Proposal for EIE 4512 Final Project 2023

Names & IDs:
Yuhang Huang 122040082 Boshi Xu 122040075 Yiwei Huang 120090800
Title: Handwritten Digit and Signal Recognition for Children

Description:

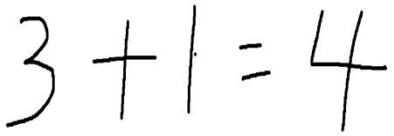
- **Introduction**

  Recognition and verification of handwritten mathematical expressions is a key area in the field of digital image processing and artificial intelligence. The focus of this project is to develop a system for verifying the correctness of handwritten arithmetic expressions for children up to the age of ten, including addition, subtraction, multiplication and division from 0 to 9. The goal is to automatically process images of handwritten arithmetic equations, recognize numbers and operators, evaluate the expressions, and determine whether the answers provided are correct.

- **Task and goal**

  The goal of our project is to create a simple and easy-to-use handwritten recognition and calculation product. The front-end part includes a handwriting board, optional image file input, and a display box for the final output results. Since it is mainly targeted at children, we will choose a more cartoonish interaction style.

- **Dataset and experiment**



The dataset for this project will collect handwritten images of arithmetic expressions from children up to the age of ten. Each image contains a complete equation involving numbers between 0 and 9 and basic arithmetic operators (addition, subtraction, multiplication, and division). This data is collected and labelled to effectively train the model.

The initial algorithms consists of the following 4 steps.

First, read the image from the frontend's handwriting board.

Next, the image detection is divided into several parts, including:1. Image pre-processing: Convert the image to grayscale, apply Gaussian blur, use the Canny edge detector to detect edges, and perform dilation and erosion operations. 2. Contour detection: Retrieve the contours in the image, calculate their area, extract the image of the region, and adjust the image boundaries to obtain the output image. Both first and second step use the library *OpenCV*.

Then, use the pre-trained CNN model to classify the extracted image regions.

Finally, output the recognition results to the frontend for display.

We will use this algorithm to connect with the frontend of our project, to complete a basic programme with GUI.

- **Expected results**

  The system will accurately recognize handwritten digits and arithmetic operators from images provided by children, and evaluate arithmetic expressions correctly. The user interface will be child-friendly with an easy-to-use handwriting board and clear display of results. The system will focus on childrens' handwriting styles and image qualities, ensuring robustness. Overall, it will help children learning by providing feedback and create conditions for more environmentally friendly, paperless learning for children.

Tentative Timeline/To-do lists:

July 3: Proposal PPT
July 7, 12 PM: Proposal document
July 21: Front-end and back-end completed separately
July 28: Final Presentation PPT and Report
July 30: Assignment submission