



HANDWRITTEN MATHEMATICAL EXPRESSION RECOGNITION

A Report for the Evaluation 3 of Project 2

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**SCHOOL OF COMPUTING AND SCIENCE AND
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BONAFIDE CERTIFICATE

Certified that this project report “**HANDWRITTEN MATHEMATICAL
EXPRESSION RECOGNITION**” is the bonafide work of “**RAHUL
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ABSTRACT

Optically, reading of the text from an image is made easier through the use of OCR. However, we can able to use the feature of OCR to solve some of the mathematically written expressions also. As we know by doing some coding Computer system is also made to solve mathematical problems that we give as input to it. Handwritten Mathematical expression Solver helps to find the solution of handwritten or documented expressions on a computer system. The system automatically translates the image of mathematical expression into a machine-readable expression. This automatic translation of the text of image into machine-encoded text is processed by optical character recognition(OCR), This is a device or an application used for optical or mechanical conversion of typed, written or printed text into machine-readable text. After the conversion, the machine-encoded text is again converted into an expression that is going to get solved by the system and finally the result of the mathematical expression is going get generated as an output on the system screen.

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Introduction

Overall Description:

The project is all about reading a Mathematical expression from the the image as a text and provide solution of it. Reading of text from an image is done by optical character recognition (ocr) and then the text is converted into expression and then the result is generated.

we have used the python libraries like: openCV , numpy , pytesseract.

1. openCV is use to read the image and convert it into grayscale image .
2. Numpy covert the properties of image into an array.
3. Pytesseract recognize the text from the image using the OCR.
4. Tkinter use to give GUI effect for selecting of image.

Coding is done in following pahses:

1. Reading of image from the file where it stored.
2. Converting of image into grayscale image.
3. Dilation and Erosion are applied to remove noise from image.
4. Threshold is applied to get image into black and white.
5. Recognition of text with tesseract.
6. Adding spaces to the after each token of expression.
- 7.Evaluating of expression.
8. Displaying of result.

Purpose:

The purpose of the project is to use OCR(Optical Character Recognition) in recognizing of expression. So that we can easily able to convert expression from handwritten or typewritten images into machine encoded text and find solution of the difficult mathematical problem.

Scope:

- Can be used in solving Mathematical expression by just providing image of it.
- Use to solve large expression.
- Use to solve expression containing variable by just providing image of it.

Literature Survey:

This project is taken from the idea of OCR(optical Character Reconization).OCR is used to read text from an image. OCR is optical or mechanical conversion of typed,handwritten or printed text into machine encoded text.

In this project we used to extend the feature of OCR to read Mathematical expression from an image.so that we can easily able to solve written equation on a system.

Intially this project is just reading the simple mathematical expression and giving of it.Then after we extend its feature in to read and solve large mathmatical expression.Now, the code is also able to recognize variable from an expression and after giving the value of the varible it is able to solve it.

Proposed Model:

The idea behind this project is to extending the feature of OCR(optical character recognition) to solve mathematical expression.

In this project we are solving handwritten, typewritten, printed mathematical expression using OCR.

We have used python programming and there libraries for Implementing this project.

Various python libraries used:

1. OpenCv :-used in processing of image.
2. NumPy :-used in converting of image into NumPy array.
3. Pytesseract:-used to extract expression from an image.
4. Tkinter:-used to implement GUI effect for selection of image.

IMPLEMENTATION:

Using the GUI image is selected from the file. Then it gets processed using the Tesseract-OCR library so that the text of an image is extracted in the form of a sequence of string. The string is again processed and gets converted into an expression which is solved using the stack method and finally, the result is displayed. If the expression contains some variable then the system will ask for the value of that variable and processing the result.

```
#read image with opencv
img=cv2.imread(img_path)

#convert to gray
gray=cv2.cvtColor(img,cv2.COLOR_BGR2GRAY)

#apply dilation and erosion to remove some noise
kernal=np.ones(tub_kernel,np.uint8)
gray=cv2.dilate(gray,kernal,iterations=1)
gray=cv2.erode(gray,kernal,iterations=2)

#write image after removed noise
cv2.imwrite(src_path+ "removed_noise.png",gray)

#apply threshold to get image with only black and white
_, gray=cv2.threshold(gray,127,255,cv2.THRESH_BINARY)

#write the image after apply opencv
cv2.imwrite(src_path+ "thresg.png",gray)

#recognize text with tesseract for python
result=pytesseract.image_to_string(Image.open(src_path+"thresg.png"))
```

Fig 1

The complete program is written in python. We have used its some of its libraries also. In coding we have followed the implementation steps. From taking images from the location, conversion of it into grayscale, reading of expression to displaying of the result.

Result:

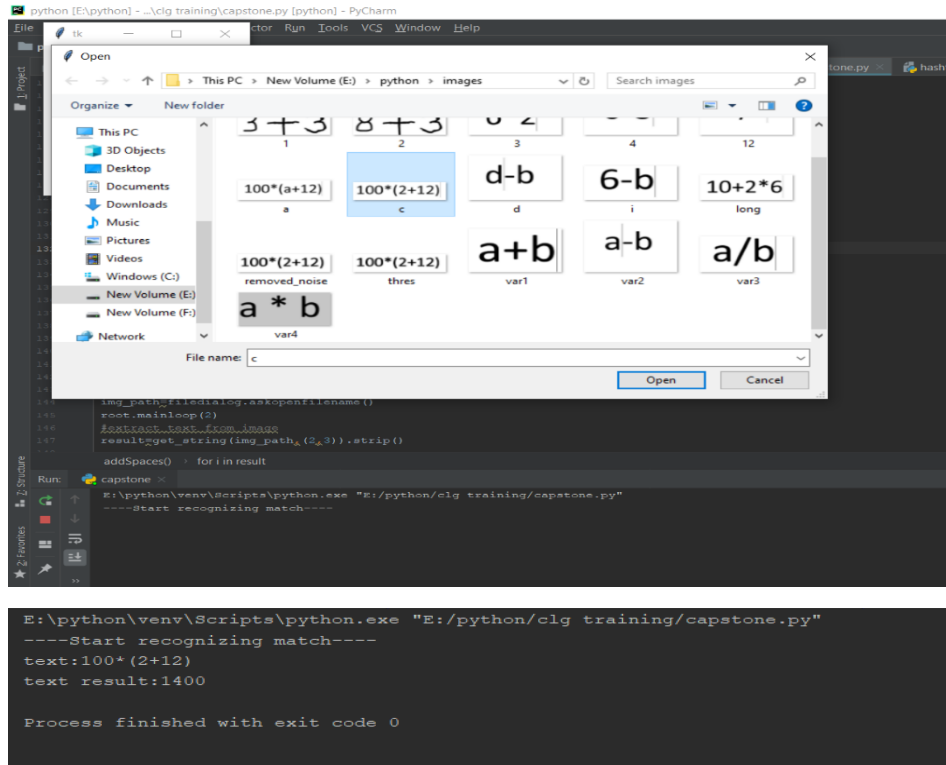


Fig2

The Figure shows the output of the evaluate expression, here we have the image 'c' which contains expression $100*(2+12)$. and then the result is evaluated which is 1400.

Discussion:

- 1.The graphical user interface is used in the selection of different types of expressions.
- 2.OCR used to read text from the image.
- 3.Able to solve Small, large and variable type mathematical expression.
- 4.stack expression evaluation method is used to solve mathematical expressions.

References:

1.<https://youtu.be/83vFL6d57OI> Recognize text from image with Python
OpenCV OCR.

2.<https://www.geeksforgeeks.org/stack-set-4-evaluation-postfix-expression/>
Evaluation of postfix expression

3.<https://www.youtube.com/watch?v=H71ts4XxWYU&t=244s> Window
dialog box to select Image.