

VISIONALPHA

Android Equation Solver

Introduction

Aditya Majumdar, Columbia University

Brian Wu, Columbia University

Robert Ying, Columbia University

Justin Zhao, Columbia University



An Unsolved Problem

Optical Character Recognition: the electronic conversion of text into machine-encoded text.

- Sophisticated systems (Tesseract) existing for converting printed text.
- Lack of robust systems to identify handwritten text.



The Application

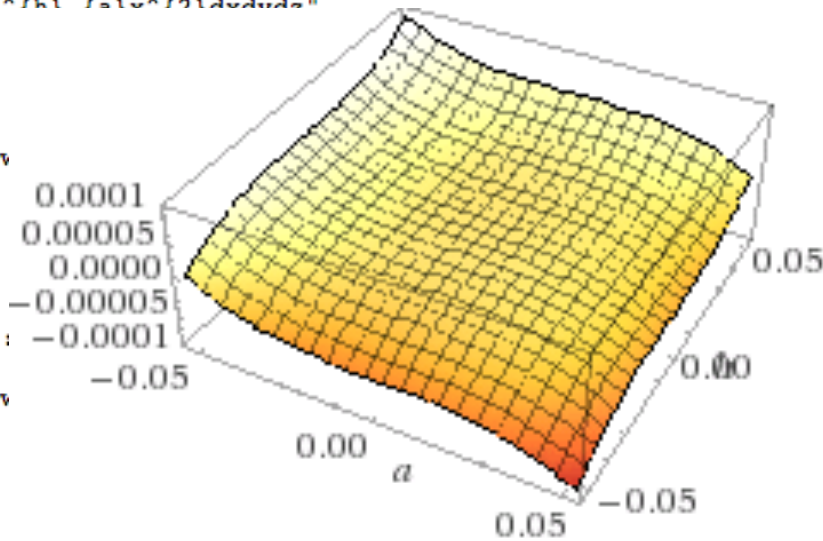
Android application that can take photographs of mathematical equations and compute the solution by interfacing with the Mathematica API.

Java Backend (Android SDK), served by Python Flask



Demonstration

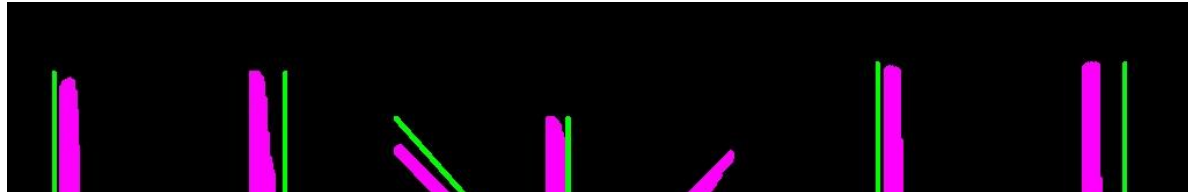
```
{  
  "latex": "\\int^a_b f(x) dx",  
  "processed_img":  
  "wolfram": {  
    "3D plot": {  
      "img": [  
        "http://www",  
      ],  
      "text": [  
        null  
      ]  
    },  
    "Contour plot": {  
      "img": [  
        "http://www",  
      ],  
      "text": [  
        null  
      ]  
    }  
  },  
}
```



g3b00002f0he9af5fc:

g3b0000359geb438d3:

Demonstration



```
{  
  "latex": "4*4",  
  "processed_img": "http://i.imgur.com/QLLUJQu.jpg"  
}
```



The Algorithm

Preprocessing:

1. Cropping and contrast using Android SDK.
2. Adaptive thresholding and canny edge detection to eliminate noise.
3. Character isolation to break apart the equation string.



The Algorithm

OCR and Classification:

1. Hough transform to identify line segments making up each symbol.
2. Classification of each symbol using a ranking algorithm that takes into consideration the line segments found in the previous stage.
3. Formulation of the equation tree to produce the final LaTeX expression.
4. The final expression query is then sent to the Mathematica API, and the appropriate results are displayed for the user.

