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Neural Network-based Risk Detection for Dyslexia and Dysgraphia in Sinhala Language Speaking Children

A Dissertation by

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ABSTRACT

The problem of Dyslexia and Dysgraphia, two learning disabilities that affect reading and writing abilities, respectively, is a major concern for the educational system. Due to the complexity and uniqueness of the Sinhala language, these conditions are especially difficult for children who speak it. The traditional risk detection methods for Dyslexia and Dysgraphia frequently rely on subjective assessments, making it difficult to cover a wide range of risk detection and time-consuming. As a result, diagnoses may be delayed and opportunities for early intervention may be lost.

The project was approached by developing a hybrid model that utilized various deep learning techniques for detecting risk of Dyslexia and Dysgraphia. Specifically, Resnet50, VGG16 and YOLOv8 were integrated to detect the handwriting issues, and their outputs were fed into an MLP model along with several other input data. The hyperparameters of the MLP model were fine-tuned using Grid Search CV, which allowed for the optimal values to be identified for the model. This approach proved to be effective in accurately predicting the risk of Dyslexia and Dysgraphia, providing a valuable tool for early detection and intervention of these conditions.

The Resnet50 model achieved an accuracy of 0.9804 on the training data and 0.9653 on the validation data. The VGG16 model achieved an accuracy of 0.9991 on the training data and 0.9891 on the validation data. The MLP model achieved an impressive training accuracy of 0.99918 and a testing accuracy of 0.99223, with a loss of 0.01371. These results demonstrate that the proposed hybrid model achieved a high level of accuracy in predicting the risk of Dyslexia and Dysgraphia.

Keywords: - Risk Detection System, Dyslexia, Dysgraphia, Deep Learning, Learning Disabilities, Data Science

Subject Descriptors

1. Deep learning → Neural networks → Dyslexia risk detection
2. Deep learning → Neural networks → Dysgraphia risk detection
3. Neural networks → Sinhala language identification
4. Human- centered computing → Child-centered computing → Children and technology
5. Education technology → Learning disabilities → Dyslexia and Dysgraphia risk detection