SAMARTHAN-AI – EARLY DETECTION OF DYSLEXIA IN CHILDREN USING AIML

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Introduction:

Dyslexia is a prevalent neurodevelopmental disorder that significantly affects an individual's ability to read, write, and process written or spoken language. This project focuses on the early prediction of dyslexia using a technological approach that integrates multiple data-driven techniques. The proposed system utilizes a combination of eye-tracking, handwriting analysis, and cognitive-behavioral exercises to detect early signs of dyslexia. It gathers input through interactive tasks that record user behavior such as click patterns, response accuracy, and average reaction time.

These behavioral indicators are supported by detailed eye movement data and handwriting characteristics to provide a comprehensive dataset. The collected information is then analyzed using machine learning algorithms to generate reliable predictions in a non-invasive and efficient manner. By leveraging artificial intelligence, the project addresses the limitations of traditional diagnosis methods, offering a modern, scalable, and user-friendly solution. The objective is to bridge the gap in early dyslexia screening by providing a tool that is accessible to educators, parents, and clinicians alike.

Objectives:

1. To design a system that integrates eye-tracking technology to identify potential dyslexia indicators through gaze patterns, fixation durations, and saccadic movements.

2. To analyze handwriting data to detect impairments by evaluating features such as stroke patterns, character alignment, and consistency.

3. To incorporate behavioral exercises, such as interactive games or tests, to measure response times, accuracy, and click patterns, assessing user cognitive and motor skills.

4. To implement advanced machine learning models for feature extraction and classification to ensure accurate and reliable dyslexia prediction.

Methodology:

- **Data Collection:** Eye-tracking data, handwriting samples, and exercise responses were collected through a custom user interface.
- **Preprocessing:** Collected data was cleaned, resized, and normalized for uniformity and accuracy.
- **Feature Extraction:** Key features such as gaze patterns, writing pressure, and click accuracy were extracted.
- **Dataset Preparation:** The features were organized, labeled, and split into training and testing datasets.
- **Model Training:** Machine learning models like CNN, MLP, and SVM were trained on respective feature sets.
- **Prediction and Classification:** Trained models classified users as dyslexic or non-dyslexic based on test scores.

- **Result Display:** The system displayed a detailed prediction report highlighting individual and combined results.

Result and Conclusion**:**

- **The eye-tracking module** accurately identified dyslexia indicators using gaze patterns and saccadic movement.
- **The handwriting analysis module** effectively classified dyslexic writing using MLP and SVM models.
- **The exercise module** predicted dyslexia based on click patterns, accuracy, and average response time.
- **Combined model outputs** showed high reliability and user-friendly interface for early dyslexia detection.
- The system is scalable, non-invasive, and suitable for educational and clinical implementation.

Future Scope:

- **Refine machine learning models** to enhance accuracy and effectiveness of the system
- **Integrate real-time data processing** for faster, more responsive support.
- **Ensure adaptability** for various age groups and languages to broaden usability.
- **Provide Personalised Strategies** for better personalized outcomes.