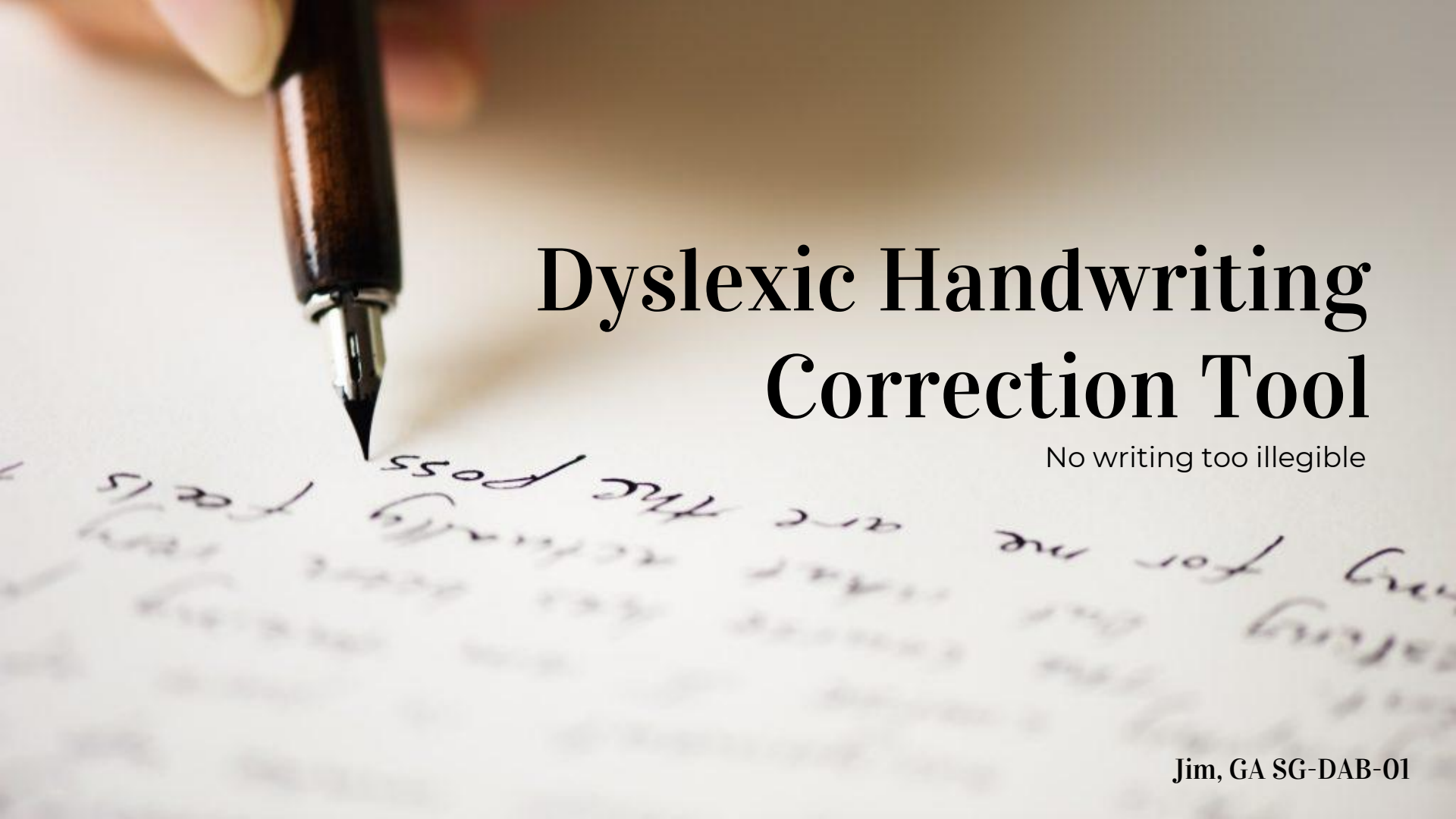
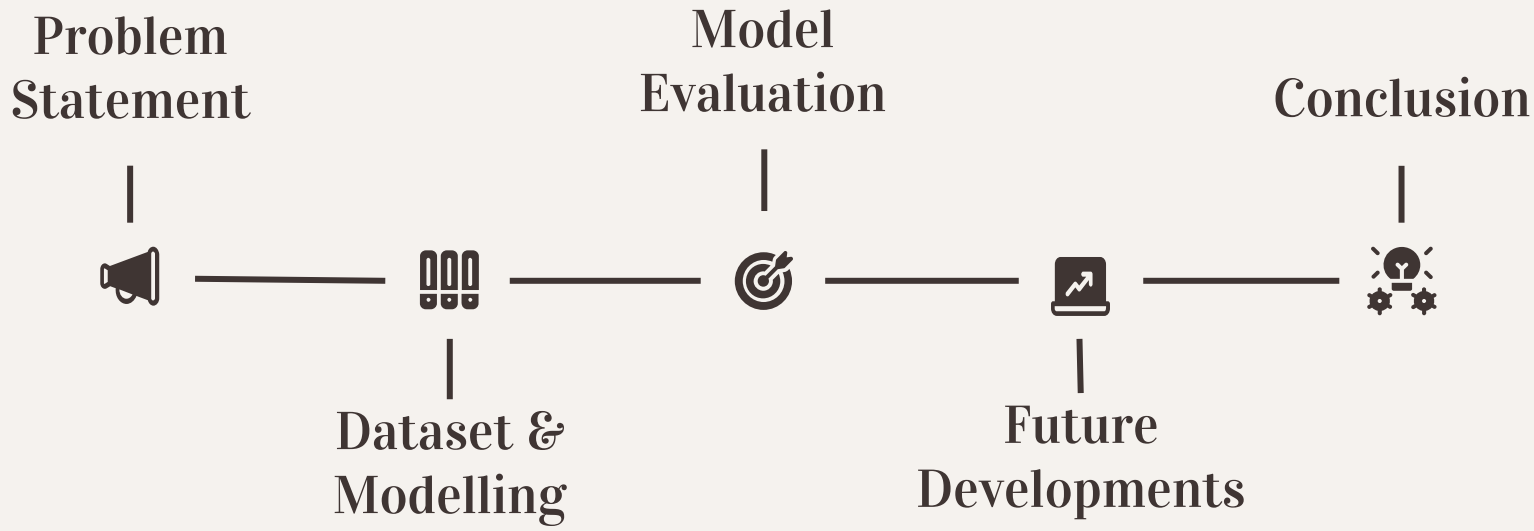


Dyslexic Handwriting Correction Tool

No writing too illegible

Jim, GA SG-DAB-01

Development Workflow



Problem Statement

Dyslexia in Singapore

- Dyslexia is a learning disability that is neurological in origin
- To level the playing field in learning, specialist intervention is required to enable dyslexic students to pick up literacy skills
- In its intervention programme every year, the Dyslexic Association of Singapore (DAS) sees about 300 pre-school students at risk of dyslexia. 67% of these students are eventually diagnosed at the end of K2
- International statistics suggests that 10% of the population is likely to have dyslexia, with 4% severe enough to warrant intervention

Challenges faced by dyslexic individuals and caregivers

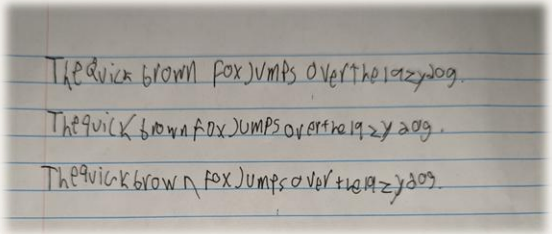
- Poor legibility
- Inconsistent letter formation
- Frequent spelling errors
- Existing assistive technologies not sufficient

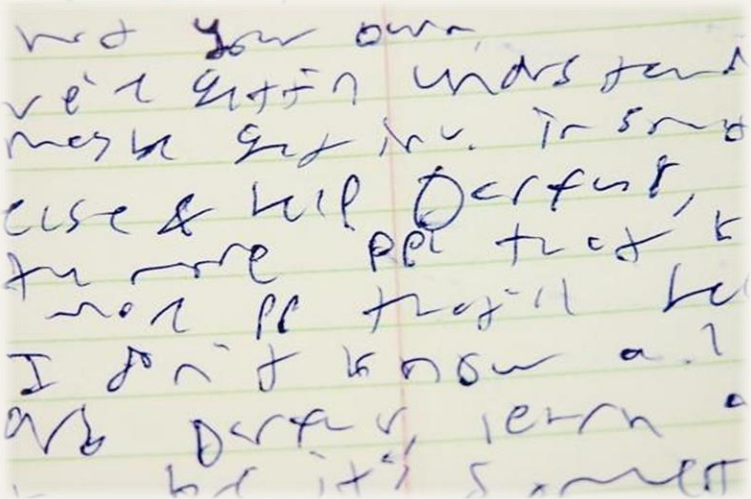
“I remember the frustration. My handwriting was a mess, a scribble that only I could decipher. Teachers would often return my assignments with a note asking me to write more legibly. It was humiliating. As a dyslexic student, I knew my brain worked differently, but I didn't know how to express that to my teachers or classmates. ”

– Tavis, Secondary 2 , dyslexic student from Ruffles Institution

The Dyslexic Handwriting Correction Tool (DHCT) aims to:

- Address the challenges in written communication faced by dyslexic individuals and their caregivers
- Leverage on machine learning techniques to provide real-time feedback and corrections





Dataset & Modelling

RECOGNITION

Detect and recognize flawed characters

CORRECTION

Rectify and display correct characters

Dataset

- ~1000 images of **52 classes** (all uppercase and lowercase alphabets)
- Train – 70%, Validation – 20%, Test – 10%

Source: Kaggle

Model Selection – YOLOv9

- You Only Look Once (YOLO) is a popular real-time object detection algorithm
- YOLOv9 introduces improved accuracy and speed compared to earlier versions
- Predicts bounding boxes and class probabilities simultaneously
- Key features of YOLOv9:
  - Speed – capable of processing real-time image / video
  - Accuracy – uses advanced techniques to improve precision and recall

Metrics

mAP

mean Average Precision (mAP) assess the model's overall detection accuracy across all classes.

PRECISION

Measures the model's accuracy in identifying relevant objects by calculating the ratio of TPs to all detections.

RECALL

Evaluates the model's ability to detect all ground truth objects, indicating the proportion of TPs among all actual ground truth instances.

$$P = \frac{\text{TP}}{\text{TP} + \text{FP}} = \frac{TP}{\text{all detections}}$$

$$R = \frac{\text{TP}}{\text{TP} + \text{FN}} = \frac{TP}{\text{all ground-truths}}$$

Model Evaluation

Model Performances

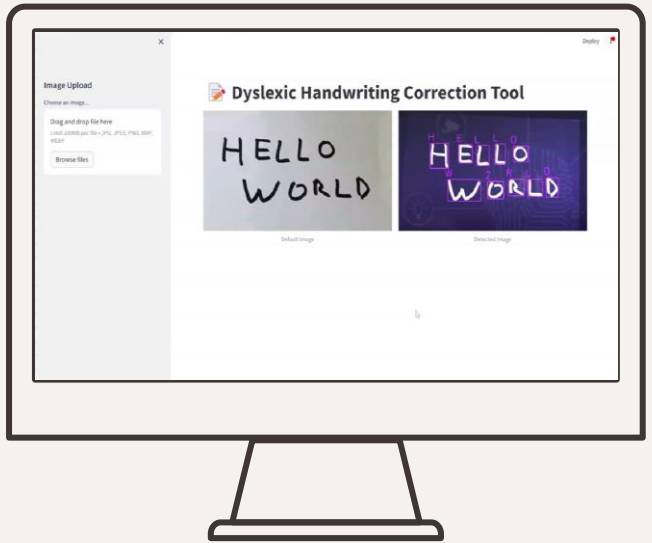
	mAP50[1]		Precision		Recall		Time Taken (hrs)
Model	Train	Test	Train	Test	Train	Test	
YOLOv5 (baseline model)	0.89	0.89	0.66	0.66	0.83	0.83	0.44
YOLOv9	0.93	0.92	0.72	0.72	0.86	0.86	0.68
YOLOv10	0.67	0.67	0.53	0.54	0.63	0.63	0.37

YOLOv9 achieved the highest mAP50 on both training and test sets, indicating superior overall object detection accuracy.

[1]mAP50 is a detection threshold that indicates that a detection is considered correct if the IoU between the predicted and ground truth bounding boxes is at least 50%. A higher mAP50 value generally indicates better model performance, as it means the model is detecting objects more accurately and with fewer false positives.

DHCT demo

Upload images of texts or paragraphs on the DHCT for detection and correction



Dyslexic Handwriting Corre

localhost:8501

Deploy

Image Upload

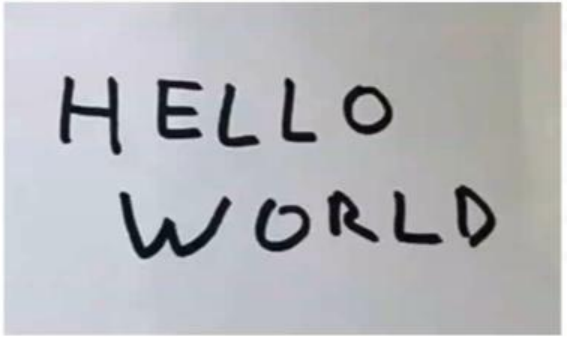
Choose an image...

Drag and drop file here

Limit 200MB per file • JPG, JPEG, PNG, BMP, WEBP

Browse files

Dyslexic Handwriting Correction Tool



Default Image

Detected Image

Dyslexic individuals / students

- Upload written work for correction before submission

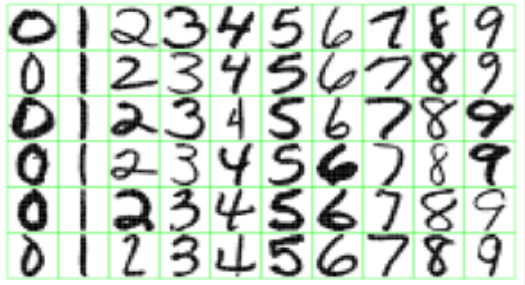
Caregivers / teachers

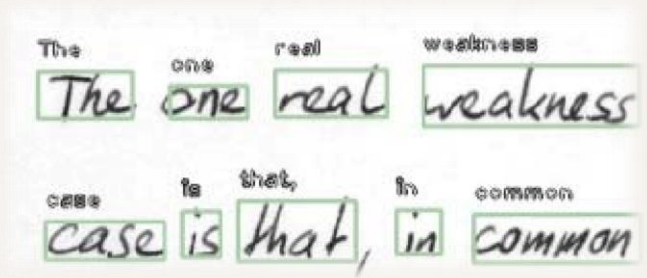
- Upload dyslexic submissions for correction before marking

Future Developments

Future Developments / Enhancements

- Updating dataset by training with new handwriting
- Detects numbers and symbols
- Detects words and paragraphs
- Integration of additional features, such as phonetic assistance
- multimodal learning support (e.g. app, webcam, video) to further enhance communication or learning experience for dyslexic students





With DHCT…

- Empowers dyslexic individuals to express themselves confidently
- Lightens burden on caregivers and teachers
- Destigmatizes dyslexia
- Lowers barrier to effective learning

Thanks

Email: weijim.tan3647@gmail.com

Q & A