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# A Novel Approach for Detecting Schizophrenia using Deep Learning Techniques like LSTM and CNN from Social Media

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Abstract— Schizophrenia is a serious intellectual disease that is one of the main reasons for disability in the world. The detection of this kind of a mental disorder is paramount for the well being of human beings; Schizophrenia gets usually identified in later stages, where it becomes a lot difficult for the person to get treated hence we need another way to identify schizophrenia beforehand so that it will not go out of control and can be treated smoothly. One of the ways currently to detect schizophrenia is using MRI scans of the brain which can only detect schizophrenia in later stages. The world we live in is a digital world and almost all of the people including all age groups use the internet and use social media as a platform to express their opinions and feelings. Thus by using the social media profile of a person we would be able to detect Schizophrenia. This paper mainly deals with various existing methodologies and drawbacks related to the above problems like detecting Schizophrenia in early stages and detection of Schizophrenia through different types of social media posts.

Keywords: Deep Learning, MRI scans, NLP, Schizophrenia, Social Media, Diagnosis.

## I. INTRODUCTION

Schizophrenia is a serious mental disorder due to which the person gets both positive and negative symptoms. The positive symptoms are the ones that patients experience that healthy people don't experience. These include delusions, disorganized speech, and hallucinations. The negative symptoms are the ones that ordinary people don't experience. These include lack of motivation, emotional expression. Almost 10% of the people in this world are suffering with schizophrenia and the number will only grow in this modern era.

Schizophrenia is such a mental disorder which if not diagnosed and treated the health of the person gets more and more deteriorated. Hence we need to identify it early which will not worsen the health. Early detection of schizophrenia is very challenging. One of the current ways to detect schizophrenia is through using MRI scans. Studies showed that schizophrenia alters the structure of the brain which will be detected through these MRI scans. But these can only be useful once the disorder has gotten into latter stages which can be harmful for the patient.

The digital world we are living, has almost all of the people addicted to the internet. Almost all people irrespective of the age groups use social media. Use of social media is only ever growing. People tend to share their feelings and emotions online using applications like instagram, twitter, reddit, facebook etc.The contents of these posts can be used to identify schizophrenia in the people. The posts are of the format text, images, audio and videos. These data can provide information about their mental health which will help us in detecting schizophrenia.

In our model we use Machine learning and deep learning models to detect schizophrenia through text. Three dimensional convolutional neural network can be used to process the images. The audio can be converted into text and then be processed like other text input. Once the detection of schizophrenia through social media is done and if it is positive then we can add another feature which will take input of MRI scans to confirm the detection of schizophrenia.

## II. EXISTING SYSTEMS

In the Existing Systems, Schizophrenia Detection was done by using various approaches. Most of them were using MRI Image datasets of the Human Brain. They used Machine Learning algorithms like SVM to classify the data into schizophrenic and non-Schizophrenic. This method will predict Schizophrenia with an accuracy of 80%, but it did not predict well when the quality of the images are not too good and It did not predict it in the early stages. These are some drawbacks for this case.

In the other Existing Systems they extracted the data from Twitter. They used NLP techniques to classify the tweets as Schizophrenic or non-schizophrenic. But it can only detect the accounts that have Schizophrenia but not the other accounts.

Some other Existing Systems tell us that we can even detect it with the help of Social Media content like



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Tweets.Here they used LDA for detecting most repeated words and it is classified according to it. But here we cannot give our own inputs and the Social Media content involves only Text data but not Audio or Video Data. So considering all the above drawbacks we are going to prepare a Model that can predict Schizophrenia at the early stages by using the Social Media content in the form of Text, Image, Audio and as well as Video.

### **III. LITERATURE SURVEY**

Jina Kim, Jieon Lee, Eunil Park & Jinyoung Han [1]. In this paper they used XGBoost and CNN models for detecting mental illness. The CNN model used word2vec API in python. CNN has multiple layers including the embedding layer and finally sigmoid function for classification. CNN has a very high accuracy of 86%.

Tianlin Zhang, Annika M. Schoene, Shaoxiong Ji and Sophia Ananiadou[2]. Main objective of this paper was to compare how machine learning and deep learning models can be useful in natural language processing for detection of schizophrenia. Deep learning models were much more efficient and easier to use.

Jihoon Oh, Baek-Lok Oh, and Kyongsik Yun [3]. MRI images were used as input. They used three dimensional CNN architecture for classification. The input was converted to a video of MRI images. They used the ReLU activation function in the neural network.

Katrin Hansel, Inna Lin, Michael Sobolev, Whitney Muscat [4]. Instagram data of users is used to detect schizophrenia. Image processing was done using python openCv library.Image processing was done using python openCv library.Image statistics such as width, height were extracted. HSV, RGB, Haar- Cascade Classifier were used to evaluate the properties used for detection of schizophrenia like saturation, colorfulness, aspect ratio.

Yi Ji Bae, Midan Shim , Won Hee Lee [5] for the dimensionality reduction they used LDA for optimum repeated terms which returns a probability distribution of terms for the challenge of textual information in this tf-idf have become used to degree the maximum essential word it acts like a vectorizer. Binary classification was done with help of logistic regression.

Margaret Mitchell, Kristy Hollingshead, Glen Coppersmith [6] They used liwc which helped in finding a number of times a user writes i or me in a post and also used a algorithm called brown brown clustering that finds similar words to make clusters and merged to form another cluster these end leaf clusters are the features values of the model they used two different models such as svm and max entropy model for this svm model accuracy is 823 for max entropy model accuracy is 8.19% this model works only for balanced dataset.

Vinnarasu A, Deepa V Jose [7] nlp is to extract the features from the speech which has a few values they used google api

which takes enter as speech and converts them into indicators and the indicators can be transformed to textual content layout this enables in changing enter from speech to textual content. They used a 2 second pause to become aware of the length of a sentence.

Kimberly McManus, Rachel L. Haynes, Jonathan D. Tatum [8] They used the natural language toolkit nltk for python to carry out tokenization and lemmatization extracted textual features and used for producing the very last numeric feature vectors in this ann and support vector machines have been used they were given special accuracy precision recall and f1 rating for every model svm with pca version helped in identifying the users who're stricken by schizophrenia with an accuracy of 8.93 only for diagnosed individuals.

Dafa Shi, Xiang Yao, [9] In this paper both the MRI and fMRI scans are used to detect schizophrenia . They used a new method called the M3 method to classify schizophrenia patients without using any Global Signal Regression. But we require large sample size data to detect schizophrenia.

Elisa Veronese, Umberto Castellani, [10] It is used to categorize Schizophrenia and Health Control. The MRI datasets are analyzed deeply after which they used sample category techniques to extract the data from the datasets, So they used a few distinct approaches of SVM based total techniques to categorize the MRI records and nucleotide polymorphism records.

Joel Weijia Lai, Candice Ke En Ang, [11] In this paper they used various AI and ML techniques to detect schizophrenia. They have taken both MRI scans and also PET scans for detecting it. Both linear and non-linear SVM methods were used to analyze the data. They used DFA to classify the data and the accuracy was 77%.

Jia Fu, Sen Yang, [12] In this paper they detected schizophrenia primarily based totally on speech instead of textual content via means of the use of CNN approaches. They used the CBAM module to categorize the data into schizophrenic and non-schizophrenic. The accuracy became round ninety one, but it did not find out the severity of the disease.

Gurparsad singh, Suri, Gurleen kaur and Sara Moein [13] They used svm(support vector machine) to classify the data into schizophrenia and healthy control groups. It applied 10-fold cross validation to confirm the results. Different ML models are presented for detecting schizophrenia patients among other cases based on the significant regions of the brain using MRI data.

Geetha soujanya chilla[14]. They used the ensemble methods to classify schizophrenia and healthy control cohorts using a diverse set of neuroanatomical measures(cortical and subcortical volumes, cortical areas and thickness, cortical mean curvature). Also they correlated such neuroanatomical features with Quality Of Life(QOF).

Yan-Jia Huang [15]. They used BERT model to detect schizophrenia based on the textual and acoustic speech



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between occupational therapists or psychiatric nurses and schizophrenia patients to predict the level of their thought disorder. They firstly record the conversation between the patient and therapist, then divides into Acoustic features, semantic textual features and syntactic textual features to predict.first record the conversation between the patient and therapist, then divide it.

Delaram Sadeghia, Afshin Shoeibib [16]. Various artificial intelligence (AI) techniques have been employed with advanced image processing methods to accurately diagnose SZ Introduces the most important conventional machine learning (ML) and deep learning (DL) techniques in the diagnosis of diagnosing SZ Future works in diagnosing SZ using AI techniques and MRI modalities.

Wei Yen Chong, Bhawani Selvaretnam, Lay-Ki Soon [17] This paper used sentiment classification. In this they used subjectivity classification and semantic association. In the subjectivity classification method the system scans the tweets phrase via way of means of phrase and reveals out the phrase that incorporates sentiment if the phrase withinside the tweet includes fine or terrible sentiment weightage the tweet might be categorized as object or subject also additionally the neutral. They used SVM, NB, maximum entropy in classifying sentiment.

Nisha Pawar, Zainab Shaikh, Poonam Shinde, Prof. Y.P. Warke [18] In this paper they used Optical Character Recognition (OCR) for image to text. The Tesseract OCR engine makes use of LSTM. LSTM is part of RNN. it is likewise appropriate at spotting large part of textual content statistics rather than single characters tesseract ocr engine substantially reduces mistakes created withinside the technique of person reputation tesseract assumes that the enter photo is a binary photo and processing takes region step-by-step the first step is to apprehend related components outlines are nested into blobs these blobs are prepared into textual content lines text lines are damaged in step with the pitching if there's a hard and fast pitch among the characters then reputation of textual content takes region thats a two-pass technique.

Su Myat Mon, Hla Myo Tun,[19] In this paper they detected schizophrenia based on the audio data, they applied HMM method to train and test the audio data. Then the data is pre-processed and the sample data is extracted to the feature vectors. It achieved an accuracy of 87.6%. But it didn't predict well for larger sample data.

Neha Gaur, Dr. Neetu Sharma (HOD), [20] In this paper they used NLP techniques to capture the sentiments of the text. They used Naive Bayes classifier to classify the data according to the emotions it predicted. Pre-processing is done after converting the text into lowercase letters.

#### **IV. PROPOSED SYSTEMS**

In our proposed system we included many ways to detect schizophrenia like by using text, audio, video, image, and finally mri scan of the brain. For text the LSTM model is used. For audio CNN was used. For live feed and image CNN is used. For the MRI images we used Decision Tree for the classification.

LSTM is a sort of RNN that may be used for series category tasks which include speech identification, time collection analysis and NLP. In the case of despair detection we are able to use an LSTM version to research serial data which include modifications in temper or behavior to pick out styles that could imply the presence of schizophrenia.

CNN is a sort of DNN, it makes use of convolutional filters to learn research and understand spatial patterns in snap shots and videos, its hierarchical shape and capacity to automatically extract features based on the features it identifies schizophrenia of a specific photo or the frame of the video.

#### **Design and Methodology**

In the building of this model, several deep learning models have been used for processing different types of data.

#### A. Data set Description:

We used 4 types of data- Text, Audio, Image and MRI images.

For the text data we used a CSV format which had a total of 3 attributes. The first one was id, the second one was the comment or text and the final attribute is the description of the text i.e whether it is schizophrenia or not schizophrenia. It is a binary value. We used a dataset of 24,000 rows after the pre-processing was done. The dataset contains empty comments which are ignored by the model. From this we took 70% of the data as training and 20% for validation and remaining 10% for testing.

For the audio we recorded our own voice for various comments to test the model. The audio module uses Convolutional Neural Network to classify the audio as schizophrenia and non-schizophrenia. The audio files must be in WAV file format.

For the image, we used a huge set of images taken from kaggle which were labeled as happy, sad, fear, angry, and other emotions. Nearly 4,000 images were used for each emotion. We used CNN for the classification of the images.

For the MRI images we used a dataset which has MRI scans of the brain and were already labeled as schizophrenia and non schizophrenia. We took 1000 images of MRI scans which were normal and 1000 which were abnormal. For this we used Decision Tree for the classification of the images.

#### Methodology:

In the text module we take the twitter username of the person we want to perform the analysis on. Using the twitter API we extract the most recent tweets of the user and predict for each tweet. We used 50% as the threshold i.e if more than 50% of the tweets chosen were predicted as schizophrenia, the user was labeled as having Schizophrenia.



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In the audio module we used CNN for classification of the audio file. We included speech prevalence, disorganized speech and other factors like standard deviation of frequency, mean frequency of the audio sample for the classification of the file.

In the image module we took 7 different types of emotions. We categorized the sad and fear emotions as schizophrenia based on our research about schizophrenia. The other emotions were categorized as non-schizophrenia.

In the live feed module we classified the person in the camera based on the actions he performed like the various hand gestures. We also used the expressions of the person like if the emotion of the person was changing many times or frequently we classify it as schizophrenia.

In the MRI module we trained our Decision Tree with two classes of data labeled as Normal meaning no schizophrenia and abnormal meaning schizophrenia.

#### B. Techniques used

- Long Short Term Memory(LSTM): LSTM units are part of a rnn(recurrent neural network) structure. These RNNs are used to utilize some varieties of artificial memory processes which can help the artificial intelligence applications to run more effectively than human intelligence. Long short-term memory(LSTM) can be used to solve various tasks that are previously not solvable by traditional learning algorithms for RNNs. As LSTMs are efficient at capturing long-term dependencies without getting influenced by the optimization hurdles which will plague the simple recurrent networks SRNs. These have also been used to advance the state of the art models for many tough problems
- 2) Convolutional Neural Network(CNN): CNN is a deep neural network which is used for the classification of image, speech and audio signals. It can have any number of layers but it has 3 primary layers- first the convolutional layer, second the max pooling layer, third the fully connected layer or the dense layer. The convolutional layer acts as the input layer and it defines the input shape of the data to be taken into the neural network. It extracts the features of the image. The max pooling layer downsamples the data by taking only the important features. Finally the dense layer in which each neuron receives input from each and every neuron in the previous layer. It gives the final classification of the model.
- 3) Decision Tree: Decision Tree is a supervised learning algorithm which can be used for classification and regression. Decision tree follows a tree-like structure consisting of a root node, branches, decision nodes or internal nodes and finally the leaf nodes which depicts the class labels used for classification. The root node represents all the samples of data and based on a certain attribute which has the highest information

gain we distribute the samples into other internal nodes. This splitting continues until the samples can no longer be divided as they belong to same class. This node is called the leaf node which has a class label.

#### V. RESULTS

Therefore a model has been created by using LSTM,CNN and Decision Tree for detecting schizophrenia from social media, it takes input from the social media by providing the Twitter id to the model, then it will collect tweets from a period of time from that account and detects schizophrenia from that. It can work on different inputs such has text, audio, vedio, image and MRI. This model is able to detect schizophrenia from inputs consisting of disorganized speech, images with different saturation, model also works on MRI data which mainly depends on the information from the right temporal area in detection of schizophrenia. Model is well trained with different data sets to detect schizophrenia from various inputs and performs better to identify the schizophrenia.We used f1 score as the metrics for our model and it gives 98% of accuracy.

## VI. CONCLUSION

By the conclusion of this project, we had developed a Deep learning model that could detect schizophrenia from social media content has it takes input from the twitter. It can work on text, audio, video, image and MRI scans. This model clearly outperforms more conventional techniques for detecting schizophrenia from those inputs. We have used the LSTM (Long Short Term Memory) for the text inputs, this model provides 98% accuracy, we used the CNN(convolutional neural network) model for audio and video inputs to detect schizophrenia because it is better than Feed forward neural network, we used Decision tree for MRI scans to detect schizophrenia through the MRI scans of brain of the user.

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