Learning Disability Detector and Classifier System

# 1. Introduction

Learning disabilities (LDs) are neurological conditions that affect an individual's ability to read, write, speak, spell, or perform mathematical calculations. Early detection is critical for providing timely support. This project aims to develop an AI-powered system to assist in identifying and classifying various types of LDs.

# 2. Objectives

- Develop a data-driven system to detect common learning disabilities.  
- Use machine learning models to classify different LD types.  
- Provide a user-friendly interface for teachers and parents.  
- Generate personalized risk assessment reports.

# 3. Methodology

The system collects input through structured questionnaires, academic records, and optional cognitive tests. Feature extraction techniques are applied to convert this data into machine-readable formats. Models like Random Forest or XGBoost are used for classification. Results are displayed via an interactive dashboard.

# 4. System Architecture

1. User Input Module  
2. Feature Extraction Layer  
3. ML-Based Detection Engine  
4. Reporting and Visualization Dashboard  
5. Admin Panel for data management

# 5. Machine Learning Model

- Input Features: Reading speed, spelling accuracy, attention span, math errors  
- Algorithm: Random Forest Classifier  
- Evaluation: Accuracy, Precision, Recall, AUC  
- Output: Probability scores and LD classification label

# 6. UI Design Overview

A responsive interface built with React or Streamlit, supporting roles for Parent, Teacher, and Admin. It includes input forms, result dashboards, and downloadable reports.

# 7. Dataset

- UCI Learning Disabilities Dataset  
- Kaggle Datasets on Dyslexia and ADHD  
- Custom survey forms for collecting real-world data from schools or NGOs

# 8. Results and Evaluation

Initial tests show promising accuracy above 85% using structured questionnaire data. Confusion matrices and AUC-ROC curves validate model reliability.

# 9. Future Scope

- Include image and voice data processing  
- Use CNNs for handwriting analysis  
- Gamify tests for engagement and better cognitive insights  
- Clinical trials and real-world pilot programs

# 10. Conclusion

This system is a support tool for early detection of learning disabilities. While it cannot replace clinical diagnosis, it empowers educators and guardians with actionable insights.