Towards Detecting Dyslexia in Handwriting using Neural Networks
Katie Spoon, David Crandall, Katie Siek, School of Informatics, Computing and Engineering, Bloomington, IN

Introduction

10.2 million kids in the US with dyslexia will not be diagnosed by the recommended age.

- Literacy is the best predictor of success later in life. Dyslexia is a learning disability (LD) characterized by a difficult to read or interpret words, letters, and symbols according to their shapes.
- Dyslexia is not tied to IQ, which is a common myth. Students with dyslexia perform just as well with accommodations. To get these accommodations, students meet with a school psychologist. However, there is a long waitlist and diagnosis is often delayed.
- If students are placed in the waitlist by the end of 2nd grade, they improve their chances of graduating from high school. However, teachers usually don’t have the training to detect LDs and often detection comes too late.

How can machine learning help?

Machine learning (ML) can recognize patterns that we don’t see (or don’t see easily). We believe this problem is ideal for ML due to the lack of an organized dyslexia detection process and human power to carry out this detection, along with numerous subtleties in the definitions of language-based LDs.

Neural Network Architecture & Potential Feature Identification

Goal: Create a tool using a subfield of ML, deep learning, to identify characteristics of dyslexic handwriting and place students into the diagnostic queue by the end of 2nd grade.

Implications

Higher Early Detection Rate Than Teachers

Why does it matter?

- Children who struggle to read in third grade are four times more likely to drop out of high school, and will struggle with reading, math and self-esteem for the rest of their lives. The UK estimates that the country spends one billion pounds annually as a result of undiagnosed dyslexia - these undiagnosed students are more likely to struggle with employment, spend time in prison and have health issues, straining the economy.
- The current detection process is biased and can over-detect or under-detect certain groups of people. Some teachers and parents are more attentive than others, causing additional bias. Our method may detect more students, fairly.

Future Work

- We will improve the model for detecting dyslexia after we collect more data, build a front-end application for teachers and parents, and utilize more data visualization techniques to better understand which features the network uses to make decisions.
- We would also like to eventually expand the system to detect different types of LDs and to monitor English Language Learners, as the tool is not language-specific.

Contact

Katie Spoon: kspoon@iu.edu