PLANT AND SEED CLASSIFICATION

INTRODUCTION

Agriculture is vital for human survival and remains a major driver of several economies around the world; more so in underdeveloped and developing economies. With increasing demand for food and cash crops, due to a growing global population and the challenges posed by climate change, there is a pressing need to increase farm outputs while incurring minimal costs. Previous machine vision technologies developed for selective weeding have faced the challenge of reliable and accurate weed detection. We compare the performances of two traditional algorithms and a Convolutional Neural Network (CNN), a deep learning technique widely applied to image recognition, for this task. Our findings show that CNN-driven seedling classification applications when used in farming automation has the potential to optimize crop yield and improve productivity and efficiency when designed appropriately.

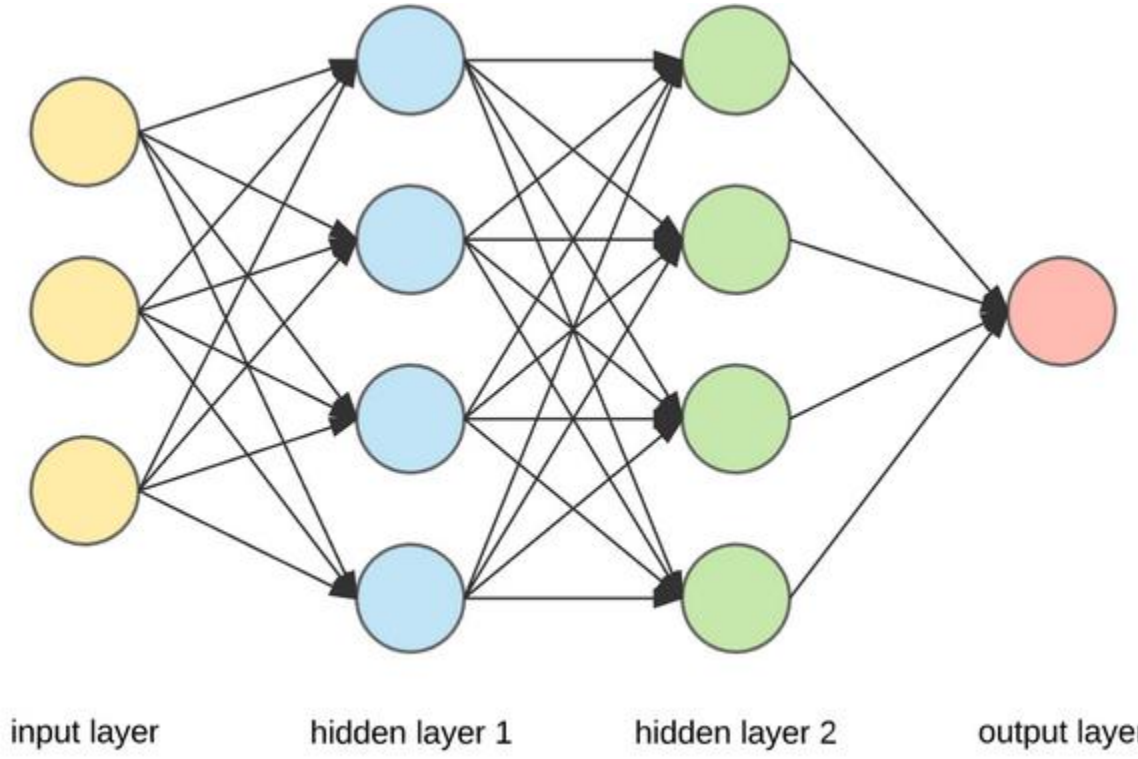
ABOUT DATASET

The data set contains 4,275 images of approximately 960 unique plants belonging to 12 species at several growth stages. The training and testing data set usually should be 70%-90% train and 30%-10% test. The following are the 12 classes/categories in which the dataset images had to fit in.

```
Black-grass
Charlock
Cleavers
Common Chickweed
Common wheat
Fat Hen
Loose Silky-bent
Maize
Scentless Mayweed
Shepherds Purse
Small-flowered Cranesbill
Sugar beet
```

METHODOLOGY

Neural networks consist of individual units called **neurons**. Neurons are located in a series of groups — **layers.** Neurons in each layer are connected to neurons of the next layer. Data comes from the input layer to the output layer along these compounds. Each individual node performs a simple mathematical calculation. Then it transmits its data to all the nodes it is connected to.



Convolutional neural networks and image classification

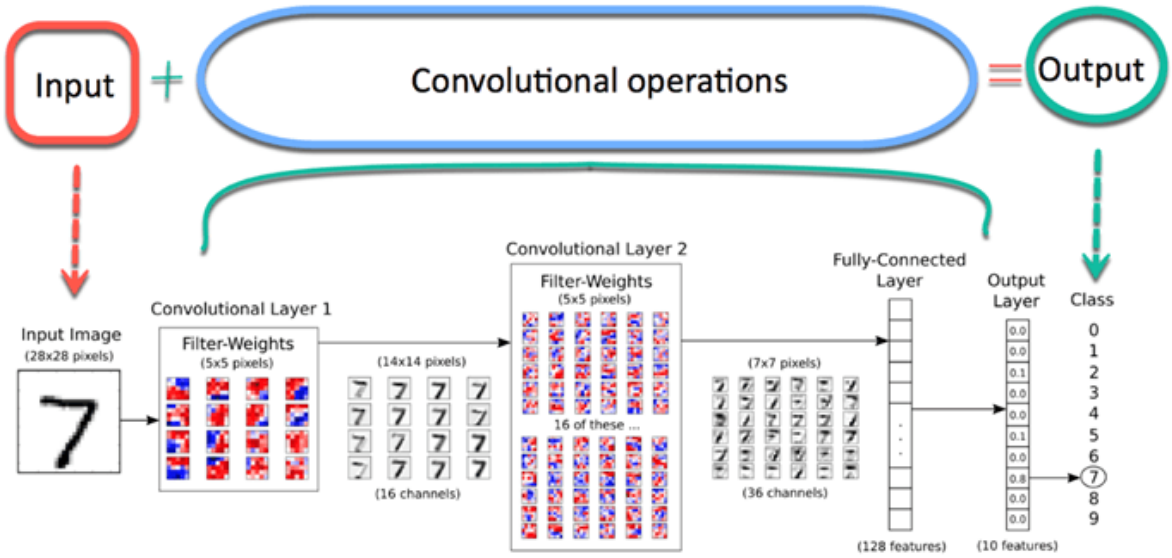
Convolutional neural networks (CNN) is a special architecture of artificial neural networks. CNN uses some features of the visual cortex. One of the most popular uses of this architecture is image classification. For example, Facebook uses CNN for automatic tagging algorithms, Amazon — for generating product recommendations and Google — for search through among users' photos.

A CNN has

- Convolutional layers
- ReLU layers
- Pooling layers
- a Fully connected layer

Instead of the image, the computer sees an array of pixels. For example, if image size is 300 x 300. In this case, the size of the array will be 300x300x3. Where 300 is width, next 300 is height and 3 is RGB channel values. The computer is assigned a value from 0 to 255 to each of these numbers. This value describes the intensity of the pixel at each point.

Architecture of a Convolutional Neural Network



RESULTS

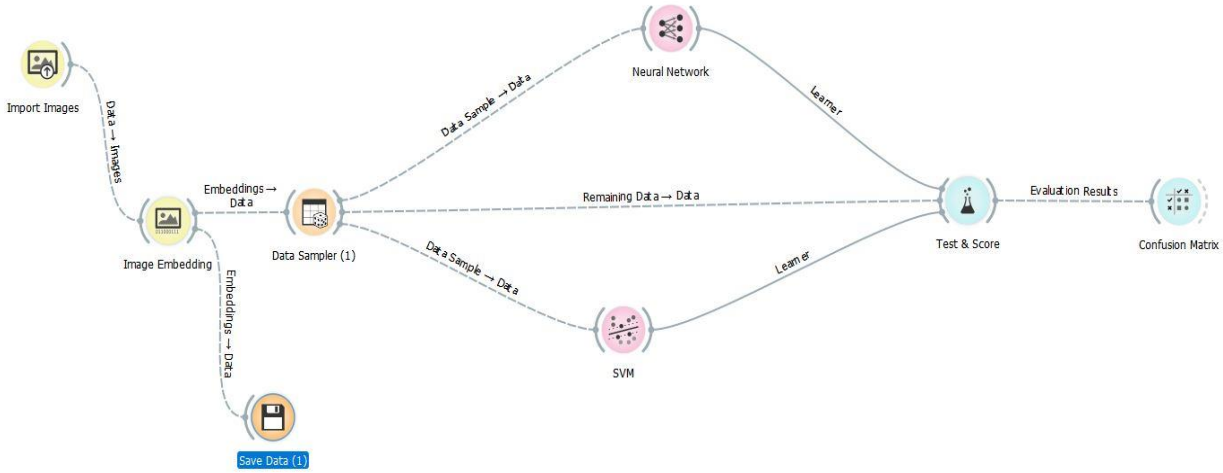
ACCURACY: 89.1

CONFUSION MATRIX:

Predicted

Actual	Black-grass	Charlock	Cleavers	Common Chickweed	Common wheat	Fat Hen	Loose Silky-bent	Maize	Scentless Mayweed	Shepherdâ€™s Purse	Small-flowered Cranesbill	Sugar beet	Σ
Black-grass	63	0	0	0	5	1	24	0	1	0	0	1	95
Charlock	0	131	1	1	1	0	1	1	0	0	1	0	137
Cleavers	0	1	92	2	0	0	0	0	2	0	3	2	102
Common Chickweed	0	0	1	177	0	2	1	1	7	5	1	4	199
Common wheat	2	0	0	1	82	4	2	0	0	0	0	1	92
Fat Hen	1	2	1	1	5	134	2	1	1	0	0	3	151
Loose Silky-bent	12	0	0	0	2	2	239	1	2	0	0	0	258
Maize	1	0	0	1	2	1	0	57	0	0	0	2	64
Scentless Mayweed	0	0	0	13	0	1	2	1	160	2	1	0	180
Shepherdâ€™s Purse	0	0	1	14	0	0	0	0	9	48	0	0	72
Small-flowered Cranesbill	0	1	0	0	0	0	2	0	2	0	176	0	181
Sugar beet	1	0	0	4	0	7	0	1	0	0	0	153	166
Σ	**80**	**135**	**96**	**214**	**97**	**152**	**273**	**63**	**184**	**55**	**182**	**166**	**1697**

WORKFLOW:


Import Images
Data → Images
Image Embedding
Embeddings → Data
Data Sampler (1)
Data Sample → Data
Remaining Data → Data
Neural Network
Learner
Test & Score
Evaluation Results
Confusion Matrix
Data Sample → Data
Learner
SVM
Embeddings → Data
Save Data (1)