Precise Weed and Maize Classification through Convolutional Neuronal Networks

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Presentation Outline

Introduction

1. Maize is one of the most important food of the world.
2. Las malas hierbas en el maiz pueden afectan hasta 5000 Kg/Hectaria de produccion.
3. La robotica esta presentando grandes avances en la agricultura de precision.
4. Inteligencia artificial cada vez se acerca mas a la inteligencia humana.

The Propose of the present study

1. Obtener muestras(imagenes) para conformar un dataset.
2. Segmentar las muestras.
3. Probar diferentes arquitecturas de Redes Neuronales Convolucionales para entrenar la red.
4. Hacer Benchmark en diferentes hardwares para analizar tiempos de procesamiento.
5. Optimizar la red.

Hardware and Software Used

Hardware

1. Raspberry Pi 3.
2. Pi camera V2.1.
3. Nvidia graphic Card GTX950M.

Software

1. OpenCV Library
2. Caffe framework
3. Ubuntu 16.04
4. PIXEL Distribution derived from Debian.

Image Processing

- Acquire an RGB image through RPi Camera v2.1
- Detect contours and crop image to the contour
- Normalize Green Channel and then $S = 2 * G - R - B$ [1]
- OTSU Thresholding
- Mask image

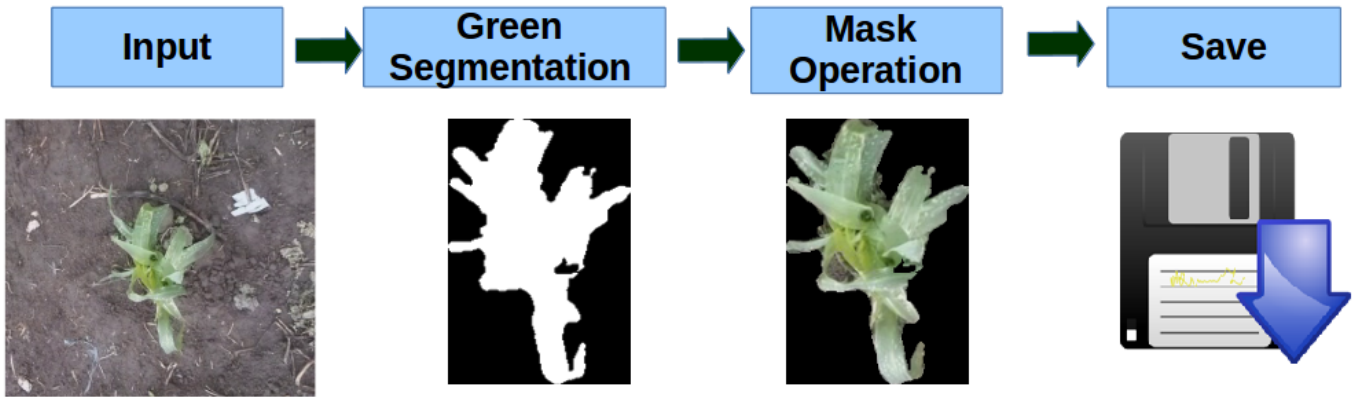

Figure : The process of image processing, por lo pronto

[1] Poner cita aqui

Dataset

Dataset Description

1. Place Pillaro Tungurahua Ecuador
2. La imagenes fueron obtenidas encampos de maiz en su estapa inicial,(plantas con 3 a 7 hojas) [1].
3. Imagenes rotadas cada 30 para mejorar la deteccion de las planta.
4. 1/5 del total de las imagenes al azar fueron usadas para la etapa de validacion

Table : Dataset distribution of each class

Images	**Maize**	**Weed**
Original	2835	880
Rotated	34222	10762
Entrenamiento	25695	8560
Validacion	8325	2000

Convolutional Neural Networks(CNN)

- Highly accurate method for image classification
- A class of deep, feed-forward artificial neural networks
- Tested on classification of plants, poner citas
- Multiple architectures and applications

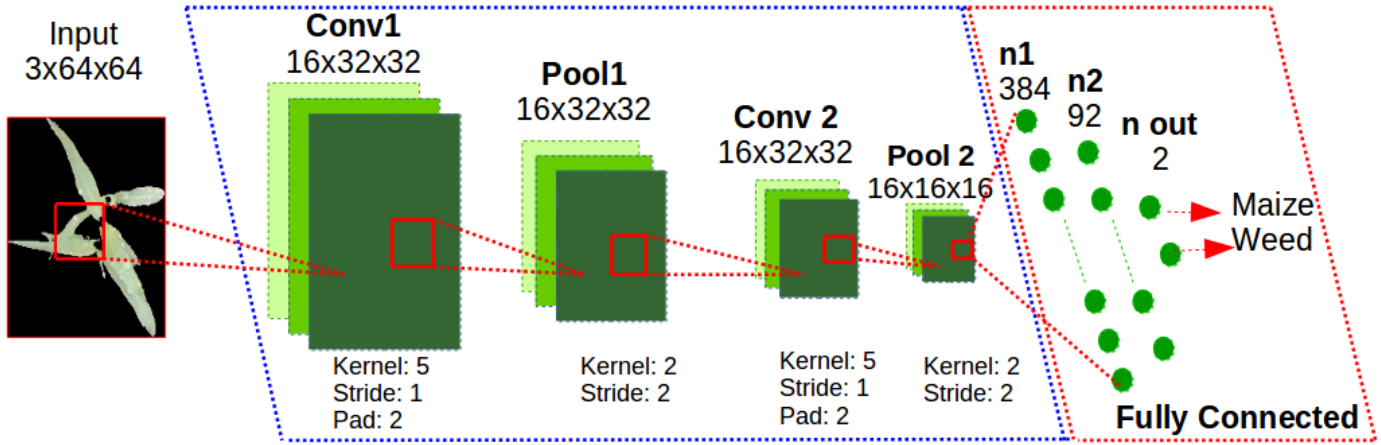

Figure : Normal architecture in a Convolutional Neural Network

Architectures tested

- Highly accurate method for image classification

Table : Comparison of the 4 types of CNN

Parameters	**LeNet**	**AlexNet**	**cNET**	**sNET**
Input size of images	32x32	64x64	64x64	64x64
Layers numbers	9	11	8	4
Number of parameters	652500	20166688	6421568	135872
Iterations	3000	3000	3000	3000
Accuracy(%)	86.48	93.86	96.4	80.4
Loss(%)	32.80	15.32	13.72	15.32

cNET Performance

1. Obtener muestras(imagenes) para conformar un dataset.

Table : Test of cNET 16 filters with optimized software

Hardware	**Accuracy Weed**	**Accuracy Maize**	**Average time of classification/image**
GPU	92.08%	89.11%	1.58 ms
CPU	92.08%	89.11%	10.92 ms
CPU(Raspberry Pi)	92.08%	89.11%	150.8 ms

Presuming performance of cNET 16 filters

Table : Test of complete image classification in FPS

Parameter	GPU	CPU	Raspberry Pi
Time(s)	0.0171	0.196	2.714
FPS	58.47	5.08	0.36

Conclusion

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Recomendations

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Thanks!


Srdjan Sladojevic, Marko Arsenovic, Andras Anderla, Dubravko Culibrk, and Darko Stefanovic.
Deep neural networks based recognition of plant diseases by leaf image classification.
Computational intelligence and neuroscience, 2016, 2016.