tools for depression recognition. However, there are no explicit review outcomes or evaluations provided in the sources.