SriGuru Institute of Technology

Department of Computer Science and Engineering

Solving Math using Image Processing & Machine Learning

Team

Femy

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Under the guidance of **Mr. M. SATHISH AP/CSE**

Problem Statement

Calculations in Maths is getting complex everyday without the utilisation of modern technologies.

Existing Applications are outdated and not working well as expected.

Area

Deep Learning

Image Processing

Expression Evaluation

Area

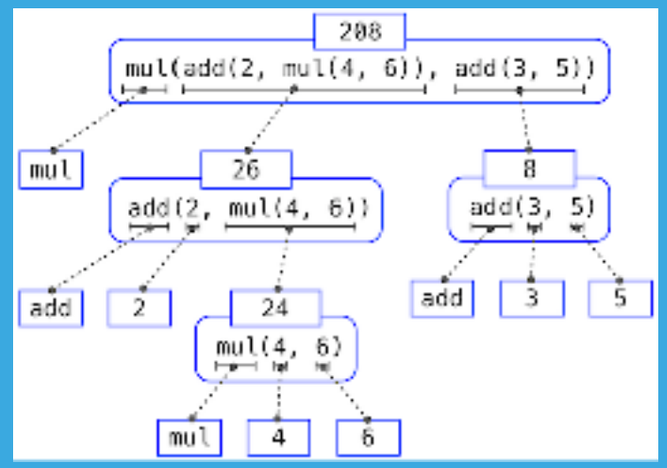
- Image Processing
  - Optical Character Recognition (OCR)
- Expression Evaluation
  - Formula Building
- Mobile App (Android)
- Deep Learning

Optical Character Recognition (OCR)

Electronic conversion of images of typed, handwritten or printed text into machine-encoded text

Expression Evaluation

Evaluating Expressions using Programming with the help of Stack



Infix, Postfix, Prefix

Machine Learning

Machine learning is a type of **AI** that provides computers with the ability to learn without being explicitly programmed

Solution

- Formulae Search Engine
- Computing Problems in Math
- Math Solver using Image Scanning

Our Solution

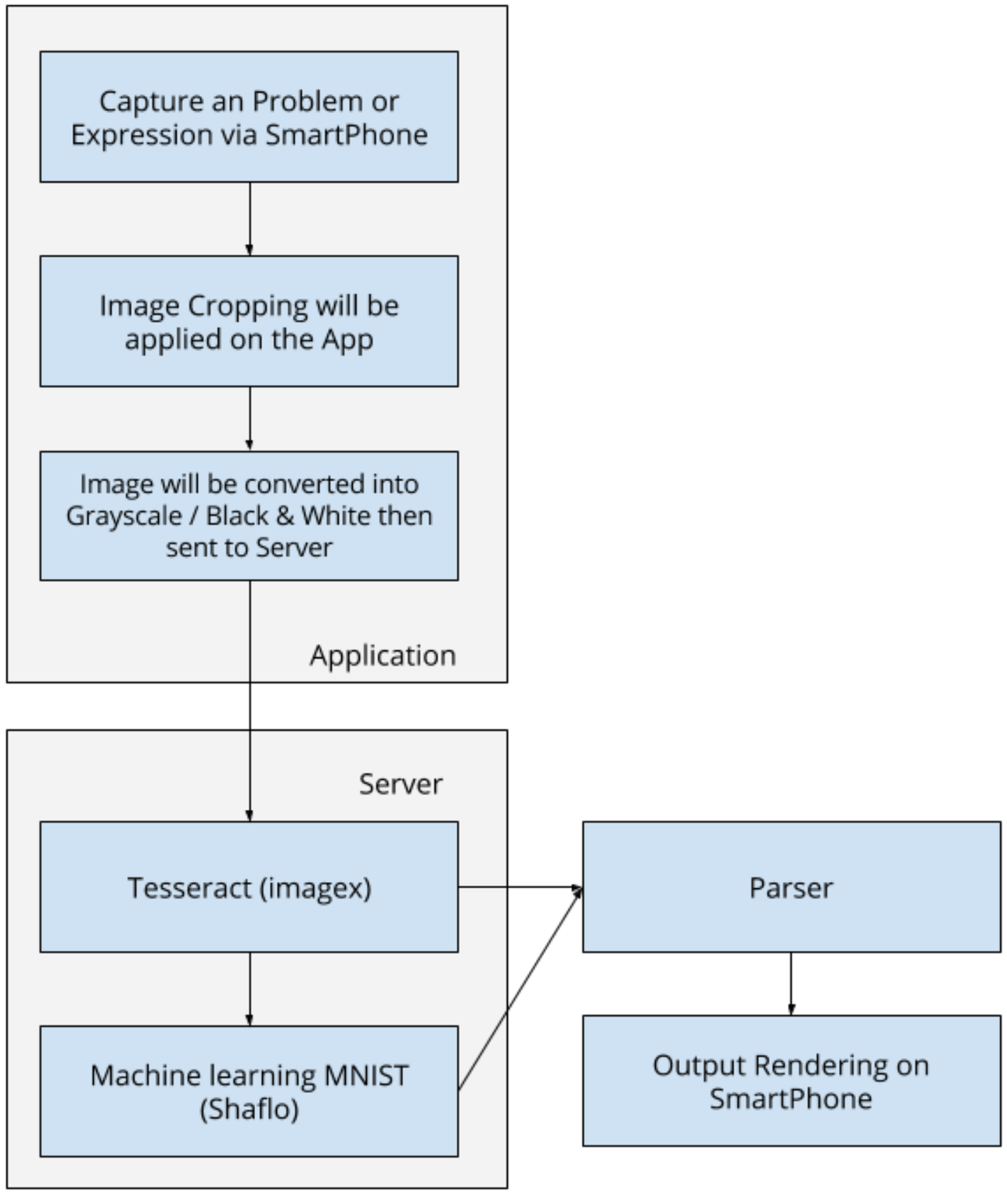
- To target all Android from 2.3.3 (100%)
- Utilising all the Modern Technologies
- Formula Search Engine
- High Performance by introducing Simultaneous Processing
- High Performance backend processing using JIT

Our Solution

- Typically a Machine Learning algorithm will take 8 days to execute *
- But our forMath will use Dynamic Intelligence and process your Math in few seconds.

* tested on 8 Core, 16 GB RAM, Intel Xeon Processor running Ubuntu 16.04 LTS

App Workflow

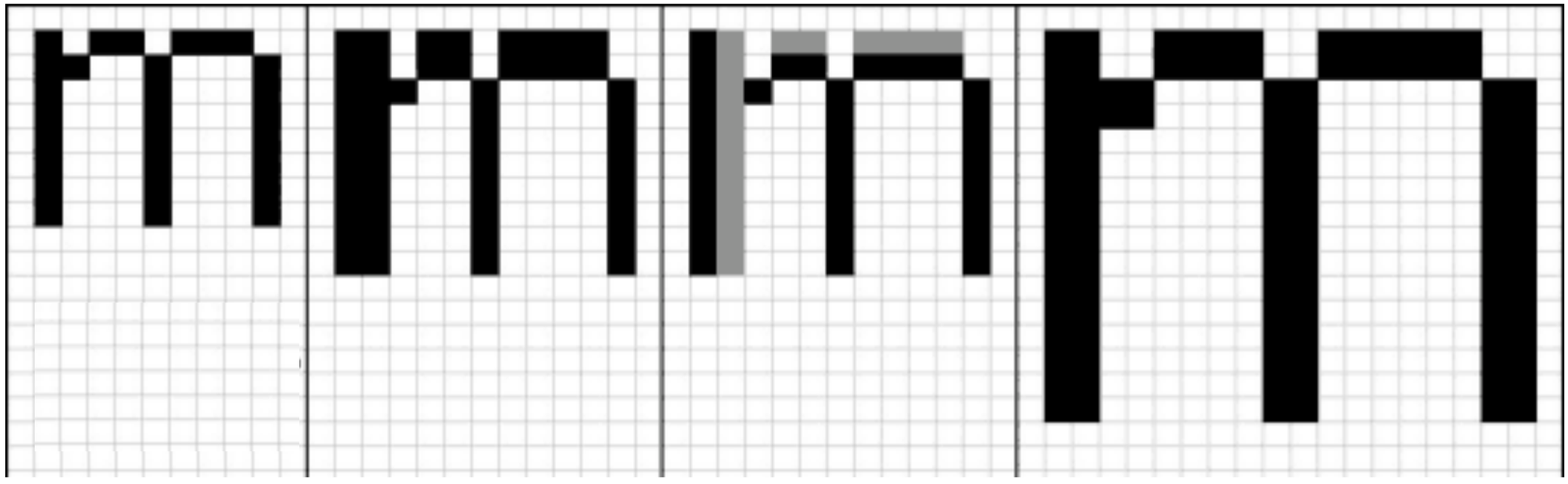


ImagEx - Image to Text Engine

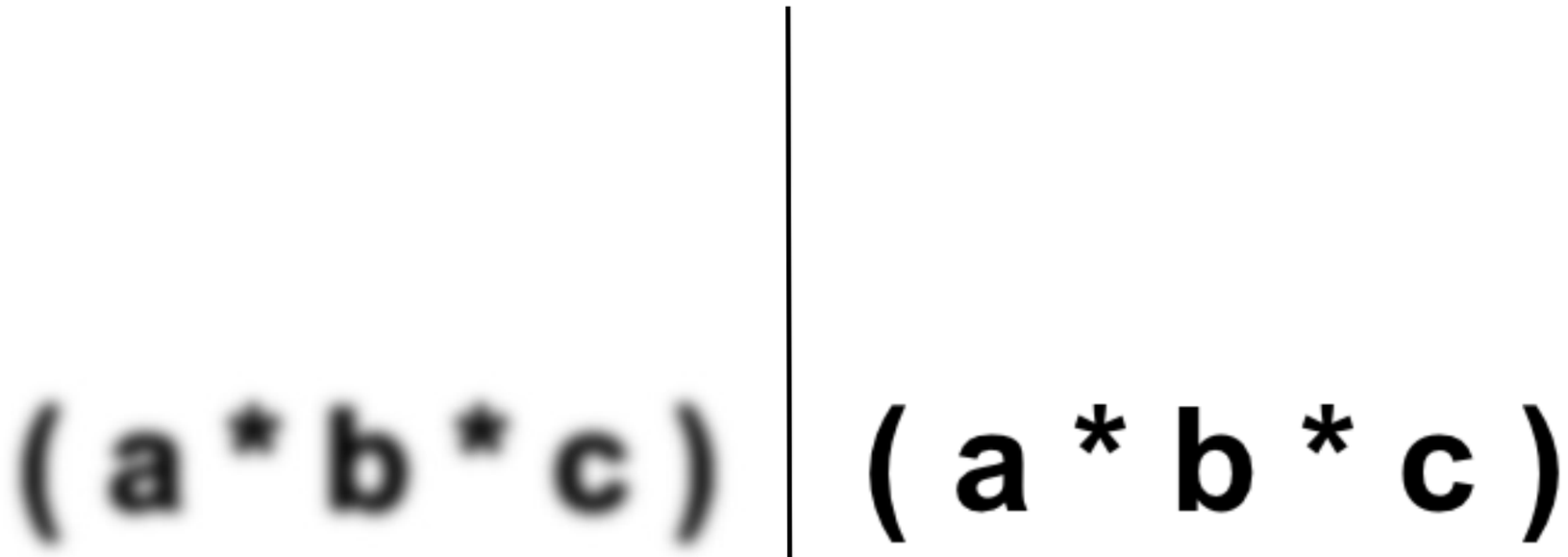
- Image Processing - Image to Text
  - Rescaling
  - Binarisation
  - Noise Removal
  - Rotation / De-skewing

ImagEx - Rescaling

- 300 DPI
- Pixel Rescaling to improve Performance

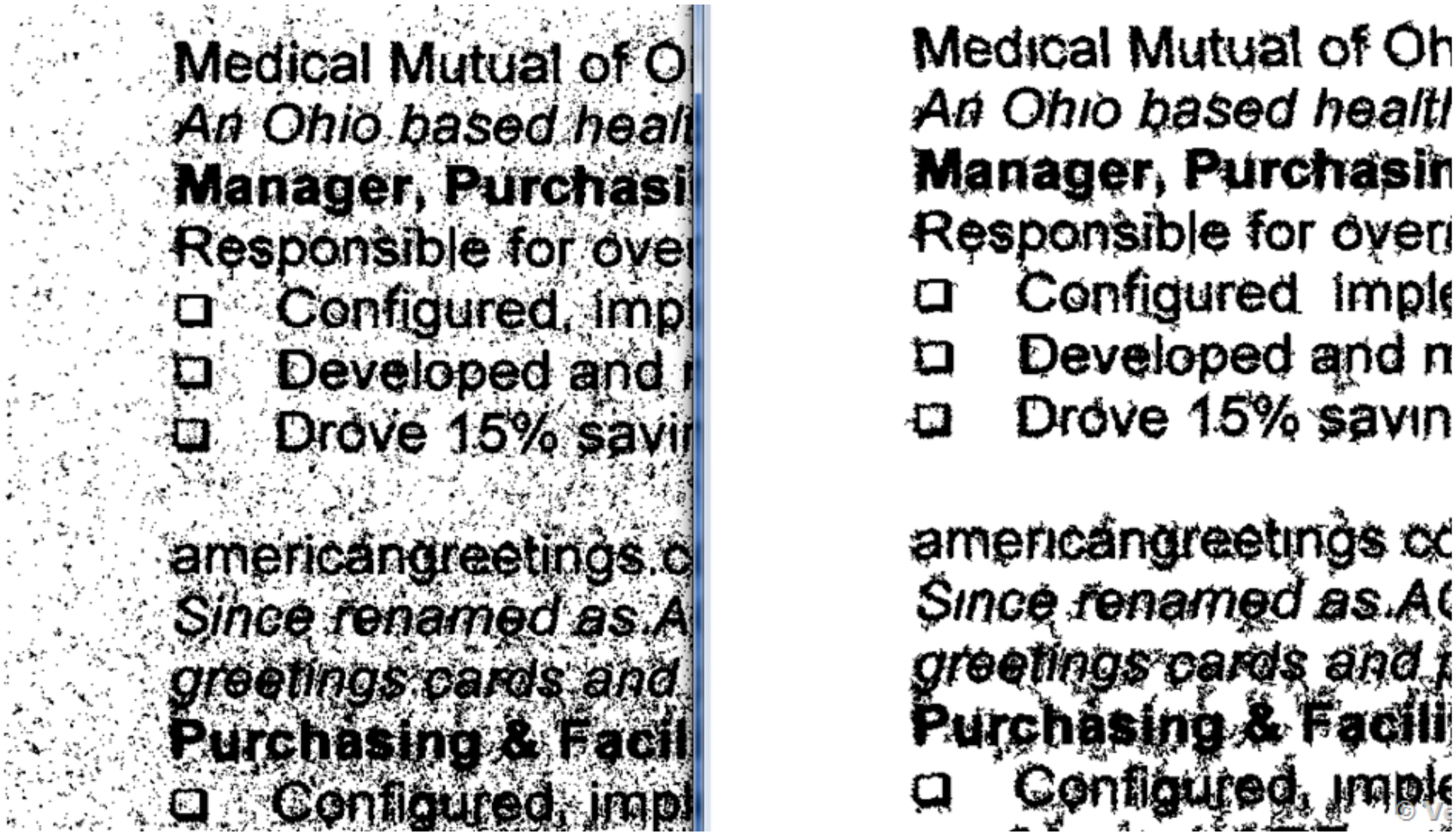


ImagEx - Binarisation

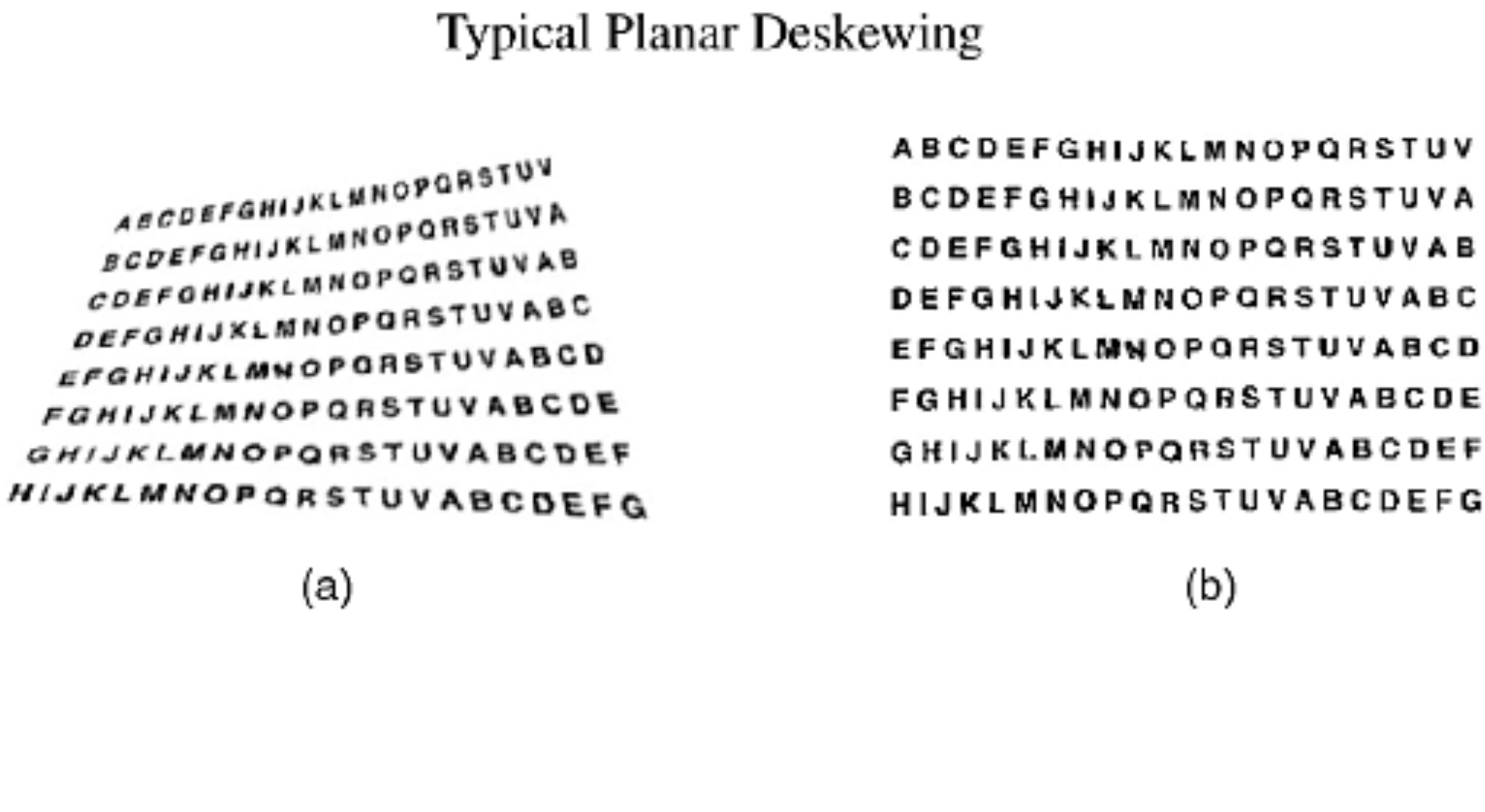


Original Image | **Binarized Image**

ImagEx - Noise Removal



ImagEx - DeSkewing



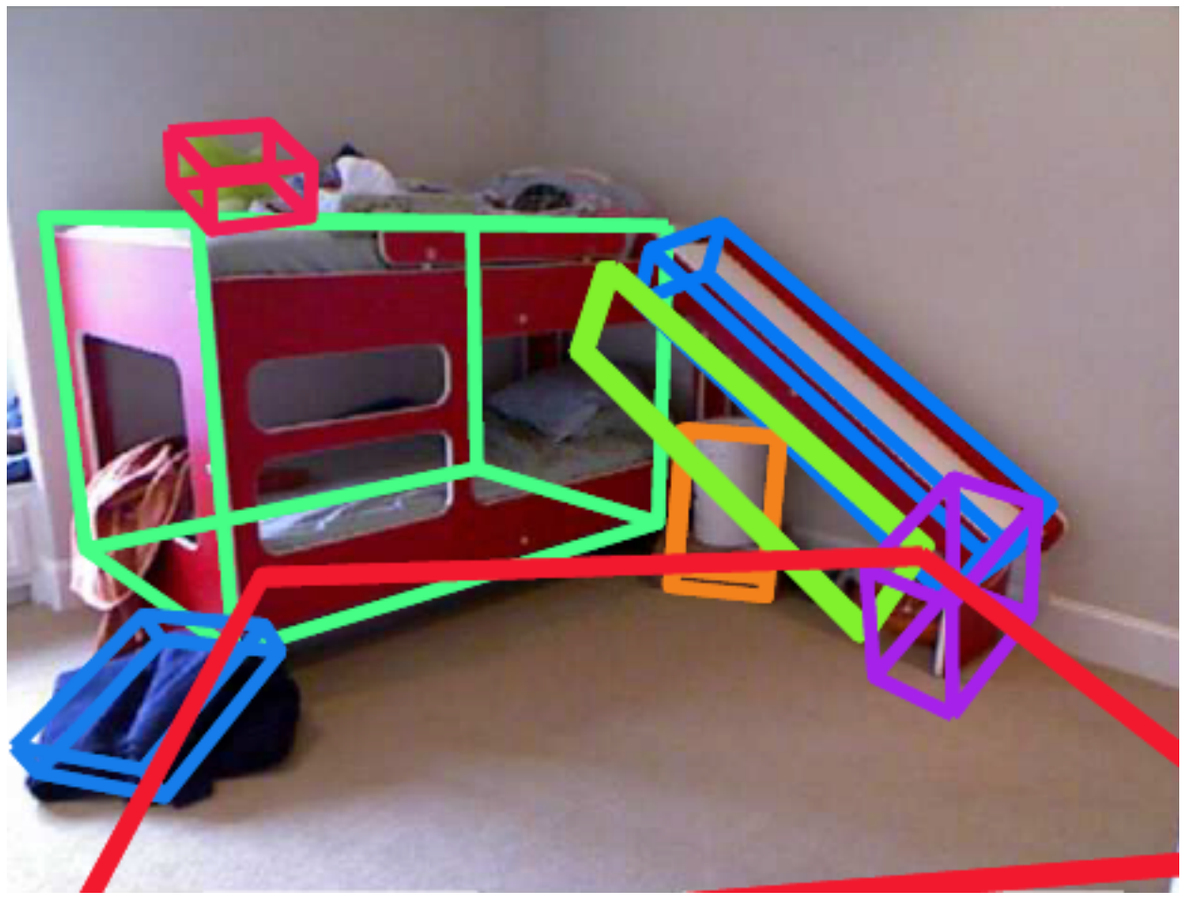
ImagEx
Digit Recognition

ShaFlo - Character Recognition Engine

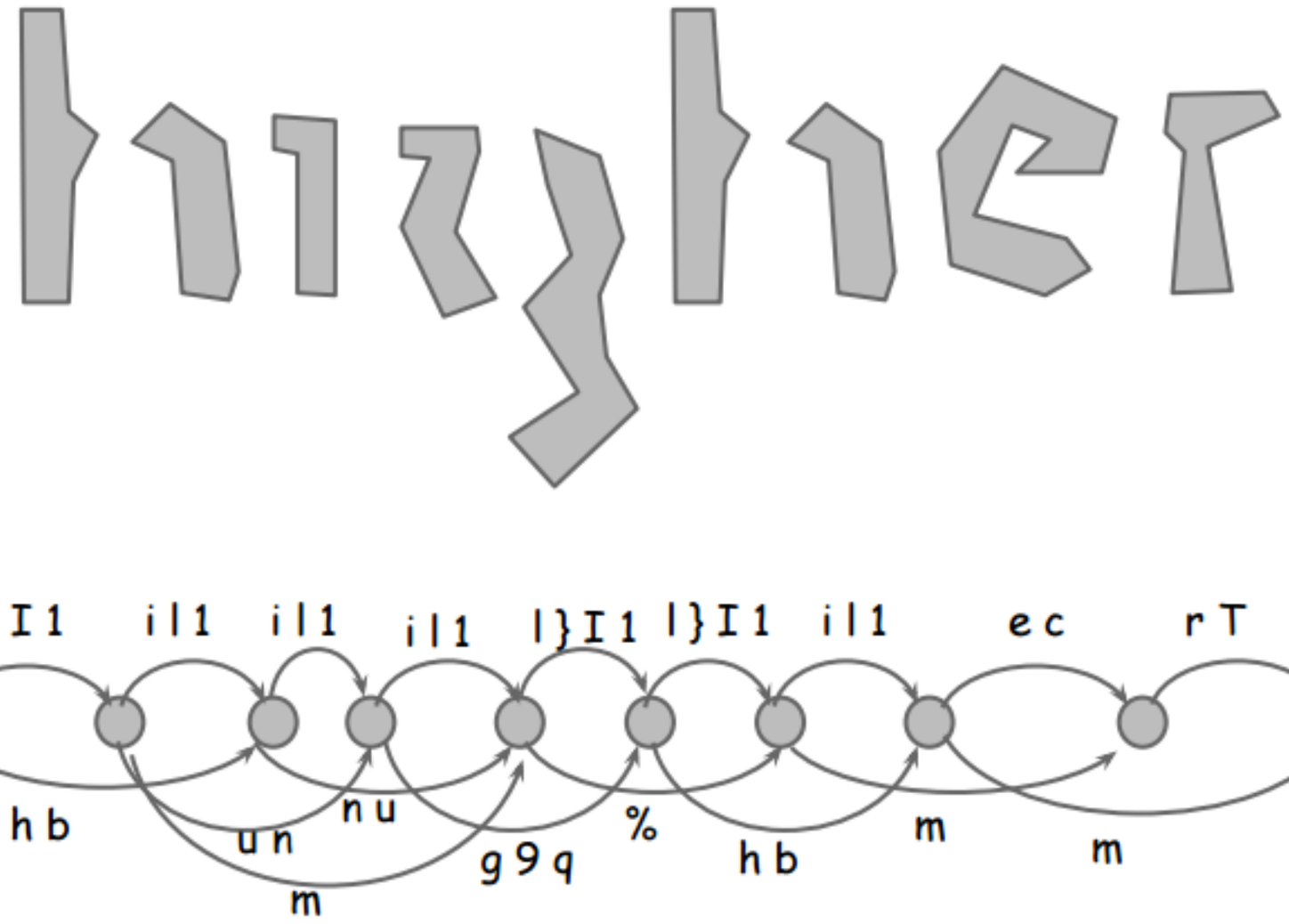
- Image Object Shape Recognition and Character Recognition
  - Recognises digits from the models learned from MNIST Database
  - Recognises the shape of images using Google's Inception v4 Database

ShaFlo

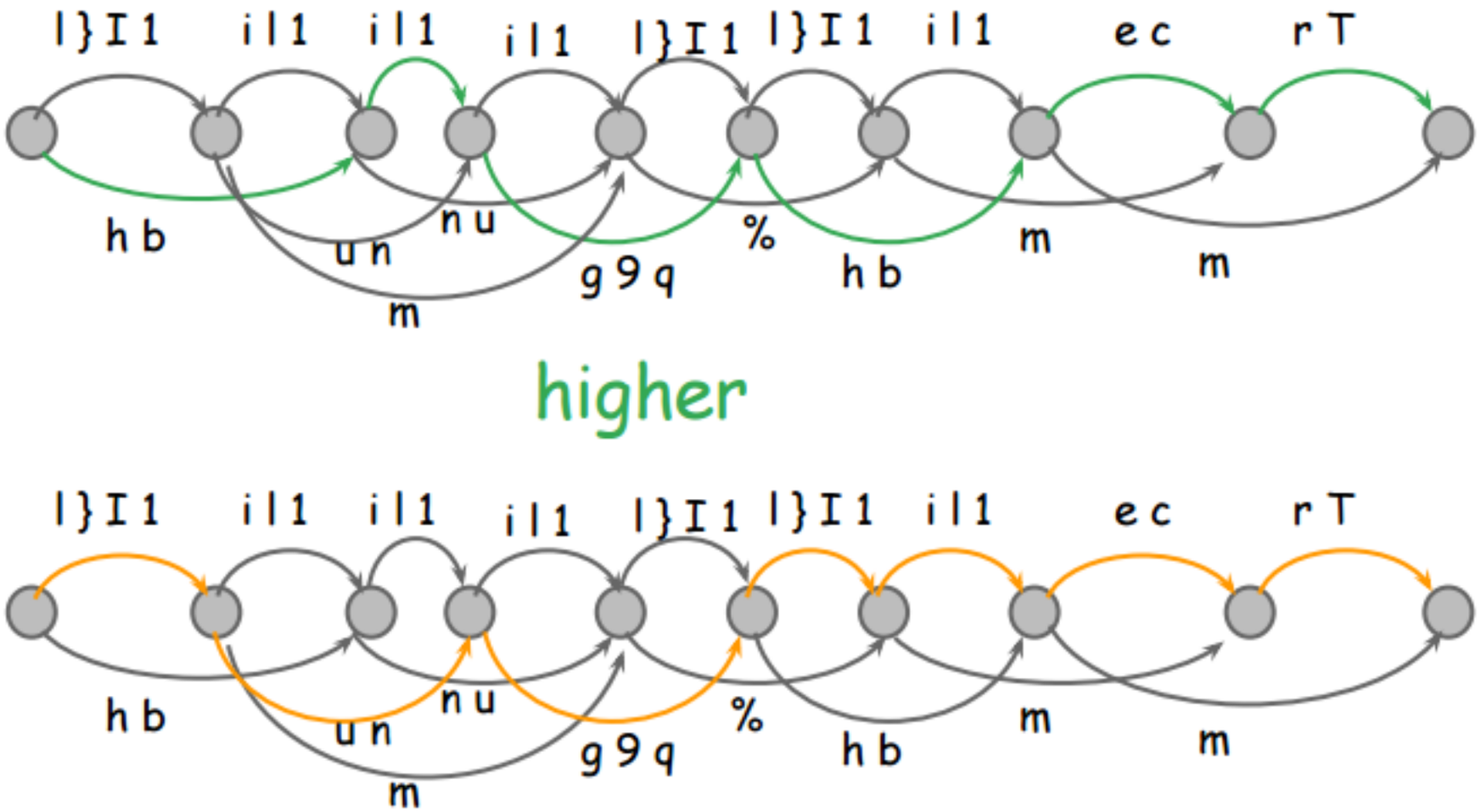
Object Shape Recognition



ShaFlo
Handwriting Recognition



ShaFlo
Handwriting Recognition



ShaFlo
Handwriting Recognition

What We Did

- Trained our algorithm to recognise digits and symbols used in math

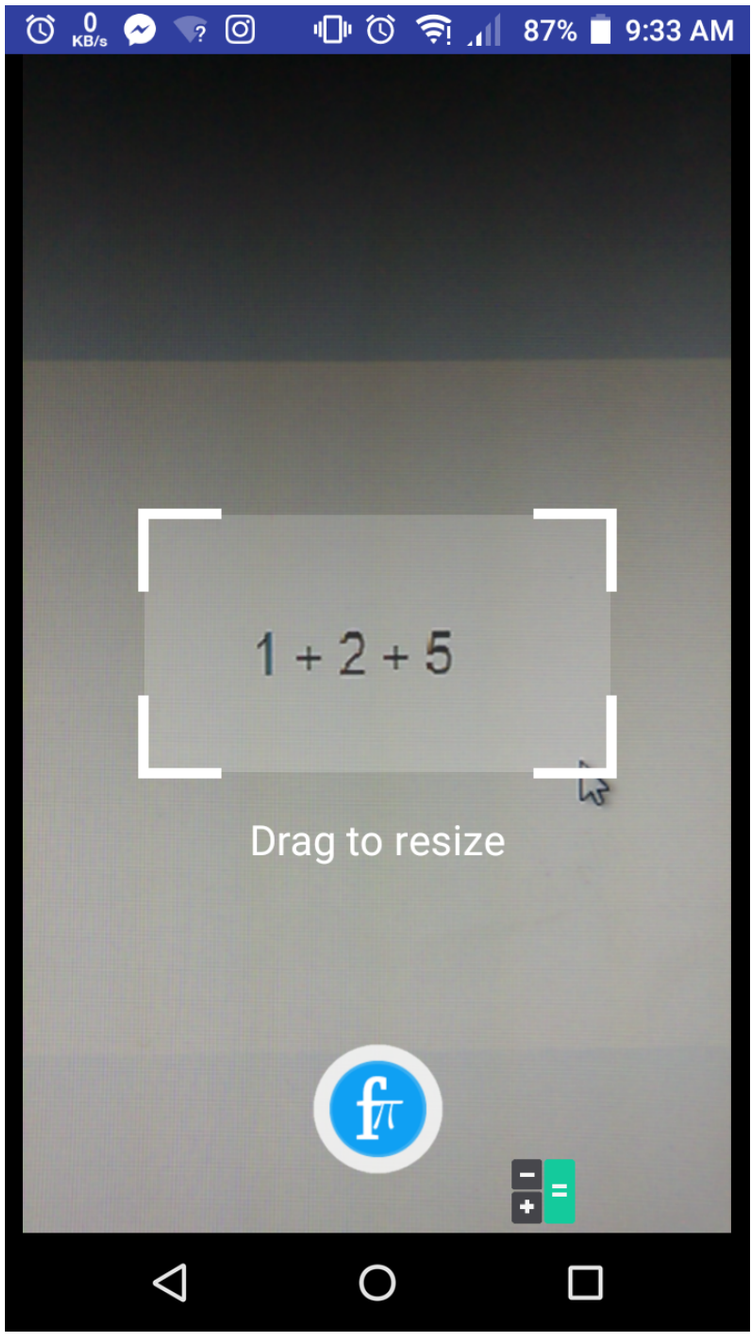
- Build a Advanced Parser that will parse and provide the Result *

- We trained our Algorithms to classify 60,000 samples provided in the MNIST Database

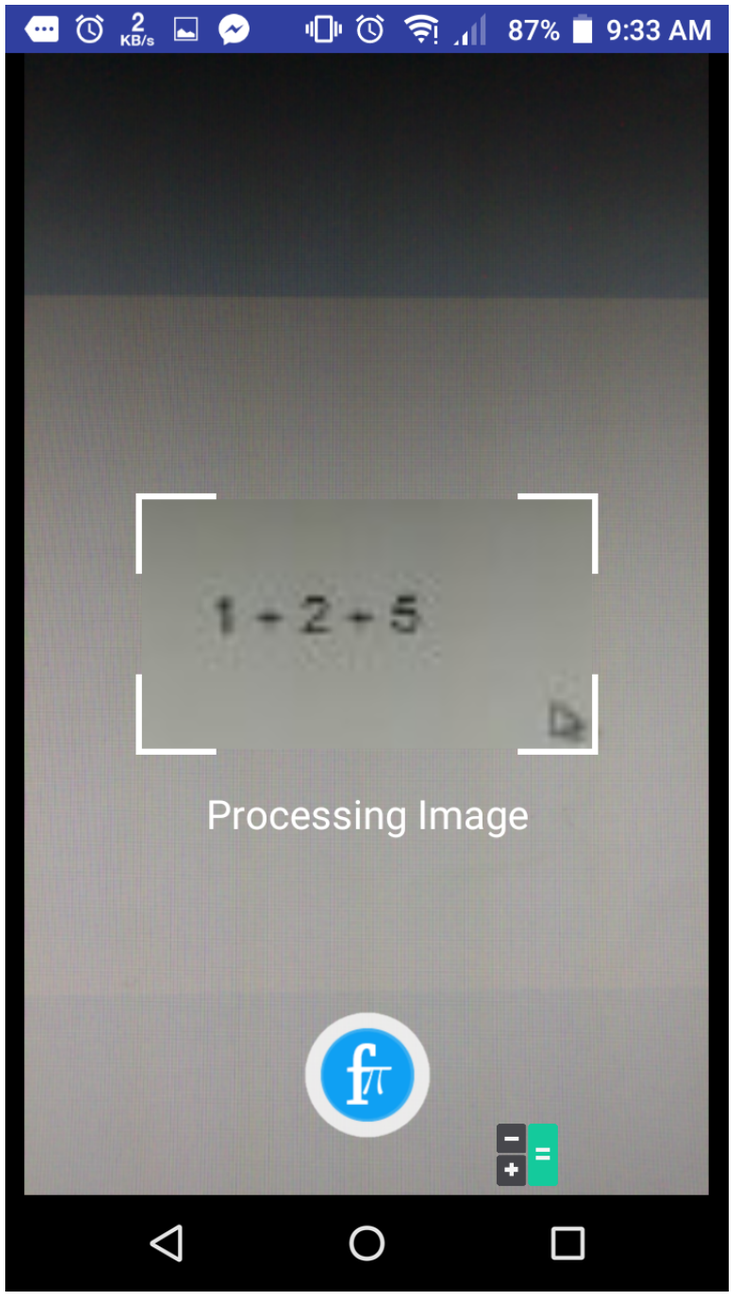
http://cs.nyu.edu/~roweis/data/mnist_train9.jpg

* training accuracy 84%

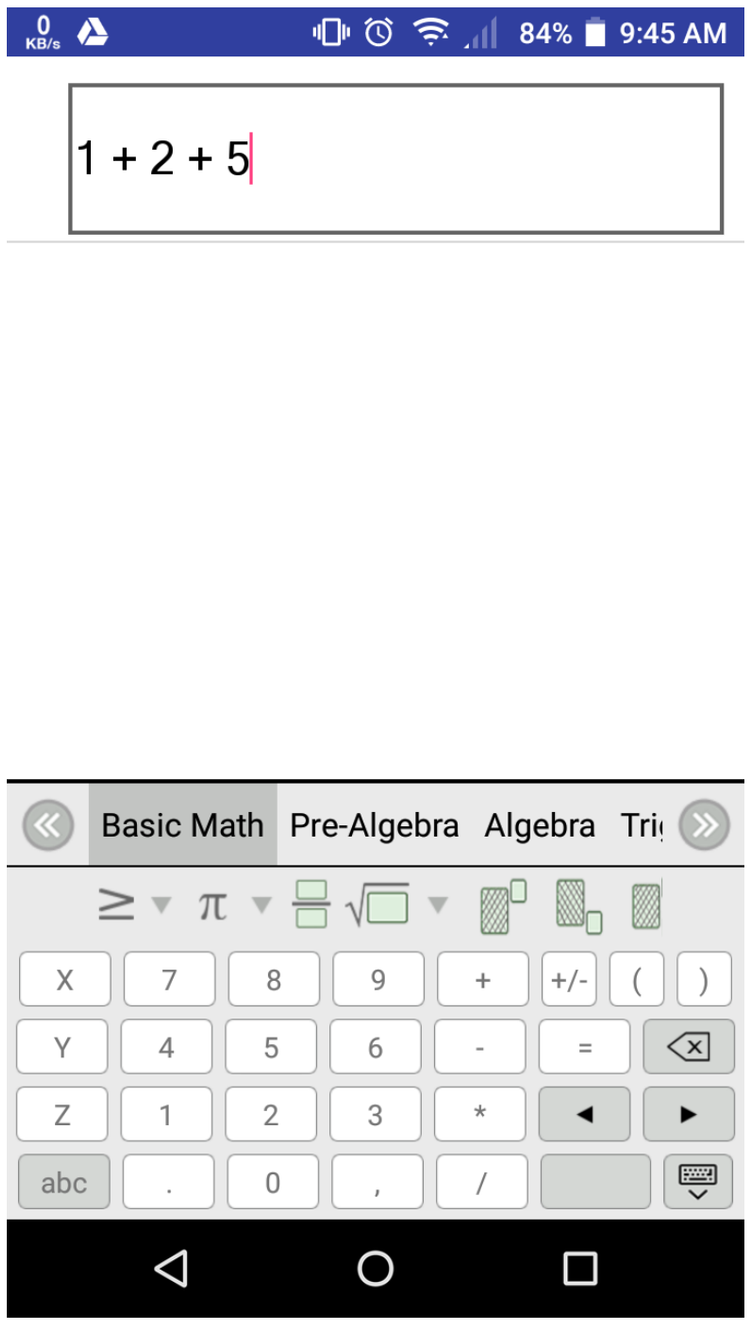
Android App
Captured Image



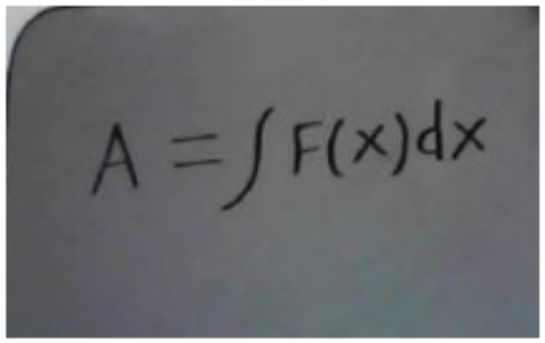
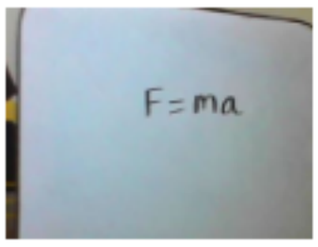
Android App
Processed Image



Android App
Formula Editor



Sample Results

Captured Image	Extracted Expression
	$A = \int F(x)dx$
	$F = ma$
$\sum \sin x = \pi$	$\sum \sin \times = \pi$

“forMath - no formulae for Life”

– JIF

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forMath App will be available on  for public beta testing tonight

References

- Google's Inception v4 - for Shape Recognition
- IBM's tesseract-ocr - for image (ocr) to text
- Show and Tell: Lessons learned from the 2015 MSCOCO Image Captioning Challenge - by Oriol Vinyals, Alexander Toshev, Samy Bengio, and Dumitru Erhan
- ImageNet Large Scale Visual Recognition Challenge
- Deep Residual Learning for Image Recognition - by Kaiming He, Xiangyu Zhang, Shaoqing Ren, Jian Sun
- Im2Text: Describing Images Using 1 Million - by Vicente Ordonez ,Girish Kulkarni, Tamara L Berg

Thank you