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Dyslexia Prediction

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ABSTRACT

Dyslexia poses significant challenges in learning, particularly in reading, due to neurological factors. Individuals with dyslexia often struggle with reading, writing, spelling, and fluency, despite having normal intelligence. Machine learning and deep learning techniques have been explored for dyslexia prediction using diverse datasets. This review evaluates the performance of deep learning models in dyslexia prediction and highlights the associated challenges. The objective is to assist researchers in developing predictive models based on available dyslexia-related datasets, addressing pertinent challenges in the field.

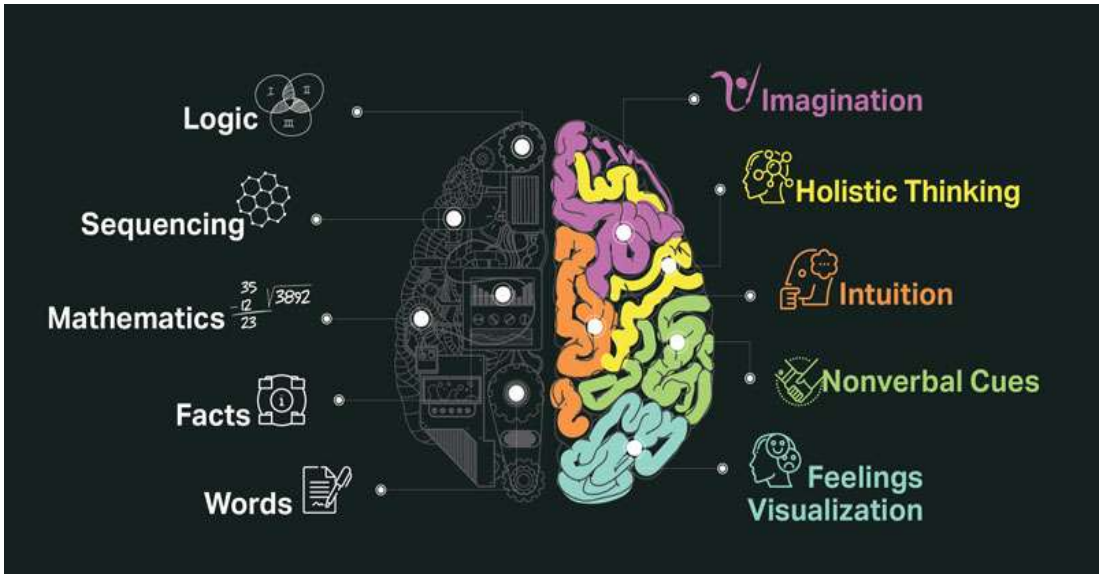
KEYWORDS: dyslexia prediction, feature extraction ,diagnosing dyslexia , machine learning , SVM, decision tree, random forest..

INTRODUCTION

Dyslexia is a prevalent learning difficulty affecting various language-related skills, such as reading, writing, and spelling, irrespective of intelligence levels. Its etymology, stemming from Greek roots, signifies a language disorder. Dyslexia's prevalence underscores the importance of early detection to mitigate its impact on learning. Neurological perspectives have enhanced dyslexia diagnosis, leveraging technologies like medical imaging. This paper reviews machine learning-based dyslexia detection methods, emphasizing recent advancements in deep learning approaches.

Dyslexia is a specific learning disorder that primarily affects reading skills, but it can also impact other areas of learning, such as writing and spelling. Dyslexia is not related to intelligence, as individuals with dyslexia typically have normal or above-average intelligence levels.

It is important to note that dyslexia is a lifelong condition, but with appropriate support and interventions, individuals with dyslexia can learn to overcome many of the challenges associated with the disorder



LITERRATURE SURVEY

1.Developmental dyslexia detection using machine learning techniques : A survey
By Shahriar Kaisar (RMIT University)

Developmental dyslexia is a learning disability that occurs mostly in children during their early childhood. Dyslexic children face difficulties while reading, spelling and writing words despite having average or above-average intelligence. As a consequence, dyslexic children often suffer from negative feelings, such as low self-esteem, frustration, and anger. Therefore, early detection of dyslexia is very important to support dyslexic children right from the start. Researchers have proposed a wide range of techniques to detect developmental dyslexia, which includes game-based techniques, reading and writing tests, facial image capture and analysis, eye tracking, Magnetic reasoning imaging (MRI) and Electroencephalography (EEG) scans. This survey paper critically analyses recent contributions in detecting dyslexia using machine learning techniques and identify potential opportunities for future research.

2. Prediction of dyslexia using support vector machine in distributed environment

By Jothi Prabha Appadurai (VIT University), R.Bhargavi VIT University), Ramesh Ragala (VIT University)
Dyslexia is a learning disorder characterized by lack of reading and /or writing skills, difficulty in rapid word naming and also poor in spelling. Dyslexic individuals have great difficulty to read and interpret words or letters. Research work is carried out to classify dyslexic from non-dyslexics by various approaches such as machine learning, image processing, understanding the brain behaviour through psychology, studying the differences in anatomy of brain. In addition to it several assistive tools are developed to support dyslexics. In this work, brain images are used for screening individuals who have high risk to dyslexia. This work also motivates the application of ma-chine learning in distributed environment. The proposed predictive model uses the machine-learning algorithm Support Vector Machine (SVM). The model is designed in Apache SPARK framework to support voluminous data. The prediction accuracy of 92.5% is achieved using SVM.

3. Machine Learning and Dyslexia: Diagnostic and Classification System (DCS) for Kids with Learning Disabilities
By Rehman Ullah Khan (University Malyasia Sarawak) , Julia Ai Cheng Lee (University Malyasia Sarawak) , Yin Bee Oon (University Malyasia Sarawak)

New generation is the future of every nation, but dyslexia which is a learning disability is spoiling the new generation. Most experts are using manual techniques to diagnose dyslexia. Machine learning algorithms are capable enough to learn the knowledge of experts and intelligently diagnose and classify dyslexics. This research proposes such a machine learning based diagnostic and classification system. The system is trained by human expert classified data of 857 school children scores in various tests. The data was collected in another fundamental research of designing special tests for dyslexics. Twenty-fifth percentile was used as threshold. The scores equal to the threshold and below were marked as indicators of children who were likely to have dyslexia while the scores above the threshold were considered to be indicators of children who were non-dyslexic. The system has three components: the diagnostic module is a pre-screening application that can be used by experts, trained users and parents for detecting the symptoms of dyslexia. The second module is classification, which classifies the kids into two groups, non-dyslexics and suspicious for dyslexia. A third module is an analysis tool for researchers. The results show that 20.7% of students seem to be dyslexic out of 257 in the testing data set which has confirmed by human expert.

SYSTEM DESIGN

A. Motivation

Early detection of dyslexia allows for timely intervention and support, which can significantly improve academic outcomes and mitigate the long-term consequences of untreated dyslexia. By identifying dyslexia in its early stages, educators, parents, and healthcare professionals can implement targeted interventions tailored to the individual needs of the child.

Dyslexia often presents significant challenges in reading, writing, and spelling, which can impede academic progress and erode self-confidence. Predictive models for dyslexia can help identify at-risk individuals before they experience academic difficulties, enabling proactive support strategies to address their learning needs effectively.

Ensuring equitable access to education for individuals with dyslexia is a fundamental principle of inclusive education. Predictive models for dyslexia contribute to the early identification of learning differences and inform the development of

inclusive educational practices that accommodate diverse learning needs and foster a supportive learning environment for all students.

B. Technologies Used

3.3.1 Operating System: Windows 10
3.3.2 IDE: Eclipse
3.3.3 Programming Language : Python

C. System Architecture

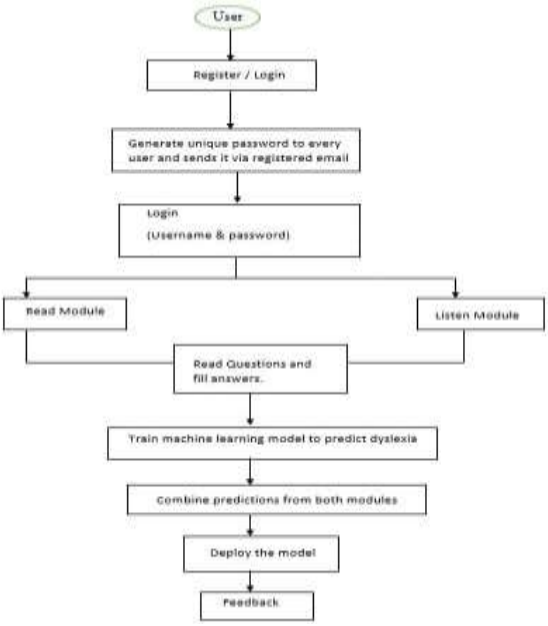


Figure 2 . Architectural Diagram

METHODOLOGY

1.Suport Vector Machine is a supervised machine learning algorithm used for both classification and regression. SVM starts with a set of labeled training data, where each data point is represented as a vector in a multidimensional space. Each dimension of the vector corresponds to a feature of the data. SVM then tries to find the hyperplane that best separates the data points into different classes. This hyperplane is chosen in such a way that it maximizes the margin, which is the distance between the hyperplane and the nearest data points of each class.

2.Randomforest Algorithm is a powerful tree learning technique in machine learning. It works by creating a number of decision tree during the training phase. Each tree is constructed using a random subset of the data features in each partition. This randomness introduces variability among individual trees reducing the risk over fitting and improving prediction performance. This collaborative decision-tree process supported by multiple trees with their insights provides precise result.

3.Decision Tree is a type of supervised leaning algorithm that is commonly used in machine learning to model and predict outcome based on input data. It is a tree-like structure where each internal node tests on attribute, each branch correspond s to attribute value and each leaf node represents the final decision or prediction. They can be used to solve both regression and classification problem.

MODULE

1. Login / Register Module:

Users authenticate to access quiz features.

2. Quiz Module:

Dyslexic features are assessed through vocabulary, audio, video, speed, and memory quizzes.

3. Prediction Module:

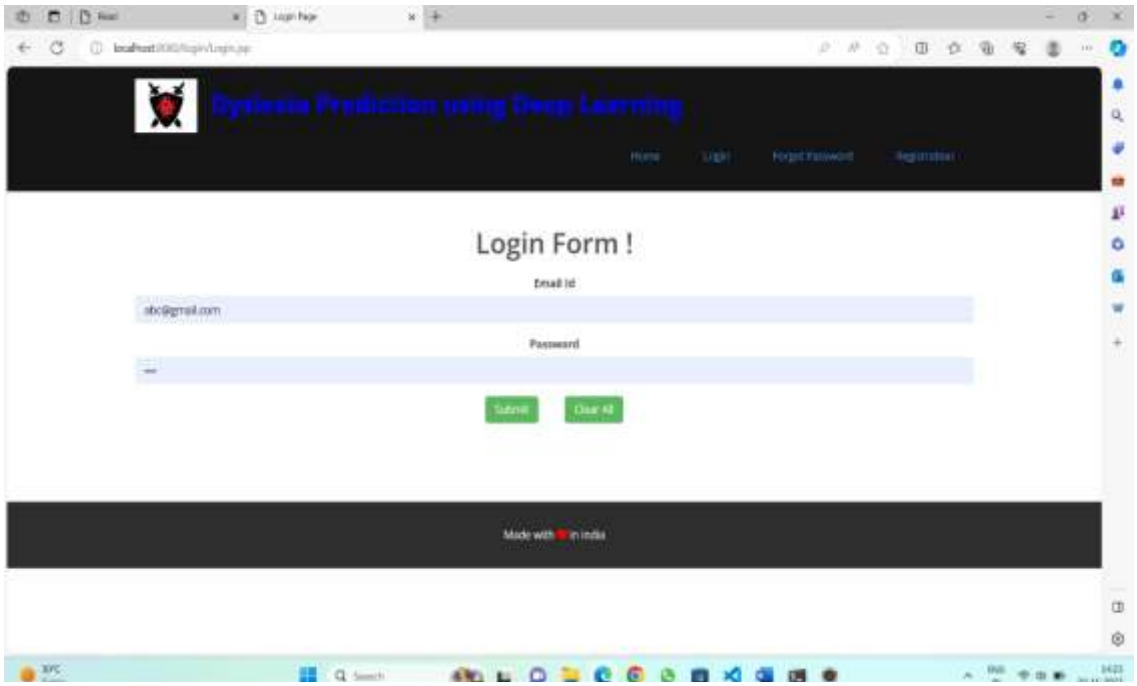
In this module, we will use some of the deep learning algorithms such as ANN or CNN to build a model which is going to help us to detect the dyslexia. Here we are implementing model using following steps:
A] Data Acquisition
B] Data Preprocessing
C] Feature Extraction and Selection
D] Classification and Performance of Deep Learning model.

4. Result

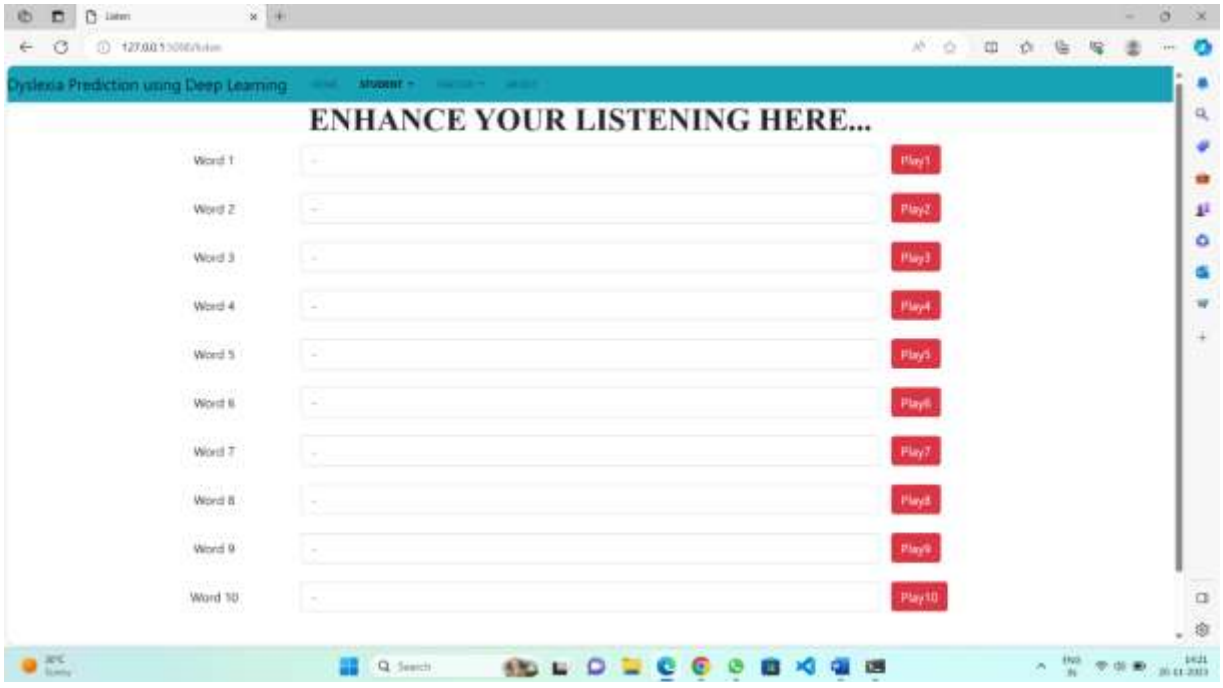
This is the final module of the system where user will be predicted to be either dyslexic or normal.

RESULT

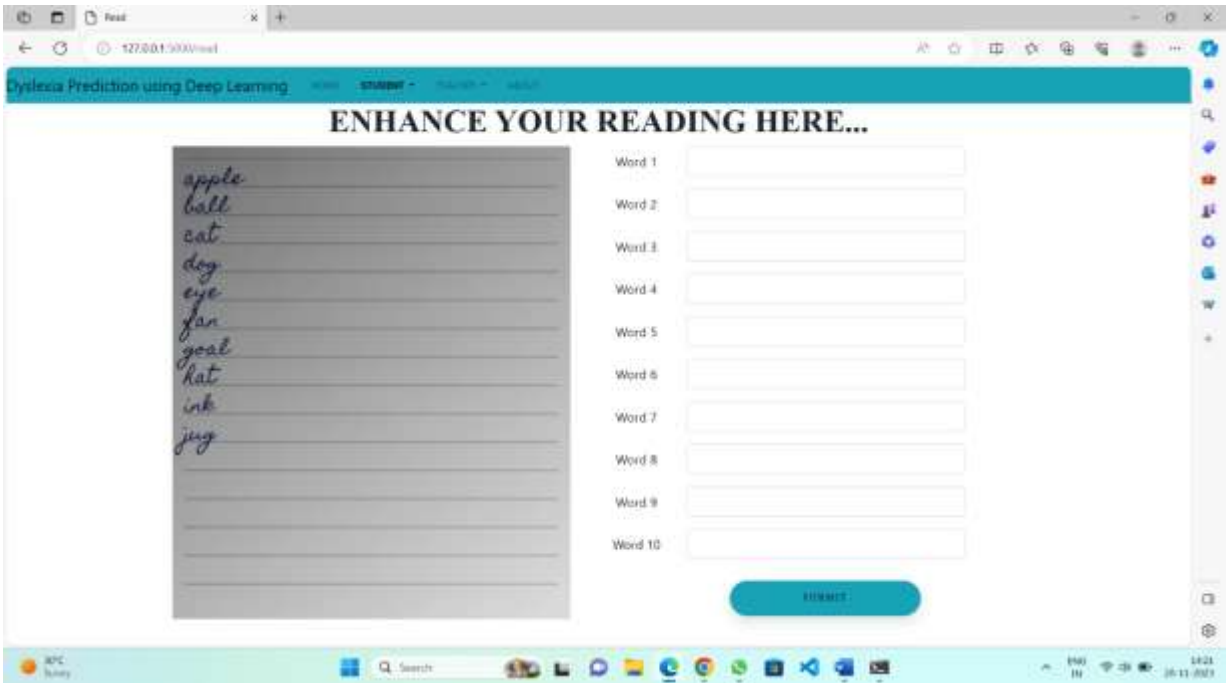
Step 1: Whenever user will open the application for very first time, he or she has to register/login himself first to use the application.



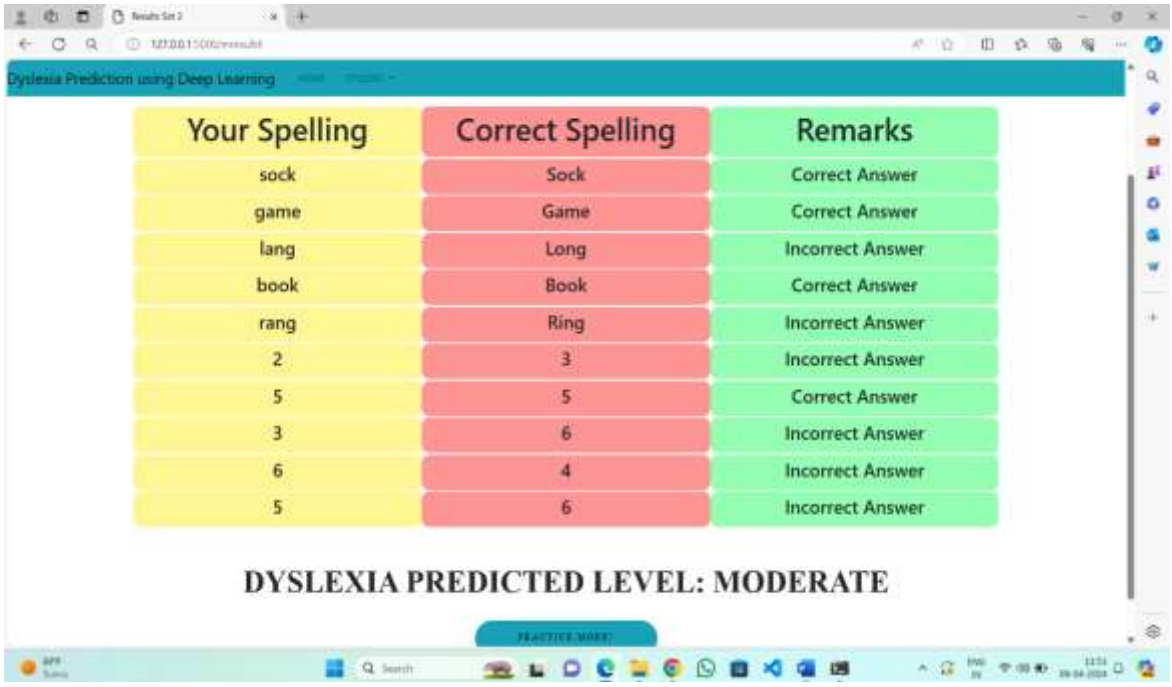
Step 2: The patient performs listening test



Step 3: The patient performs reading test



Step 4: The result of the listening test are displayed and dyslexia prediction level is calculated.



Step 5: The result of the audio test are displayed and dyslexia prediction level is calculated.

CONCLUSION

Dyslexia detection is crucial for mitigating its impact on learning. Deep learning methods offer promising avenues for accurate prediction. This review underscores the need for further research and dataset collection to improve dyslexia prediction models.

Dyslexia prediction is a critical area of research aimed at identifying and supporting individuals with dyslexia early in their learning journey. Through the utilization of machine learning and deep learning techniques, researchers have made significant strides in developing predictive models for dyslexia detection. These models leverage various datasets and methodologies, including brain imaging, linguistic analysis, and cognitive assessments, to accurately identify individuals at risk of dyslexia.

The reviewed literature demonstrates the efficacy of machine learning algorithms, such as Support Vector Machine (SVM), in distinguishing between dyslexic and non-dyslexic individuals with high accuracy. Additionally, deep learning approaches, including artificial neural networks (ANN) and convolutional neural networks (CNN), show promise in improving dyslexia prediction through advanced feature extraction and classification techniques.

FUTURE SCOPE

Future research could explore the combination of machine learning methods for enhanced dyslexia detection, considering language-specific nuances. Additionally, addressing the variability in dyslexia severity among students warrants further investigation.

Continuing advancements in machine learning and artificial intelligence offer opportunities to enhance dyslexia prediction models. Researchers can explore more sophisticated algorithms, ensemble methods, and deep learning architectures to improve accuracy and reliability.

Developing scalable and accessible screening tools for early detection of dyslexia is crucial. Mobile applications, online assessments, and automated screening systems can facilitate early identification, enabling timely intervention and support for at-risk individuals.

Collaborating with educators, healthcare professionals, policymakers, and advocacy groups is essential for raising awareness, promoting early intervention, and advocating for inclusive education policies. Community engagement fosters interdisciplinary collaboration and ensures the dissemination of evidence-based practices.

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