



Farm Suraksha

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Team Members:

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Problem Statement

Inspiration Agriculture is main source of livelihood to majority of the population of U.P. More than 70 percent of population U.P. directly or indirectly depend on agriculture and allied sectors. There are many healthcare issues in the farm ecosystem as people in rural areas are not much aware of their farm's health.

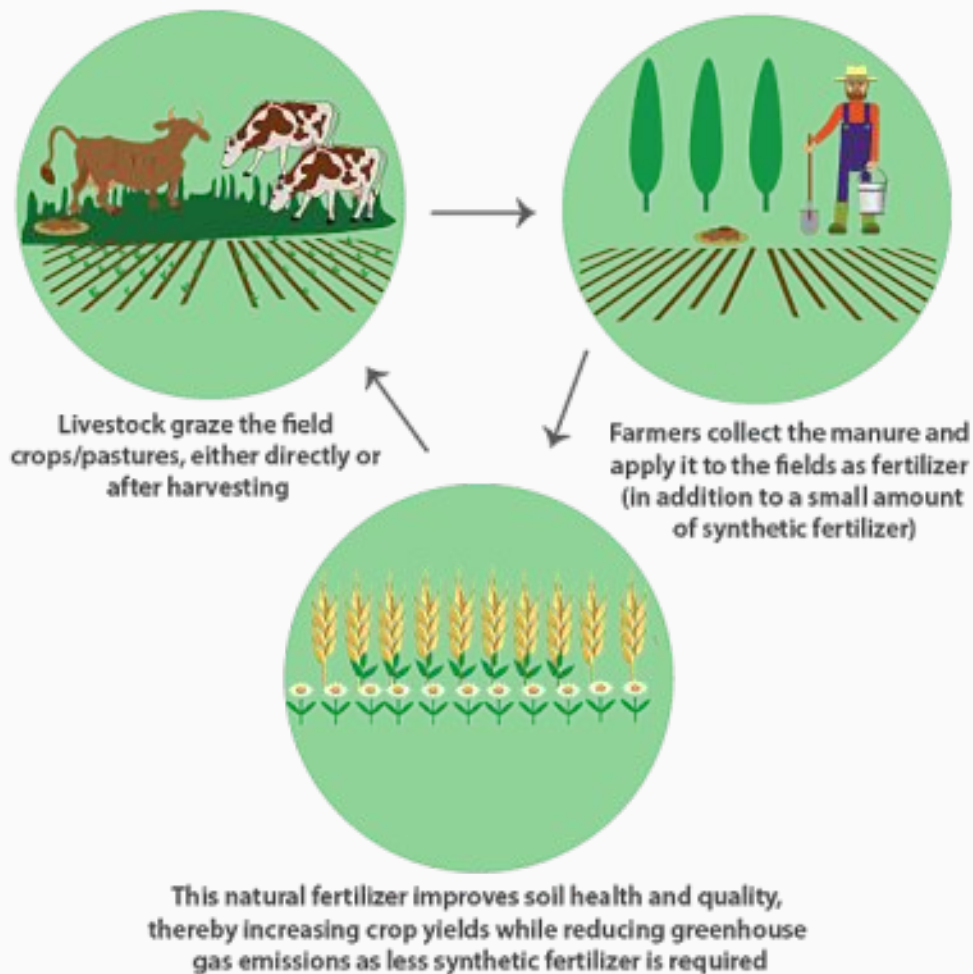
So there's a need to monitoring the healthcare of the farm ecosystem.

Solution includes

- 1.) Crop Healthcare
- 2.) Soil Healthcare
- 3.) Livestock Healthcare
- 4.) Recommendation System

We want to create a user friendly and regional compatible application. This will be a digital solution using IOT sensors and Machine Learning.

How an integrated cropping-livestock system works



Recommendation System

Tech Stack

- TensorFlow
- NLP
- APIs

Features

- Farmer can easy get help from this
- Any information regarding crops



Key Features Of Portal

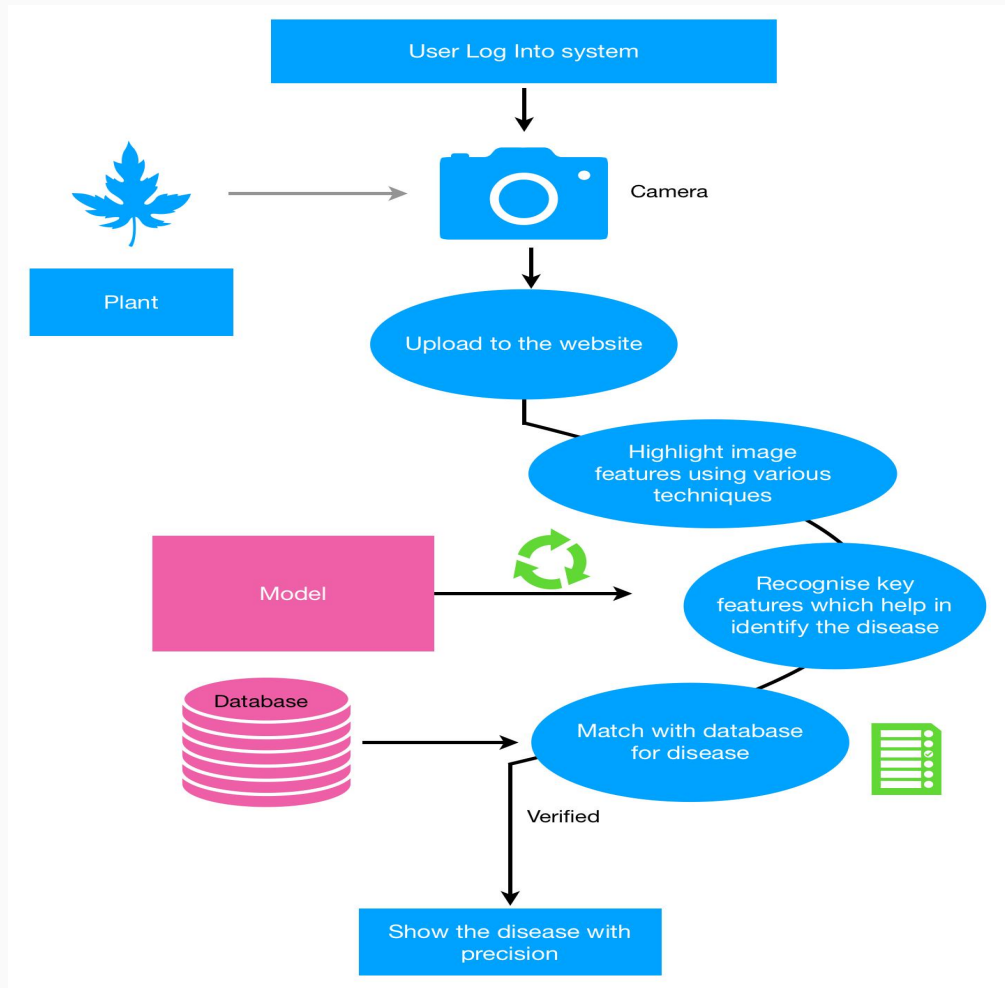
- Recommendation System
- Multi regional language support
- Fully compatible design for mobile
- Interactive Dashboard
- Studio has image cropping feature

Crop Healthcare



Use Case Diagram & Technology Stack

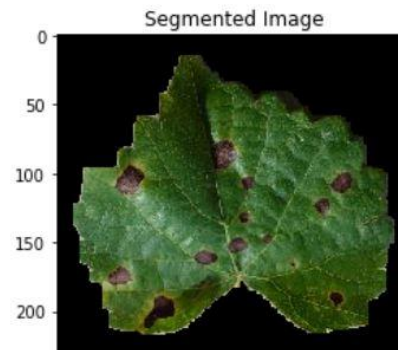
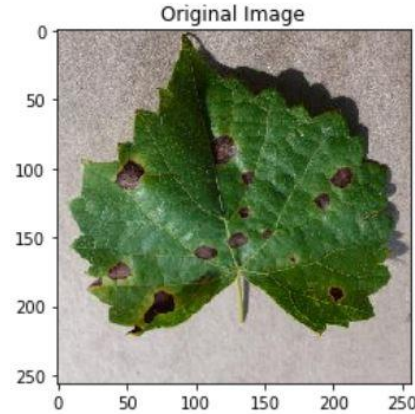
- OpenCV
- Deep Learning Libraries, such as Keras with tensorflow backend
- Django
- Rest API
- Numpy, Scipy, Sklearn and python libraries



Segmentation Technique

In the next step, Otsu segmentation is used to automatically perform clustering based image thresholding which helps in obtaining clearly demarcated region of interest from background.

```
[('Grape__Black_rot', 100.0),  
 ('Grape__Leaf_blight_(Isariopsis_Leaf_Spot)', 1.4395392701222615e-12),  
 ('Grape__Esca_(Black_Measles)', 9.924341147602052e-13),  
 ('Grape__healthy', 5.1673287960640445e-15)]
```



YOLO v2 (Darkflow)

It is used for identifying different infected leaves in the frame. It is trained on different classes of disease of Cassava crop. Size is 608px X 608px.

We have run 300 epochs with learning rate 10E-5 in collaboration with Adam Optimizer.

TRAINING RESULTS

```
step 17400 - loss 1.3430875539779663 - moving  
ave loss 1.316706913101056
```

This model is able to detect leaf disease with real time background in multiple leaves.

```
Load | | input | (?, 608, 608, 3)
Load | Yep! | conv 3x3p1_1 +bnorm leaky | (?, 608, 608, 32)
WARNING:tensorflow:From /content/drive/My Drive/Cassava_Disease/darkflo

Load | Yep! | maxp 2x2p0_2 | (?, 304, 304, 32)
Load | Yep! | conv 3x3p1_1 +bnorm leaky | (?, 304, 304, 64)
Load | Yep! | maxp 2x2p0_2 | (?, 152, 152, 64)
Load | Yep! | conv 3x3p1_1 +bnorm leaky | (?, 152, 152, 128)
Load | Yep! | conv 1x1p0_1 +bnorm leaky | (?, 152, 152, 64)
Load | Yep! | conv 3x3p1_1 +bnorm leaky | (?, 152, 152, 128)
Load | Yep! | maxp 2x2p0_2 | (?, 76, 76, 128)
Load | Yep! | conv 3x3p1_1 +bnorm leaky | (?, 76, 76, 256)
Load | Yep! | conv 1x1p0_1 +bnorm leaky | (?, 76, 76, 128)
Load | Yep! | conv 3x3p1_1 +bnorm leaky | (?, 76, 76, 256)
Load | Yep! | maxp 2x2p0_2 | (?, 38, 38, 256)
Load | Yep! | conv 3x3p1_1 +bnorm leaky | (?, 38, 38, 512)
Load | Yep! | conv 1x1p0_1 +bnorm leaky | (?, 38, 38, 256)
Load | Yep! | conv 3x3p1_1 +bnorm leaky | (?, 38, 38, 512)
Load | Yep! | conv 1x1p0_1 +bnorm leaky | (?, 38, 38, 256)
Load | Yep! | conv 3x3p1_1 +bnorm leaky | (?, 38, 38, 512)
Load | Yep! | maxp 2x2p0_2 | (?, 19, 19, 512)
Load | Yep! | conv 3x3p1_1 +bnorm leaky | (?, 19, 19, 1024)
Load | Yep! | conv 1x1p0_1 +bnorm leaky | (?, 19, 19, 512)
Load | Yep! | conv 3x3p1_1 +bnorm leaky | (?, 19, 19, 1024)
Load | Yep! | conv 1x1p0_1 +bnorm leaky | (?, 19, 19, 512)
Load | Yep! | conv 3x3p1_1 +bnorm leaky | (?, 19, 19, 1024)
Load | Yep! | conv 3x3p1_1 +bnorm leaky | (?, 19, 19, 1024)
Load | Yep! | conv 3x3p1_1 +bnorm leaky | (?, 19, 19, 1024)
Load | Yep! | concat [16] | (?, 38, 38, 512)
Load | Yep! | conv 1x1p0_1 +bnorm leaky | (?, 38, 38, 64)
```

Deep Learning Model (VGG-16)

We chose VGG16 for the purpose of transfer learning in our model by fine tuning on our data. Reason being its ability to extract deep features and it's is considered to be best of the class model for extracting useful features in ImageNet data.

It outperformed all other models like Googlenet , Resnet and Alexnet in terms of feature extraction and classification for plant disease detection.

TRAINING RESULTS

We have trained our model on different Neural Networks like VGG13 , Alexnet , VGG16 .Out of which VGG16 gives best results with 98.8 % accuracy results across the validation set.

VGG16 is also proved to be the best model to extract useful features in imagenet data.

Layer (type)	Output Shape	Param #
input_3 (InputLayer)	(None, 256, 256, 3)	0
block1_conv1 (Conv2D)	(None, 256, 256, 64)	1792
block1_conv2 (Conv2D)	(None, 256, 256, 64)	36928
block1_pool (MaxPooling2D)	(None, 128, 128, 64)	0
block2_conv1 (Conv2D)	(None, 128, 128, 128)	73856
block2_conv2 (Conv2D)	(None, 128, 128, 128)	147584
block2_pool (MaxPooling2D)	(None, 64, 64, 128)	0
block3_conv1 (Conv2D)	(None, 64, 64, 256)	295168
block3_conv2 (Conv2D)	(None, 64, 64, 256)	590880
block3_conv3 (Conv2D)	(None, 64, 64, 256)	590880
block3_pool (MaxPooling2D)	(None, 32, 32, 256)	0
block4_conv1 (Conv2D)	(None, 32, 32, 512)	1180160
block4_conv2 (Conv2D)	(None, 32, 32, 512)	2359808
block4_conv3 (Conv2D)	(None, 32, 32, 512)	2359808
block4_pool (MaxPooling2D)	(None, 16, 16, 512)	0
block5_conv1 (Conv2D)	(None, 16, 16, 512)	2359808
block5_conv2 (Conv2D)	(None, 16, 16, 512)	2359808
block5_conv3 (Conv2D)	(None, 16, 16, 512)	2359808
block5_pool (MaxPooling2D)	(None, 8, 8, 512)	0
global_average_pooling2d_3 ((None, 512)	0
dense_7 (Dense)	(None, 1024)	525312
dropout_5 (Dropout)	(None, 1024)	0
dense_8 (Dense)	(None, 256)	262400
dropout_6 (Dropout)	(None, 256)	0
dense_9 (Dense)	(None, 14)	3598
=====		
Total params: 15,505,998		
Trainable params: 5,510,926		
Non-trainable params: 9,995,072		

Key Features

- In addition to disease prediction, the website recommends steps of control and cure of the disease.
- Other probable diseases are also shown.
- Website can be translated into many languages as per user convenience.
- User can select region of interest themselves from the uploaded image.
- Multiple ROIs can be selected with different colors for each region.
- The developed website is phone compatible.
- Fully Responsive.

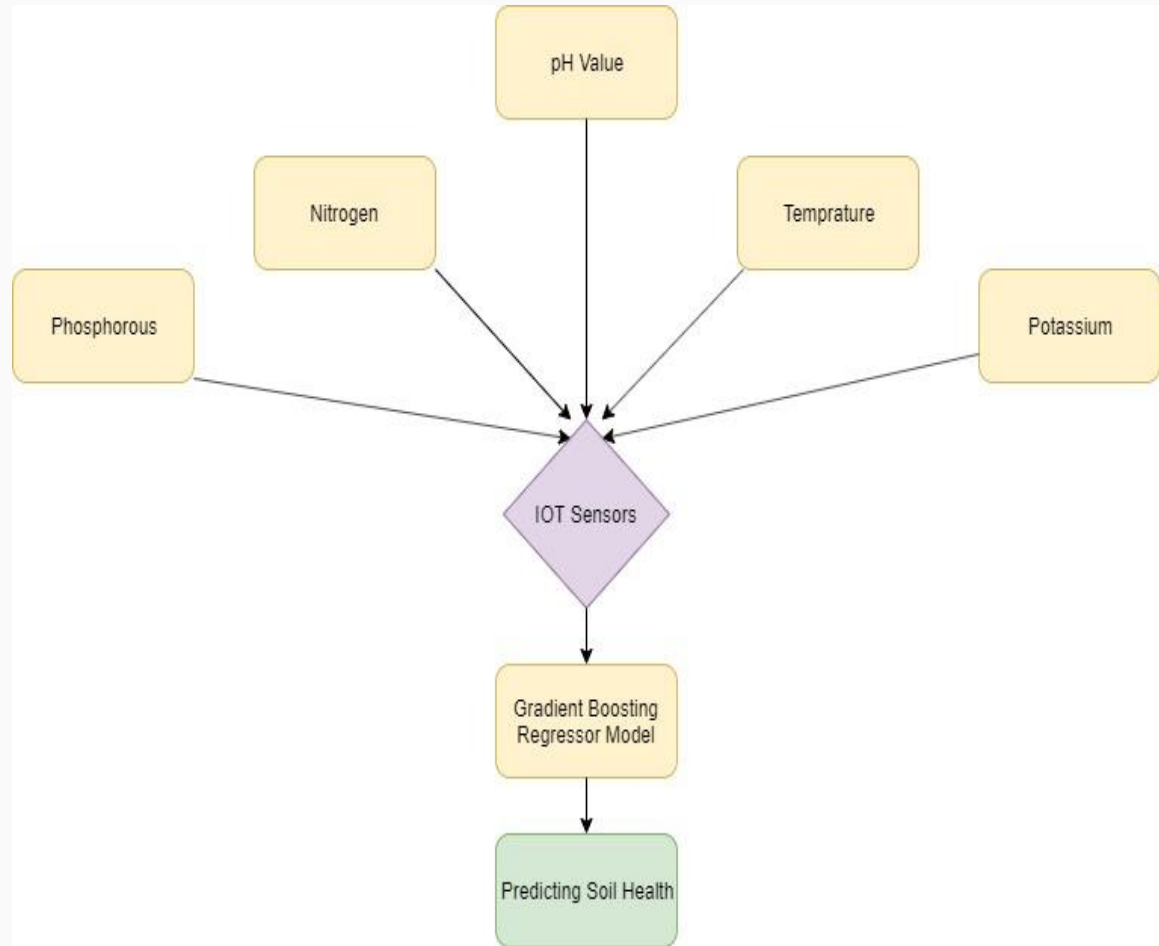
Soil Healthcare

Use Case Diagram & Technology Stack

Predict the Soil Health by processing the feature values from the IOT sensors.

Different libraries and functions used:

- SKlearn
- Gradient boosting
- Rest API



REGRESSION MODEL

We have used certain machine learning models like linear regression, lasso regression, elastic net, k nearest regressor, decision trees and gradient boosting regressor models.

TRAINING RESULTS

Out of these models the best performing model is gradient boosting regressor model that gives the least error among all and further training it with different hyper parameters using grid search CV we get the accuracy results of 88%.

<u>Model</u>	<u>Error</u>
LR	0.025
LASSO	0.024
Elastic Net	0.069
Decision Tree	0.23
GBR	0.014

Screenshot of sensor cost

Outdoor Living › Gardening › Gardening Tools › Soil Testers › Agrinex Corporation Soil Health Indicator or N-P-K & pH Testing Kit (Black)



Agrinex Corporation Soil Health Indicator or N-P-K & pH Testing Kit (Black)

by Agrinex Corporation

★★★★☆ 10 ratings | 3 answered questions

M.R.P.: ₹697.00

Price: ₹450.00 **Fulfilled** **FREE Delivery.** [Details](#)

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10 Days
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📍 **Deliver to Kartik - Noida 201309**

Sold by **Agrinex Corporation** (3.0 out of 5 | 2 ratings) and **Fulfilled by Amazon.**

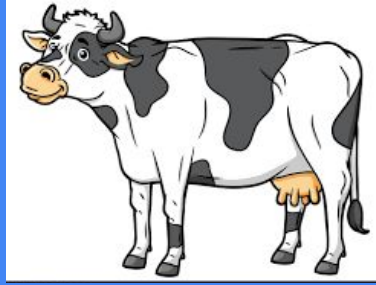
New (1) from ₹650.00 + FREE Shipping

- Soil test kit includes all the amenities you need to perform 10 test for each four different factors: nitrogen, phosphorus, potassium, and ph (acidity/alkalinity)
- Colour: Black
- Test your soil to determine exact fertility status of n-p-k and ph to apply fertilizer/ nutrients in the crop effectively and economically

[Report incorrect product information.](#)

Key Features

- Determine the health & fertility of the soil.
- The farmers will be notified about the current soil health status and they can plant crops accordingly.
- The farmers are also given recommendations to improve the productivity of the crops and the necessary methods that have to be practised in order to implement the changes.
- Determine soil tilth which refers to the overall physical character of the soil in the context of its suitability for crop production.



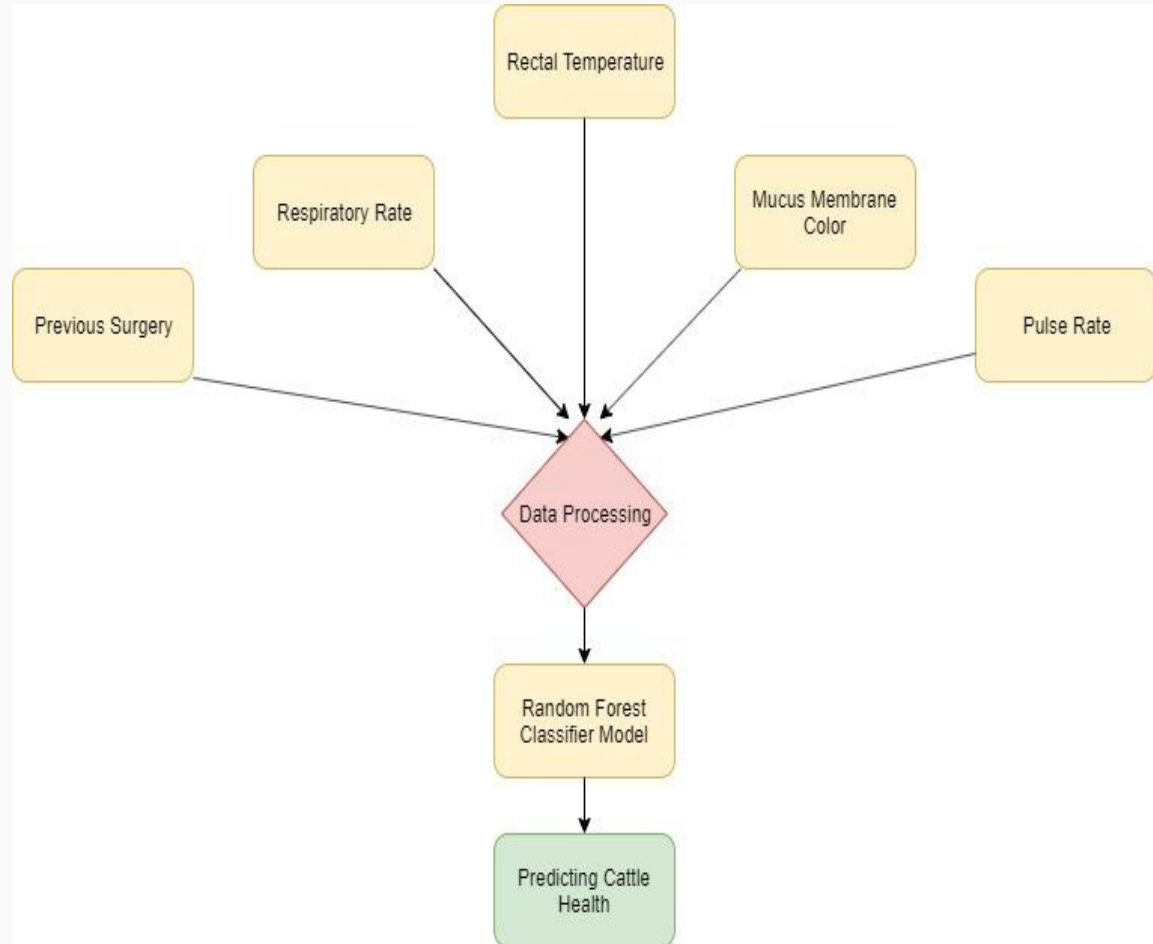
Livestock Healthcare

Use Case Diagram & Technology Stack

Classify the current health status of livestock according to certain obtained parameters.

Health of the Cattles are divided among three different categories:

- Chronic Disease
- Acute Disease
- Healthy



Classifier Model

We have used certain machine learning models like logistic regression, decision tree classifier, random forest classifier, SVC, Kneighbors classifier, GBM models.

Training Result

Out of these models the best performing model is Random Forest model that gives the least error among all and further training it with different hyper parameters using grid search CV we get the accuracy results of 82%.

<u>Model</u>	<u>Accuracy</u>
LR	72.00%
Decision tree	61.67%
Random Forest	82.00%
SVM	73.33%
KNM	68.00%
GBM	72.67%

Key Features

- It monitors and give early warning to prevent animal diseases
- Help to determine disease prone cattles and also disease caused by those animals .

- Farmer can make a video clip of their crops while inspecting his farm. We will then process the video clip and capture each frame of the clip and pass it to our model which predicts the aggregate results out of all the frames that are captured.
- This will also provide us a cheaper method to predict health of crops instead of using an expensive IOT device that are already present in the market such as Drones.

Thank you!!

**The total farm
healthcare
solution.**