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Deep Learning Based Early Depression Detection Using Social Media

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Abstract: *Depression detection on Twitter posts or comments is critical for applications like controversial event extraction, building AI chatter bots, content recommendation, and sentiment analysis. We define this task as being able to classify social media posts as potentially indicating signs of depression or not. The complexity of the natural language constructs makes this task very challenging. The proposed system processed text using a supervised learning approach for Depression detection in desired tweets, posts or comments. The system also uses a polarity data-set to identify sentiment basis. The proposed method used a deep learning approach for classification. In the present research, a deep learning depression detection model is established with the help of deep learning models. Deep learning techniques such as RNN are applied to the social media data set. A comparative analysis is performed to validate the proposed method's performance and efficiency..*

Keywords: Feature Extraction, Depression speech Content Detection, Social Media, Potential User Detection, Supervised Classification, Identity Deception.

I. INTRODUCTION

Social media platforms are one of the crucial means for communication and information dissemination over the internet. These fake identities can be created by bots or humans. The fake identities by bots generally target large group of peoples at a time. Also various preprocessing steps such as stop word removal, Porter's algorithm for stemming lexical analysis are applied on the data extracted through social media data. Deep learning methodology, according to which we can automatically build an automatic text classifier by learning, from a set of pre-classified text documents based on the characteristics of the categories of interest. Predict depression ideation based on score or weight with class label. In many situations humans who are depressed are totally ignorant of their disturbed mental condition. They are unable to identify the cause of constant unhappiness in them and eventually such students fall into a state of mind where they start having suicidal tendencies. In some cases students do know that they are suffering from depression, but they are hesitant to seek any kind of help from anyone mainly due to the wrongly conceived notion of 'humiliation' associated with depression. It is better to identify the signs of depression at initial stages of depression. Depression if identified in the initial stages, just a simple one hour talk with a counselor may be of immense help for the student.

II. LITERATURE SURVEY

According to [1] This project uses deep learning (DL) methods like CNN, LSTM, and RNN to improve depression diagnosis. Social media data from platforms like Facebook, Reddit, and Twitter helps identify patterns, contributing to AI-driven mental health detection.

According to [2] This project introduces two architectures using multi-task learning (MTL) to detect stress and depression in social media posts. Shared and task-specific BERT layers are used, with one approach including an Attention Fusion Network. MTL outperforms single-task learning (STL), with future work focused on explainability and model improvement.

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This project proposes a CNN-based method for early depression detection using Early and Late Fusion strategies with pre-trained embeddings. Results show improved performance and highlight the importance of emotions through emoticon mapping. Future work will explore alternative models, larger datasets, and demographic factors for enhanced accuracy.

According to [4] Identifying anxiety and depression through prediction models analyzing social media language can complement traditional screening. Continuous temporal analysis of social media data is crucial, with studies increasing during the COVID-19 peak (2019–2020). While ethical considerations are necessary, AI-based models could help detect early symptoms before severe psychosocial consequences ariseAccording to [5] Reddit users' postings to see if there are any indicators that might show how relevant online people feel about depression. To do this, we train the data using Natural Language Processing (NLP) methods and machine learning techniques, and then test the effectiveness of our suggested strategy. We find a vocabulary that is more prevalent in narratives of depression. The results demonstrate that the performance accuracy of our suggested strategy may be greatly increased. Bigram, along with the Support Vector Machine (SVM) classifier, is the best single feature for detecting depression with 80% accuracy and 0.80 F1 scores. The Multilayer Perceptron (MLP) classifier has the best performance for depression identification, thereby demonstrating the power and usefulness of the combined features (LIWC+LDA+bigram).

According to [6] a hybrid technique has been put out that can identify sadness using textual user postings. Early Detection of Depression in CLEF eRisk 2019 is a pilot project in which performance of deep learning algorithms was assessed using test data from the dataset of Reddit. Deep learning algorithms were taught using training data. Particularly, Bidirectional Long Short Term Memory (BiLSTM) with various word embedding methods and metadata elements was suggested, and it produced positive results.

According to [7] a machine learning classifier method for diagnosing sadness using social media messages takes 90 distinct characteristics as input. These features are able to provide outstanding results in terms of depression identification since they are derived from a mix of feature extraction methodologies combining sentiment lexicons textual contents.

According to [8] in-depth research is done on depression predictors. The strategies include asking people to fill out surveys, posting on social media, using text in conversational interactions, and observing facial expressions to gather data. The outcome is obtained from the retrieved data. The outcome here is whether or not the individual need care. In this study, several machine learning algorithms and classifiers, including Decision Trees, SVM, Naive Bayes Classifier, Logistic Regression, and KNN Classifier, are examined to determine a target group's mental health status. The general public, including high school kids, college students, and working professionals, are the target populations employed in this identification procedure.

According to [9] the information gathered from internet databases. For improved prediction, the data has been label-encoded. To produce labels, the data is being subjected to several machine learning approaches. The model that will be developed to forecast a person's mental health will then be based on these categorised labels. Before the algorithm is used to create the model, its correctness will be examined. We intended to use classification techniques like Nave Bayes, Random Forest, and Decision Tree.

According to [10] using machine learning methods to identify potential depressed Twitter users based on their network activity and messages. Using information gleaned from a person's network activity and tweets, trained and tested
classifiers may determine if a user is sad or not. The findings indicated that the accuracy F-measure scores in identifying sad users increased with the number of characteristics included. A data-driven, predictive strategy is used in this technique to identify depression or any other mental diseases early on. The examination of the traits and their influence on determining the depression level is the key contribution.

According to [11] Advances in deep learning have improved methods for identifying depression, which is one of the illnesses that affect the health of individuals. Some researchers employ a variety of deep-learning approaches to improve the diagnosis, detection, and prediction of depression to support expert decision-making. The researchers identified the available prediction techniques and tools used to detect, forecast, compare, and classify depression in victims systematically. Twenty-eight (28) articles relevant to machine learning and thirty-two (32) articles linked to deep learning were chosen and considered using boolean keyword searches in different publishing databases and filters.

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A significant number of the studies, according to the conclusions of the analysis, used machine learning techniques such as decision trees, K-nearest neighbours, naive bayes, random forests, and support vector machines. The deep learning models that are most frequently utilised include convolutional neural networks, long short-term memory, and recurrent neural networks with different datasets to detect subjects suffering from depression using social media data. The datasets used in these studies include Twitter, Facebook, Reddit, tweets from the Kaggle website, and clinic patients' records. These datasets can include posts, comments, audio, video, images, and interviews.

In [12] machine learning models used to detect anxiety and depression through social media. Six bibliographic databases were searched for conducting the review following PRISMA-ScR protocol. We included 54 of 2219 retrieved studies. Users suffering from anxiety or depression were identified in the reviewed studies by screening their online presence and their sharing of diagnosis by patterns in their language and online activity. Majority of the studies (70%, 38/54) were conducted at the peak of the COVID-19 pandemic (2019–2020). The studies made use of social media data from a variety of different platforms to develop predictive models for the detection of depression or anxiety. These included Twitter, Facebook, Instagram, Reddit, Sina Weibo, and a combination of different social sites posts. We report the most common Machine Learning models identified. Identification of those suffering from anxiety and depression disorders may be achieved using prediction models to detect user's language on social media and has the potential to complimenting traditional screening.

In [13] the first study, which exploits two different datasets collected under different conditions, and introduce two multitask learning frameworks, which use depression and stress as the main and auxiliary tasks respectively. Specifically, we use a depression dataset and a stressful dataset including stressful posts from ten subreddits of five domains. In terms of the first approach, each post passes through a shared BERT layer, which is updated by both tasks. Next, two separate BERT encoder layers are exploited, which are updated by each task separately. Regarding the second approach, it consists of shared and task-specific layers weighted by attention fusion networks.

According to [14] a method of early detection of depression in social media based on a convolutional neural network in combination with context-independent word embeddings and Early and Late Fusion approaches. These approaches are experimentally evaluated, considering the importance of the underlying emotions encoded in the emoticons. The results show that the proposed method was able to detect potentially depressive users, reaching a precision of 0.76 with equivalent or superior effectiveness in relation to many baselines ($F1$ (0.71)).

III. METHODOLOGY

We here propose a system, which will take the data from social networking sites and will detect depression ideation eventually in the real time. The comments or public posts of the persons will be considered and these data will be further processed and hence the system will display the result as "depressed" or "Not Depressed".

Here we have used a dataset that contains comments with their respective label. The label of a particular comment indicates whether that comment is showing any risks or not. If the label is "Depressed" then it means that the comment indicates that a person has some signs of being depressed and which could lead to risk eventually. On the other hand, if the label is "Not Depressed" that means that particular comment shows no sign of sadness or depression and hence reflects no risk of depression ideation.

Now these comments are then passed through the pre-processing phase where the data are made ready for passing through either training or testing module. For training testing we consider 70-30% pattern for execution and 5_fold, 10_fold and 15_fold cross validation respectively.

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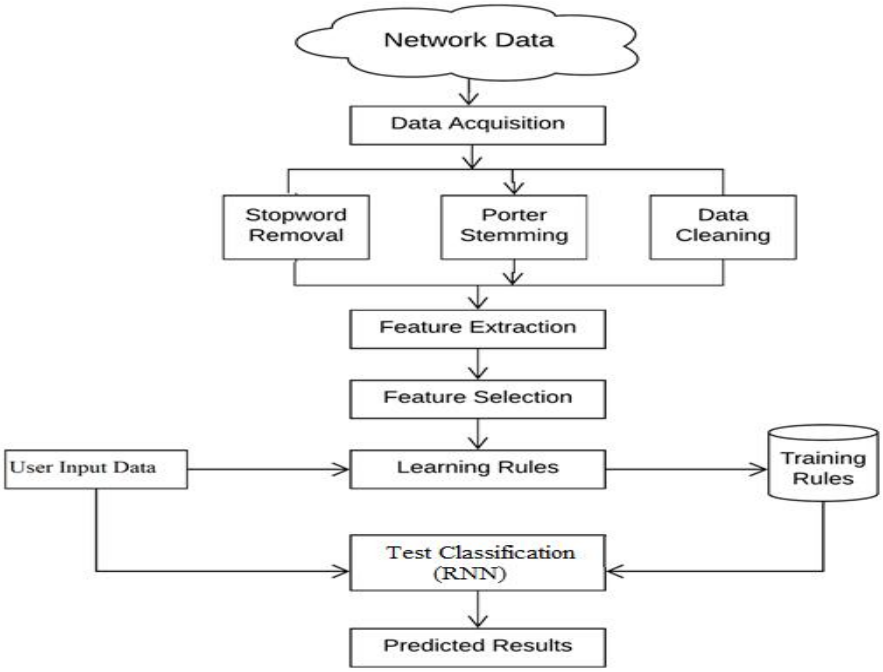

Figure 1: Proposed system

Implement Process

A natural language Processing has been applied to the training data for the feature extraction, which consists of the following phases:

Data Acquisition:

First of all the information for different social media accounts based on certain parameters is extracted from social network using API.

Pre-processing:

Collection of text based on categories. Every text belongs to one category and has been corrected labeled.

We divided this corpus into two sets: the training set and the testing set.

Remove all the unnecessary elements in the text, such as lexical analysis, stopword, punctuation, or unreadable text.

Feature Extraction

The appropriate set of features from the given document can be extracted such that it can improve the overall performance.

In feature extraction, based on some counter measure the feature can be extracted.

Classification:

After choosing proposed text classification algorithms deep learning and feed the training corpus to the classifier to get a training model.

After we get the training model, we can feed the testing data into it and get the prediction of classification. The testing stage includes preprocessing of testing text and classification of the testing text.

For training testing we consider 70-30% pattern for execution and 5 fold, 10 fold and 15 fold cross validation respectively.

Execution Process

Step 1: We will extract data from our own web application which contains various comments as well as user reviews as well as we have some synthetic datasets.

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Step2: Apply NLP during the training, NLP consist below phases

- Tokenization
- Stop word removal
- Porter stemming
- Feature extraction
- Feature selection

Step3: Once feature selection has done, each feature has stored on respective topic, at the time training phase execution has finished.

Step4: we have used as base classifier for features extraction and generate the Background Knowledge (BK) of system as supervised earning. We used Recurrent Neural Network (RNN) for proposed new classifier on same.

Step5: Similar NLP will be execute for testing and extract the features.

Step6: Respective algorithm similarity mapping techniques has used to generate the weight and assign test label.

Step7: evaluate the accuracy using confusion matrix evaluate the performance analysis of system

Input and Expected output

In this approach, there are 2 phases. One is the training phase. In this phase, the system can be trained with the help of a sorted dataset. And another is the testing phase, in which the system can test and analyze data with the help of the system's proposed mechanism. The system categorizes testing data as "depressed" or "Not Depressed," etc. The system gets social media data through social media web site. It is run time data accessing from the user account. Give analysis graph and result on a different type of data with analysing the accuracy and a false ratio with the help of confusion matrix.

Algorithm Details:

Input: Test Dataset which contains various test instances TestDBLits [], Train dataset which is build by training phase TrainDBLits[] , Threshold Th.

Output: HashMap <class_label, SimilarityWeight> all instances which weight violates the threshold score.

Step 1: For each read each test instances using below equation

$$testFeature(m) = \sum_{m=1}^{n} (.featureSet[A[i] \dots\dots A[n] \leftarrow \text{TestDBLits})$$

Step 2 : extract each feature as a hot vector or input neuron from $testFeature(m)$ using below equation.

Extracted_FeatureSetx [t……n] = $\sum_{x=1}^{n}(t) \leftarrow testFeature$ (m)

Extracted_FeatureSetx[t] contains the feature vector of respective domain

Step 3: For each read each train instances using below equation

$$trainFeature(m) = \sum_{m=1}^{n} (.featureSet[A[i] \dots\dots A[n] \leftarrow \text{TrainDBList})$$

Step 4 : extract each feature as a hot vector or input neuron from $testFeature(m)$ using below equation.

Extracted_FeatureSetx[t……n] = $\sum_{x=1}^{n}(t) \leftarrow testFeature$ (m)

Extracted_FeatureSetx[t] contains the feature vector of respective domain.

Step 5 : Now map each test feature set to all respective training feature set

$$weight = calcSim\ (\text{FeatureSetx} \,||\, \sum_{i=1}^{n} \text{FeatureSety[y]})$$

Step 6 : Return <object_id, weight>

Problem statement

The proposed research to design and implement a system for depression prediction using Deep learning, the vocal features has extracted from users' input text data and predict the label of depression.

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Objective

- To design and develop a system for depression detection using deep learning algorithm.
- To design and developed a NLP approach for with training as well testing.
- To develop and validate the proposed system with synthetic data as well as real time input data.
- To evaluate the proposed system result with existing approaches

Mathematical Model

Let S is the Whole System Consist of
S= {I, P, D, O}
I = Input data.
P = Process:
D = Dataset
Step1: User will enter the query.
Step2: After entering query the following operations will be performed.
Step3: Data Preprocessing.
Step4: Feature extraction and feature selection.
Step5: Training and Testing dataset.
Step6: Classification.
Step7: Final output optimized classifier and its performance indicator.
O= Output (Predicted class label)

IV. RESULTS AND DISCUSSION

The RNN model was used in this experiment to measure accuracy, precision, recall, and f-score through several cross-validations. Figure 1.2 depicts the validation of the model through the utilization of cross-validation, specifically employing RNN. Take into account the following Figure 1.2 illustrates the validation of the model by cross-validation using the RNN classifier.

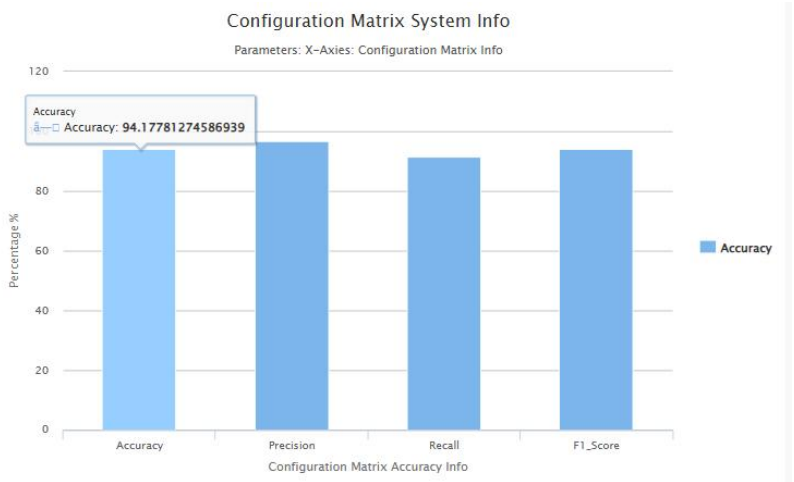

Figure 1.2: Validation of Model with Cross Validation using RNN Classifier

Experimental findings of figure 1.2 shows by using cross validation, the accuracy, precision, recall and f-score of RNN model is 94.17, 96.83, 91.35 and 94.01 respectively.

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V. CONCLSUION

The proposed system describes feature extraction and feature selection approach using various techniques, basically the system proposed NLP approach for data preprocessing as well as data normalization. Select important features from entire data set all document it is much important for accurate classification. The system works with basic NLP features like tokenization, stop word removal and dependency parser respectively. Once the preprocessing has done system deals with feature extraction, in this phase we extract features as well as dependency rule base features including lemmas features. To select specific features from extracted vector according to aspect category, five aspect categories has considered during the feature selection. In this phase we also add some synonyms for respective tokens to achieve accuracy for build the train model. After completion of whole process you will apply prospective classifier to generate the rules and system training has completed.

REFERENCES

[1] Wadzani Aduwamai Gadzama, Danlami Gabi , Musa Sule Argungu , Hassan Umar Suru"The use of machine learning and deep learning models in detecting
depression on social media ."ScienceDirect , 2024 .
[2] Loukas Ilias , Dimitris Askounis. "Multitask learning for recognizing stress and depression in social media" . ScienceDirect, 2023 .
[3] José Solenir L. Figuerêdo , Ana Lúcia L.M. Maia, Rodrigo Tripodi Calumby
. "Early depression detection in social media based on deep learning and
underlying emotions" .ScienceDirect, 2022.
[4] Arfan Ahmed , Sarah Aziz ,Hashem Abu Serhan , Carla T. Toro , Alaa A. Abd-alrazaq , Mahmood Alzubaidi, Sara Irshaidat , Mowafa Househ. "Machine learning models to detect anxiety and depression through social media: A scoping review ". ScienceDirect, 2022.
[5] Tadesse, Michael M., et al. "Detection of depression-related posts in reddit social media forum." IEEE Access 7 (2019): 44883-44893.
[6] Shah, Faisal Muhammad, et al. "Early depression detection from social network using deep learning techniques." 2020 IEEE Region 10 Symposium (TENSYMP). IEEE, 2020.
[7] Chiong, Raymond, Gregorious Satia Budhi, and Sandeep Dhakal. "Combining sentiment lexicons and content-based features for depression detection." IEEE Intelligent Systems 36.6 (2021): 99-105.
[8] Narayanrao, Purude Vaishali, and P. Lalitha Surya Kumari. "Analysis of machine learning algorithms for predicting depression." 2020 international conference on computer science, engineering and applications (iccsea). IEEE, 2020.
[9] Laijawala, Vidit, et al. "Classification algorithms based mental health prediction using data mining." 2020 5th International Conference on Communication and Electronics Systems (ICCES). IEEE, 2020.
[10] AlSagri, Hatoon S., and Mourad Ykhlef. "Machine learning-based approach for depression detection in twitter using content and activity features." IEICE Transactions on Information and Systems 103.8 (2020): 1825-1832.
[11]Gadzama, Wadzani Aduwamai, et al. "The use of machine learning and deep learning models in detecting depression on social media: A systematic literature review." Personalized Medicine in Psychiatry 45 (2024): 100125.
[12] Ahmed, Arfan, et al. "Machine learning models to detect anxiety and depression through social media: A scoping review." Computer methods and programs in biomedicine update 2 (2022): 100066.
[13] Ilias, Loukas, and Dimitris Askounis. "Multitask learning for recognizing stress and depression in social media." Online Social Networks and Media 37 (2023): 100270.
[14] Figuerêdo, José Solenir L., Ana Lúcia LM Maia, and Rodrigo Tripodi Calumby. "Early depression detection in social media based on deep learning and underlying emotions." Online Social Networks and Media 31 (2022): 100225.