UNIVERSITI TEKNOLOGI MARA

DYSLEXIA HANDWRITING DETECTION USING CONVOLUTIONAL NEURAL NETWORK (CNN) ALGORITHM

SOFEA NAJIHAH BINTI MOHD ZAKI

Thesis submitted in fulfillment of the requirements for Bachelor of Computer Science (Hons.)

College of Computing, Informatics and Mathematics

January 2024

ACKNOWLEDGMENT

Alhamdulillah, praise and thanks to Allah, who is Almighty and gave upon me the greatest rewards, I completed this research in the time given to me. To everyone who gave me the chance to finish this report, I would like to thank you and show my appreciation. First and foremost, I would like to express my gratitude to Ts. Dr. Hasiah Mohamed@Omar, my supervisor, for investing the time necessary to encourage ideas and offer direction in order to finish the report. I would especially like to express my gratitude to my parents, for their continuous backing and support while I finished the project. I would like to express my gratitude to the course lecturer, Madam Ummu Fatihah Binti Bahrin, for providing me with the guidance and explanations I required to complete this project. Finally, as well as most importantly, I would want to thank my friends—especially my closest friend, who is a student in Turkey right now, for their willingness to exchange ideas and to remind me to finish this project report.

ABSTRACT

Dyslexia is a neurological learning situation that affects a person's ability to read, spell, write, and speak. Children with dyslexia frequently suffer from negative emotions including sadness, anger, and low confidence. Thus, it's critical to detect dyslexic children early to provide them proper support that they need. The handwriting style is a simple way to detect the most common dyslexia sign. Many computational and intelligent techniques have been put forward, and they provided a variety of outcomes to assess the recommended system's effectiveness. This project attempts to accurately detect the type of dyslexic handwriting. Convolutional Neural Network (CNN) algorithm was chosen as one of the possible solutions after a thorough analysis of many algorithms for dyslexic handwriting identification. This is because CNN can automatically extract new image data from written material. The CNN model is trained and evaluated on a wide range of handwritten sample datasets. It successfully detects dyslexia-related handwriting type (normal or reversal) with an 90% accuracy rate and high precision 0.93 for Class 1 (Reversal). The dyslexia handwriting detection prototype demonstrates how machine learning may improve the detect handwriting issues in educational settings. A user-friendly desktop prototype was developed, and users may upload handwritten samples and get immediate results for the dyslexia handwriting type (normal or reversal) and status of handwriting (detect or not detect). Further enhancements might involve including machine learning algorithms to improve the prototype's accuracy by learning from a larger dataset, which would eventually improve the prototype's ability to offer deep understanding into handwriting patterns related to dyslexia.

TABLE OF CONTENTS

CONTENT PAGE

SUPERVISOR APPROVAL ..... **i**

STUDENT DECLARATION ..... **ii**

ACKNOWLEDGMENT ..... **iii**

ABSTRACT ..... **iv**

TABLE OF CONTENTS ..... **v**

LIST OF FIGURES ..... **ix**

LIST OF TABLES ..... **xi**

LIST OF ABBREVIATIONS ..... **xii**

CHAPTER ONE 14

INTRODUCTION 14

1.1 Background of Study 14

1.2 Problem Statement 15

1.2.1 Lack of alternative detection to identify dyslexia handwriting. 15

1.2.2 Dyslexia detection by experts is time consuming. 16

1.3 Research Objectives 17

1.4 Research Scope 17

1.4.1 Target user 17

1.4.2 Data 17

1.4.3 Algorithm 17

1.4.4 Image Processing 18

1.5 Research Significance 18

1.6 Research Framework 18

1.7 Conclusion 19

CHAPTER TWO 21

LITERATURE REVIEW 21

2.1 Image Processing 21

2.2 Deep Learning 22

2.3 Convolutional Neural Network (CNN) Algorithm 23

2.3.1 CNN and How it Works 23

2.3.3 CNN Algorithm Features 27

2.3.4 Advantages of CNN Algorithm 27

2.4 Implementation of CNN Algorithm in Various Problem 28

2.4.1 Attention-deficit/hyperactivity disorder (ADHD) 28

2.4.2 Autism 29

2.4.3 Syndrome Down 30

2.4.4 Hyperactive 30

2.5 Dyslexia Detection 34

2.5.1 Cause of Dyslexia 35

2.5.2 Diagnosis of Dyslexia in Children 36

2.5.3 How Dyslexia Affects Handwriting Skills in Children 36

2.5.4 Benefits of early detection of Dyslexia 37

2.6 Similar Works 38

2.6.1 Fuzzy-C-Means and Rusbossted Tress 38

2.6.2 Convolutional Neural Network (CNN) 38

2.6.3 Support Vector Machine (SVM) 39

2.6.4 Artificial Neural Networks (ANN) 40

2.7 The Implication of Literature Review 44

2.8 Conclusion 44