COP3503 Term Project, Group 39

OpenOCR

Definition

OpenOCR is computer vision software that recognizes simple arithmetic expressions in images and evaluates them. It is valuable because it provides a bridge between handwriting and efficient computer evaluation.

Analysis

OpenOCR accepts an image of a written arithmetic expression. Then, it locates characters in the image, and finds a bounding box for each character. Next, it resizes the image of each character to match the size of the training data. Afterwards, it classifies each character as a digit (0 - 9) or an operand (+, -, *) and determines the character's value (e.g., '*', 7, 0, etc.) using an artificial neural network. Finally, it computes the value of the expression formed by all the characters and displays it to the user.

Design

Modules

OpenOCR consists of 4 components:

1. **I/O (main)**
   Interacts with the user, loads image files, and calls the image processing function.
2. **Segmenter**
   Finds characters in the image.
3. **Converter**
   Resizes character images to match the training data (28x28).
4. **Neural Network (NN)**
   Manages, trains, and stores the neural network. Processes character images using the NN.

Classes and Methods

(see the UML)

Shared Classes and Methods

Libraries

We will use OpenCV for image segmentation. We will use the Armadillo linear algebra library for constructing our NN.

Besides these libraries, nothing is shared across all modules, besides STL.

Execution Plan

Coding Task Division

Since everything depends on the NN class, our entire team will develop this first. Afterwards, our group will split into Team A and Team B. Team A will work on the I/O, and Team B will train

the NN. Next, Team A will develop the segmenter, and Team B will develop the Converter. Finally, the team will come together to run final tests and debug.

Development Plan

Deadline 1 (Sunday Nov 5):

- Finish the neural network code.

Deadline 2 (Sunday Nov 12):

- Do the I/O (main) class.
- Complete training/testing of the NN.

Deadline 3 (Sunday Nov 19):

- Finish the segmenter and begin testing/optimizing/thresholding.
- Complete the image converter class.
- Begin testing/debugging the code as a whole.

Deadline 4 (Monday Dec 4):

- Finish testing/debugging and submit project.

Sample Makefile

```
================================================
openocr: main.o segmenter.o converter.o nnet.o

main.o: main.cpp segmenter.h converter.h nnet.h
     g++ main.cpp -std=c++11
segmenter.o: segmenter.cpp
     g++ segmenter.cpp -std=c++11
converter.o: converter.cpp
     g++ converter.cpp -std=c++11
nnet.o: nnet.cpp
     g++ nnet.cpp -std=c++11
================================================
```