Eyes on the Ground

Using AI to identify the type of Crop damage from smart phone pictures

Presented By : Wayne, Imelda and Dominic

The Challenge

The "Eyes on the Ground" project is a collaboration between ACRE Africa, the Kenya Agricultural & Livestock Research Organization (KALRO), the International Food Policy Research Institute (IFPRI), and the Lacuna Fund, to create a large machine learning (ML) dataset that provides a close-up view of smallholder farmer's fields, with the aim of developing a Picture Based Insurance framework.

In order to help farmers across Africa manage agricultural risk, ACRE Africa uses image data to settle insurance claims and carry out loss assessment.

Evaluating images for thousands of insured smallholder farmers to verify insurance claims and provide personalized agricultural advisories is **time-consuming**, slowing down claims settlement and **increasing the costs** of the advisory service

Goals

The objective of this challenge is to create a machine-learning algorithm to classify crops into categories: Good growth (G), Drought (DR), Nutrient Deficient (ND), Weed (WD), and Other (including pest, disease or wind damage).

Goal 1

To build a model to classify crop damage type across multiple seasons

Goal 2

To evaluate, fine-tune and select the best-performing model

Goal 3

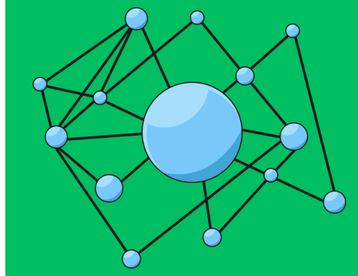
To deploy the model to be integrated into the Acre's Fund insurance claim application

Solution and Strategy

Using the client's dataset, which consists of over ~26K with images distributed across seasons, we propose to develop a machine learning data pipeline that can classify crop damage types from pictures.

- Train and evaluate models on the data
- By knowing what type of damage a crop experiences, images can be fed into a model to indicate whether a crop was damaged, and needs to be evaluated for insurance payouts

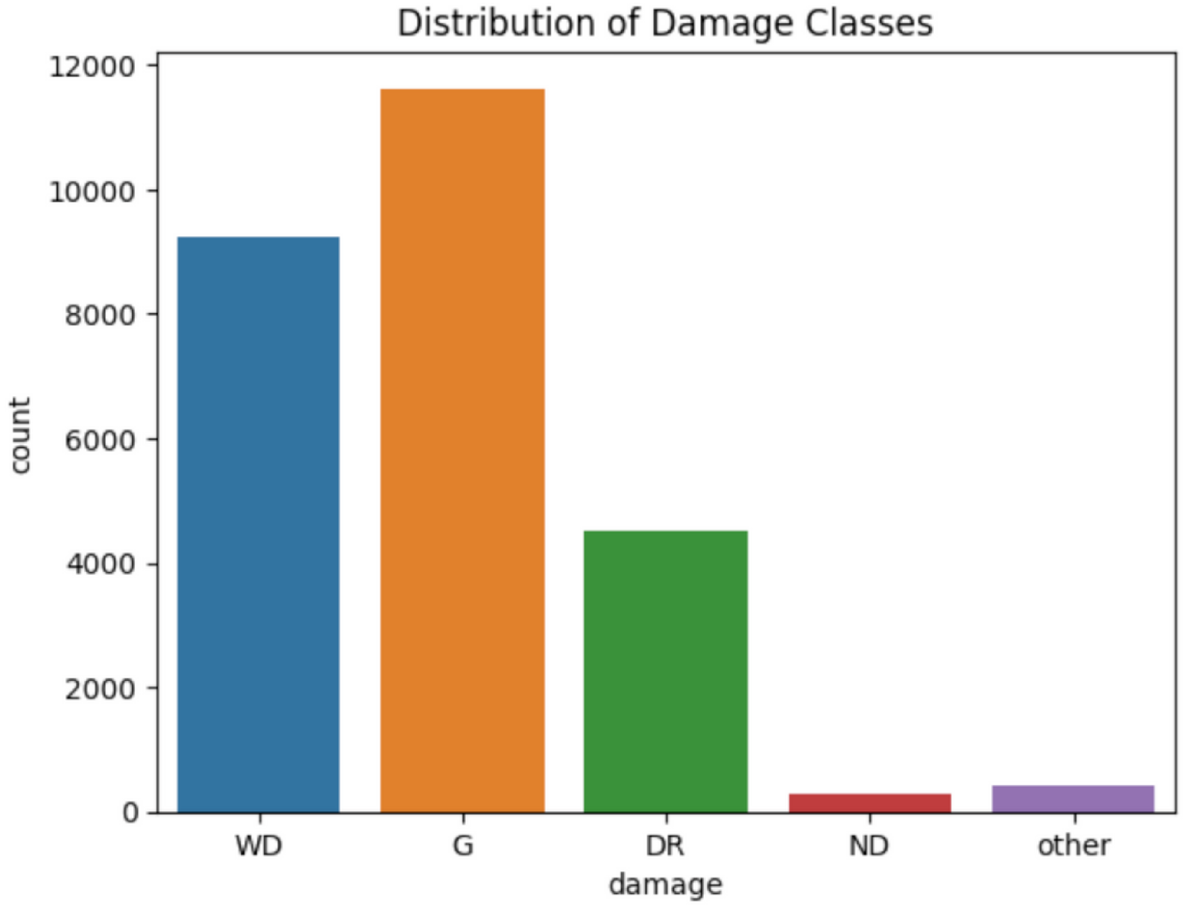
Data at a Glance



The data consists of over 26,000 images. The data is divided into the training set, for which labels are provided and the test set for which no labels are provided.

Damage types

Damage	Definition
DR	Drought
G	Good (growth)
ND	Nutrient Deficient
WD	Weed
other	Disease, Pest, Wind



Data at a Glance

Damage: G

Damage: WD

Damage: G

Damage: DR

Maize Dominance:

- The dataset prominently features maize as the dominant crop.
- Maize accounts for a significant portion of the overall dataset composition.

Project Significance:

- The prevalence of maize is a crucial factor in shaping the project's scope and focus.
- The dataset's composition imposes constraints on the machine learning model's applicability.

Modeling Approach

- **Data Preparation**
  - Organizing data according to class
  - Class balancing
    - Manual minority class oversampling was employed
- **Data Preprocessing**
  - Horizontal Flipping
  - Zooming
  - Shearing
  - Scaling

Model Architecture

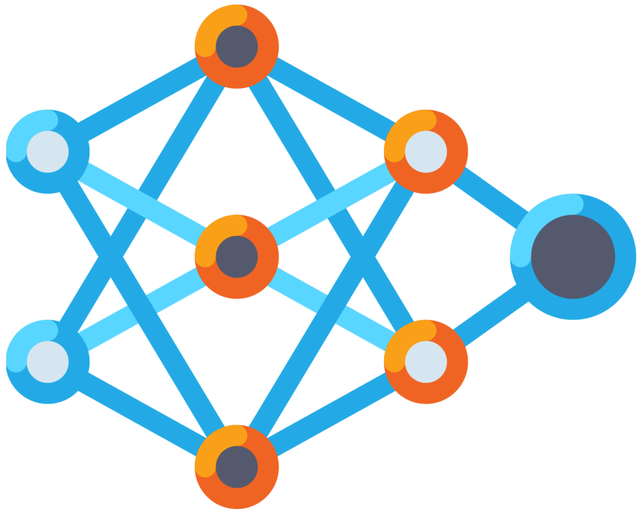
Convolutional Neural Network

Base Model

Model: "sequential"

Layer (type)	Output Shape	Param #
conv2d (Conv2D)	(None, 222, 222, 32)	896
max_pooling2d (MaxPooling2D)	(None, 111, 111, 32)	0
conv2d_1 (Conv2D)	(None, 109, 109, 64)	18496
max_pooling2d_1 (MaxPooling2D)	(None, 54, 54, 64)	0
conv2d_2 (Conv2D)	(None, 52, 52, 128)	73856
max_pooling2d_2 (MaxPooling2D)	(None, 26, 26, 128)	0
flatten (Flatten)	(None, 86528)	0
dense (Dense)	(None, 128)	11075712
dropout (Dropout)	(None, 128)	0
dense_1 (Dense)	(None, 5)	645

Total params: 11169605 (42.61 MB)
Trainable params: 11169605 (42.61 MB)
Non-trainable params: 0 (0.00 Byte)



Optimized Model

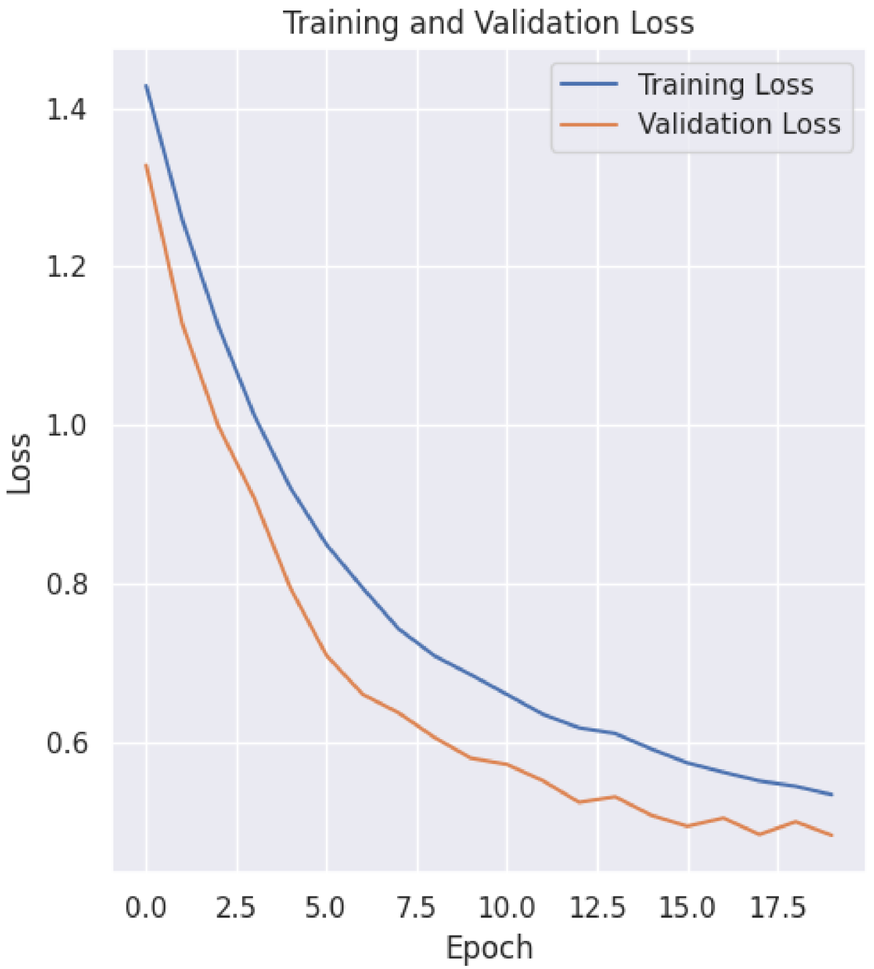
Model: "sequential_3"

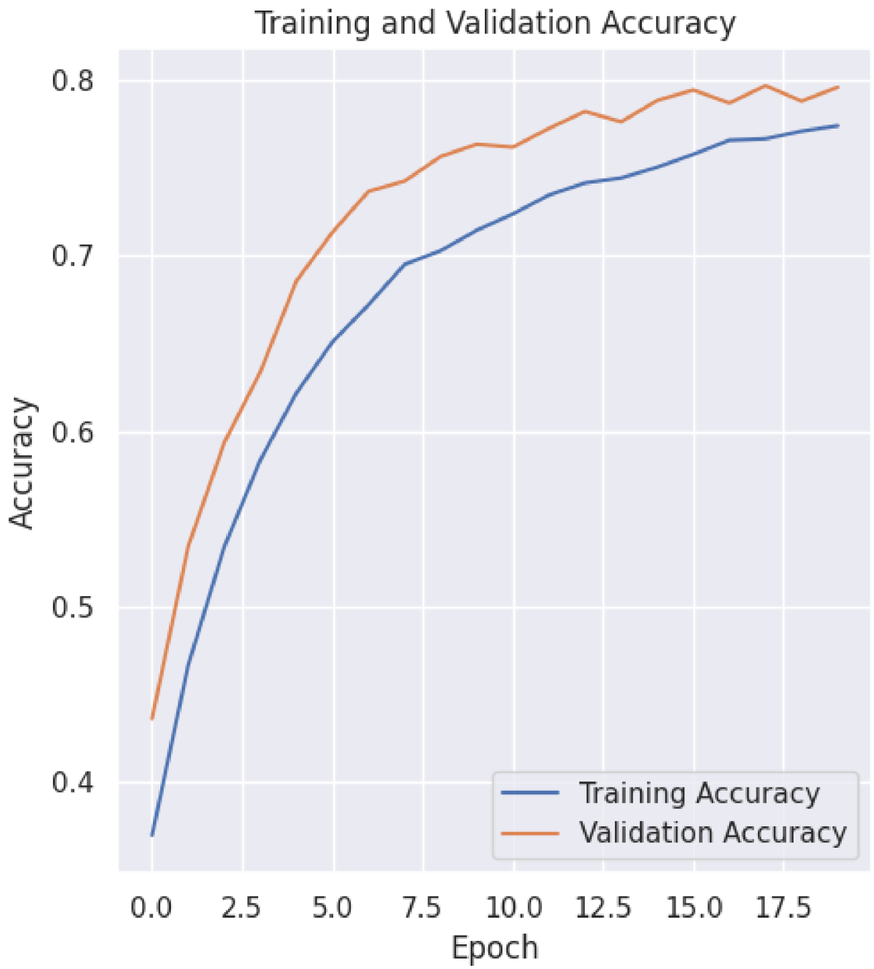
Layer (type)	Output Shape	Param #
conv2d_15 (Conv2D)	(None, 222, 222, 32)	896
max_pooling2d_15 (MaxPooling2D)	(None, 111, 111, 32)	0
conv2d_16 (Conv2D)	(None, 109, 109, 64)	18496
max_pooling2d_16 (MaxPooling2D)	(None, 54, 54, 64)	0
conv2d_17 (Conv2D)	(None, 52, 52, 128)	73856
max_pooling2d_17 (MaxPooling2D)	(None, 26, 26, 128)	0
conv2d_18 (Conv2D)	(None, 24, 24, 256)	295168
max_pooling2d_18 (MaxPooling2D)	(None, 12, 12, 256)	0
conv2d_19 (Conv2D)	(None, 10, 10, 128)	295040
max_pooling2d_19 (MaxPooling2D)	(None, 5, 5, 128)	0
flatten_3 (Flatten)	(None, 3200)	0
dense_6 (Dense)	(None, 128)	409728
dropout_3 (Dropout)	(None, 128)	0
dense_7 (Dense)	(None, 5)	645

Total params: 1093829 (4.17 MB)
Trainable params: 1093829 (4.17 MB)
Non-trainable params: 0 (0.00 Byte)

Results

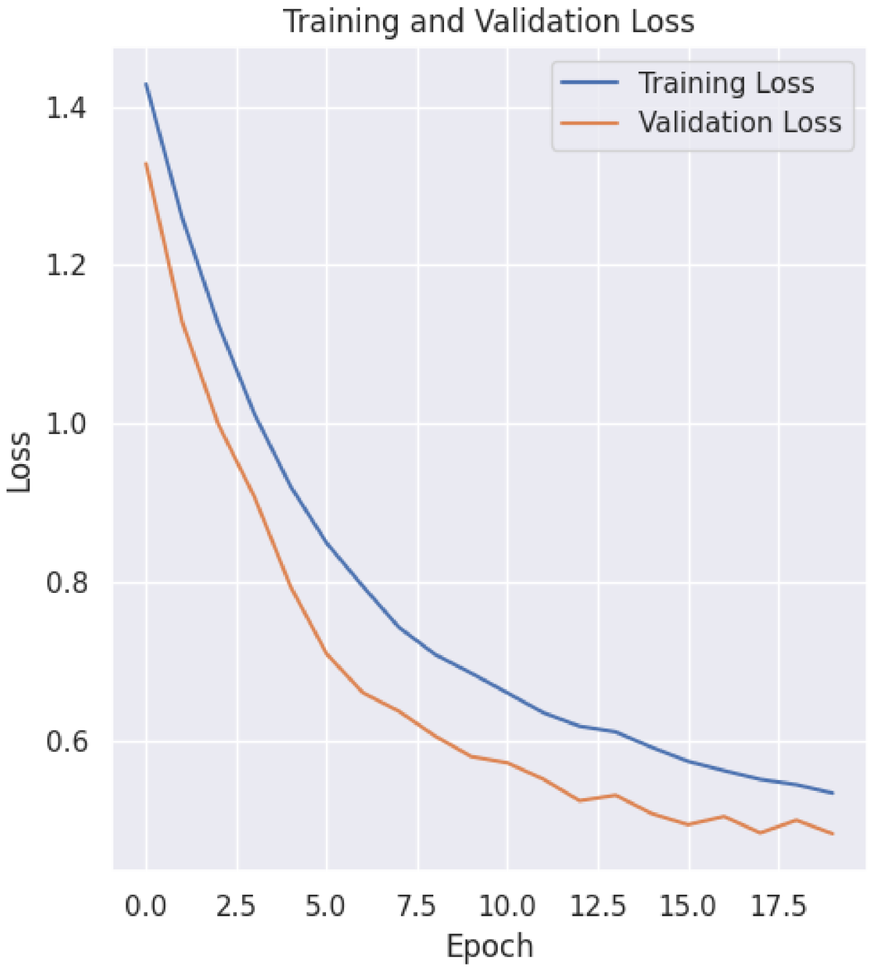
Base Model

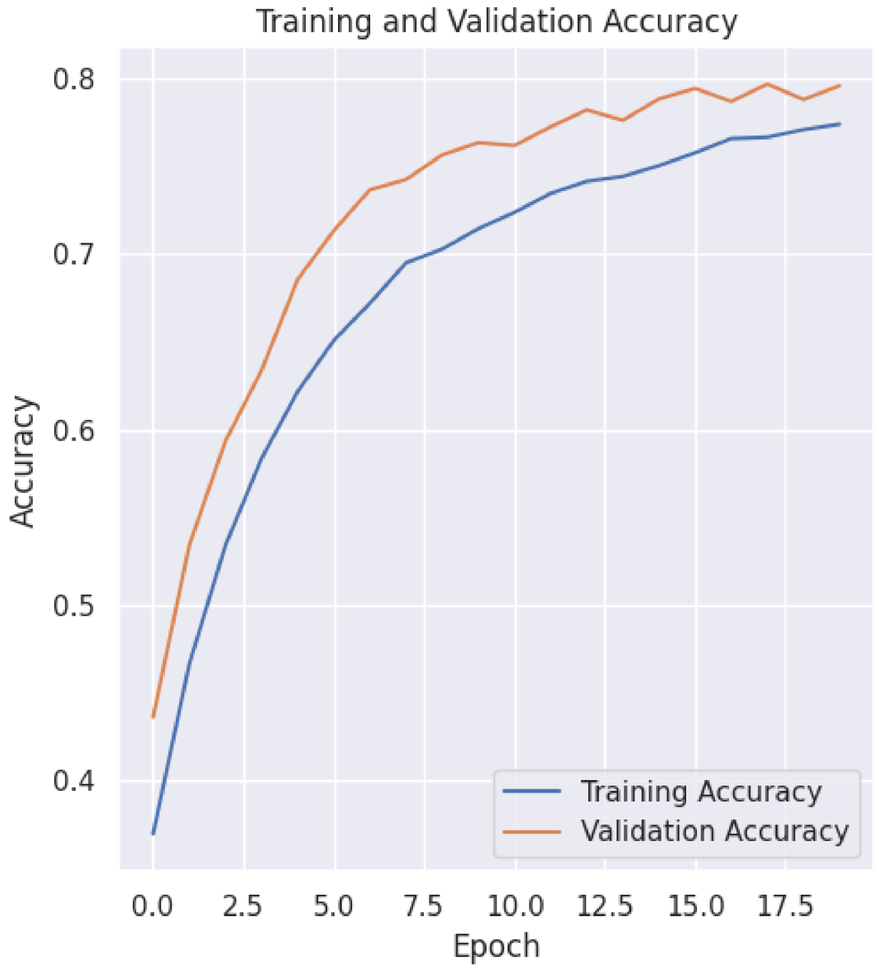




Results

Optimized Model





Recommendation

Labelling

- The crops need to be correctly labelled to improve model accuracy

Caveat

- Model is trained to work with damage to maize crops only

Conclusion

We built a model that can be used for predicting the type of damage on a crop

Model can be fine tuned and keep learning from more of the data records.

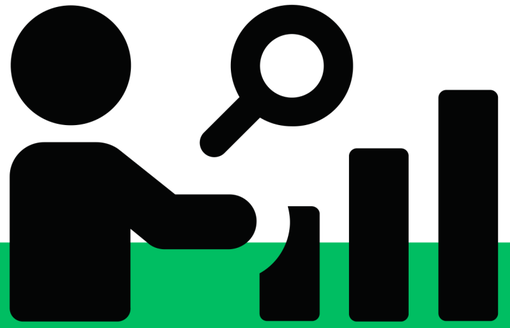
Nailed it!

Future

Win!

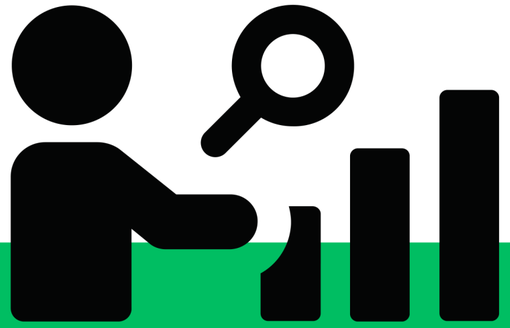
ACRE Africa have greatly improved their advisory services, and the farmers are happy

The Team



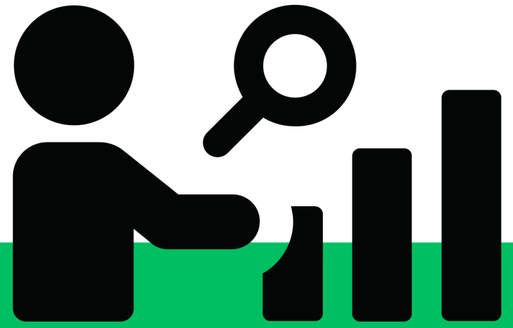
Wayne Kipkorir

Data Analyst



Celestine Imelda

Data Analyst



Dominic N Mugo

Data Analyst