ARTIFICIAL INTELLIGENCE IN AGRICULTURE

GROUP NO - 15

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INTRODUCTION

- Artificial Intelligence is a branch of computer science dealing with the simulation of intelligent behavior in computers.
- Compared to the other industries, the agriculture sector has been slow to implement and take advantage of the variety of technologies.
- Poor infrastructure and heavy regulatory burdens have raised the costs for food systems.

GREEN REVOLUTION

- The global population is expected to reach 10 billion people by 2050, which means double agricultural production in order to meet food demands which is about 70% increase in food production.
- This means that the global agriculture sector is under more strain than ever with 2 billion more mouths to feed within the next 33 years.
- Farm enterprises require new and innovative technologies to face and overcome these challenges.
- By using AI we can resolve these challenges.

The Ways AI is shaping the farms of the future

- **Drones**

  Providing new ways of increasing crop yields through in-depth field analysis, long-distance crop spraying and high-efficiency crop monitoring.
- **Driverless tractors**

  Combining ever-more sophisticated software with ‘Off-the-shelf’ technologies such as sensors, radar and GPS systems.
- **Automated irrigation systems**

  Thankfully, though, automated irrigation systems are designed to utilize real-time machine learning to constantly maintain desired soil conditions to increase average yields.
- **Crop health monitoring**

  Conventional crop health monitoring methods are incredibly time-consuming and are categorical in nature.

Robots in Agriculture - Irrigation

Presented By - Abhik Naskar(17CS30001)

Introduction

1. The UK Agri-Food chain, from primary farming through retail, generates over **£108bn p.a.**, and with **3.7m** employees in a truly international industry yielding £20bn of exports in 2016. **Robotics has played a substantial role in the agricultural production and management.**
2. The robots are performing various agricultural operations autonomously such as **weeding, irrigation, guarding the farms etc.**
3. The main purpose of coming up with this technology is to **replace human labor and produce effective benefits on small as well as large scale productions.**

Brief History and Inception

1. The idea of coming up with such a technology came with the introduction of a machine called Eli Whitney's cotton gin which gave birth to autonomous agricultural robots.
2. A basic automated model was introduced to determine the actual position of seeds . Ultra high precision placement of seed was also established.
3. The status or the development of plant were recorded by automated machines. For the effective use of water, automated irrigation systems were also established.

Automated Irrigation Systems

1. **Motivation :** come up with more efficient technologies in order to ensure proper use of water resources in irrigation.
2. The **plant evapotranspiration** which was dependent on various atmospheric parameters such as **humidity, the wind speed, solar radiations and even the crop factors** such as the **stage of growth, plant density, the soil properties, and pest** was taken into consideration while implementing autonomous irrigation machines.
3. **Action :** In 2017 researchers developed an automated robotic model for the detection of the moisture content and temperature of the **Arduino and Raspberry pi3.** The data is sensed at regular intervals and is sent to the microcontroller of Arduino (which has an edge level hardware connected to it), it further converts the input analog to digital. The signal is sent to the **Raspberry pi3 (embedded with KNN algorithm)** and it sends the signal to Arduino to start the water source for irrigation - **The M2M(Machine to Machine) Model**
4. Various other researchers came up with their automated robotic model for efficient and automated irrigation system like **Savitha and UmaMaheshwari(2018)**, **Varatharajalu and Ramprabhu(2018)** etc. are few to be mentioned.

No.	Algorithms	Method of Evapotranspiration	Other Technologies	Advantage/Results
1.	**PSLR and other regression models**	Evapotranspiration model	Sensors for data collection, IOT HW Implementation.	Increased efficiency and economic feasibility
2.	**Artificial Neural Network based control system**	Evapotranspiration model	Sensors for measurement of soil,temperature,wind speed, etc.	Automation
3.	**Fuzzy Logic**	FAO Penman- Monteith method		Optimization
4.	**ANN (multilayer neural model), Levenberg Marquardt, Backpropagation**	Penman–Monteith method		Evaporation decreased due to schedule and savings observed in water and electrical energy.
5.	**Fuzzy Logic**		WSN, Zigbee	Experimental results verification. Can be applied to home gardens and grass
6.	**ANN**			Optimization of water resources in a smart farm.
7.	**Fuzzy Logic Controller**	Penman–Monteith method	Wireless sensors	Drip irrigation prevents wastage of water and evaporation
8.	**Machine Learning algorithm**		Sensors, Zigbee, Arduino microcontroller	Prediction and tackles drought situations.

AI in Weed Detection

Motivation

In recent years, weeds have been responsible for most agricultural yield losses. To deal with this threat, farmers resort to spraying the fields uniformly with herbicides. This method not only requires huge quantities of herbicides but impacts the environment and human health.

One way to reduce the cost and environmental impact is to allocate the right doses of herbicide to the right place and the right time (precision agriculture).

Proposed method (3 steps)

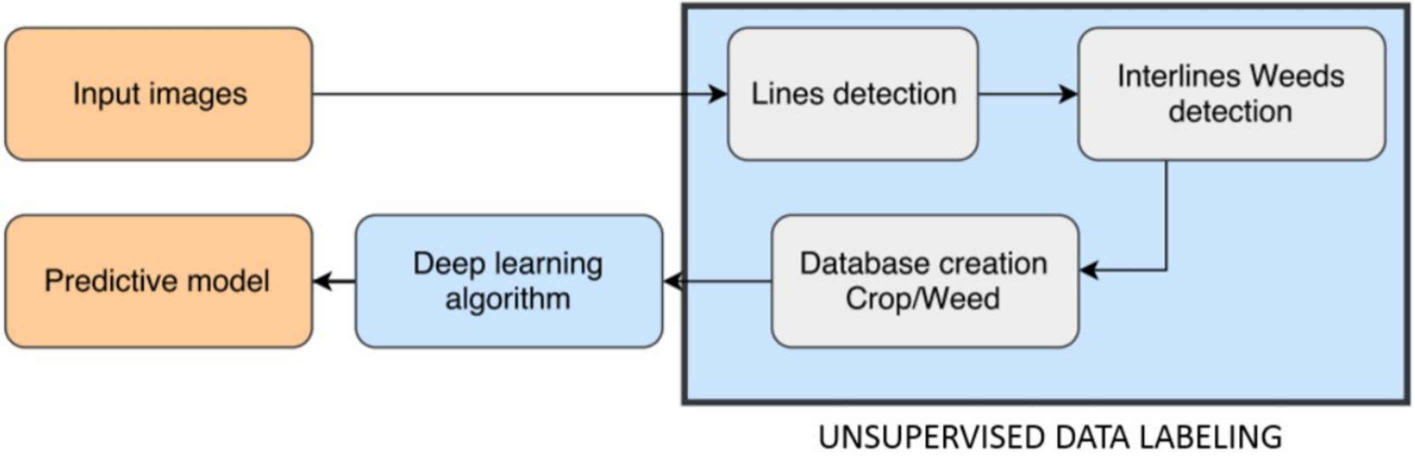
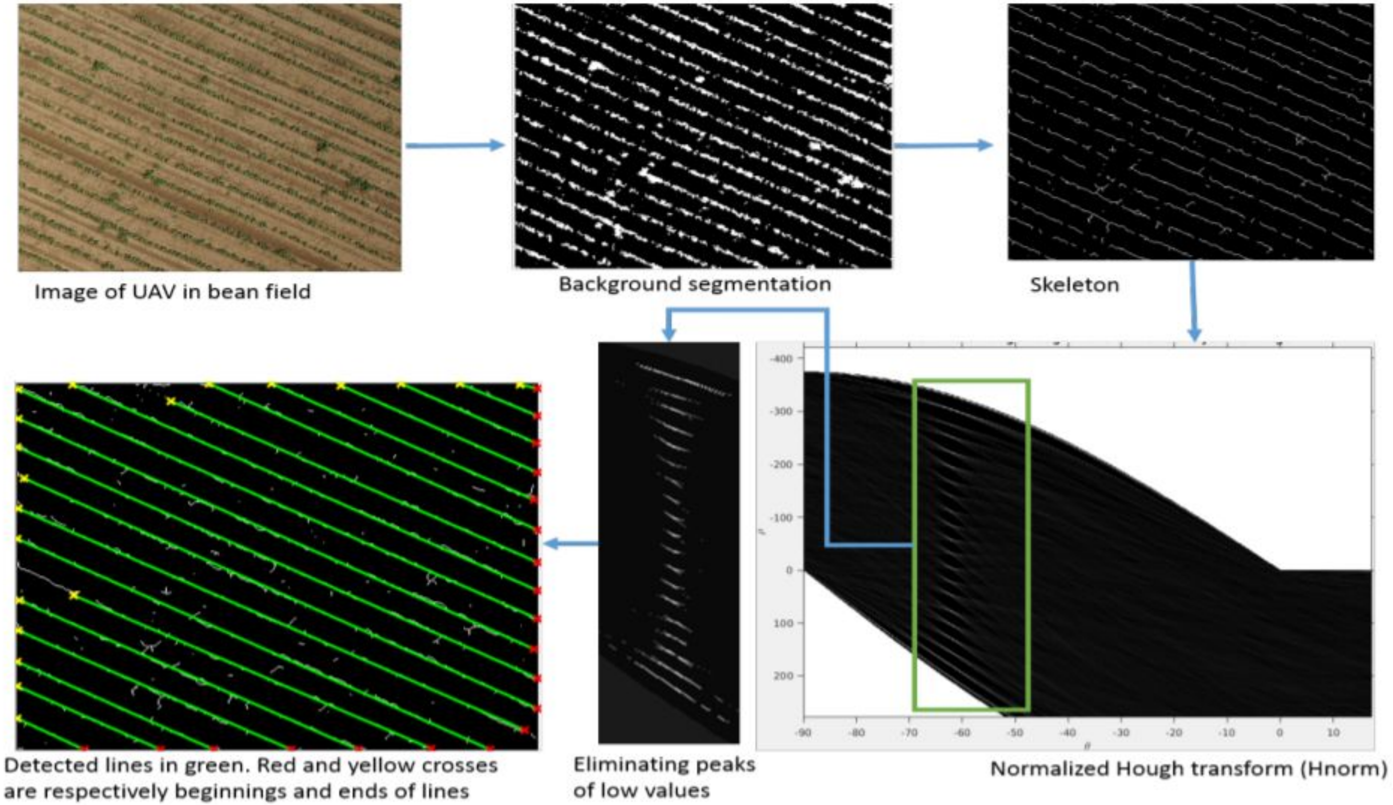
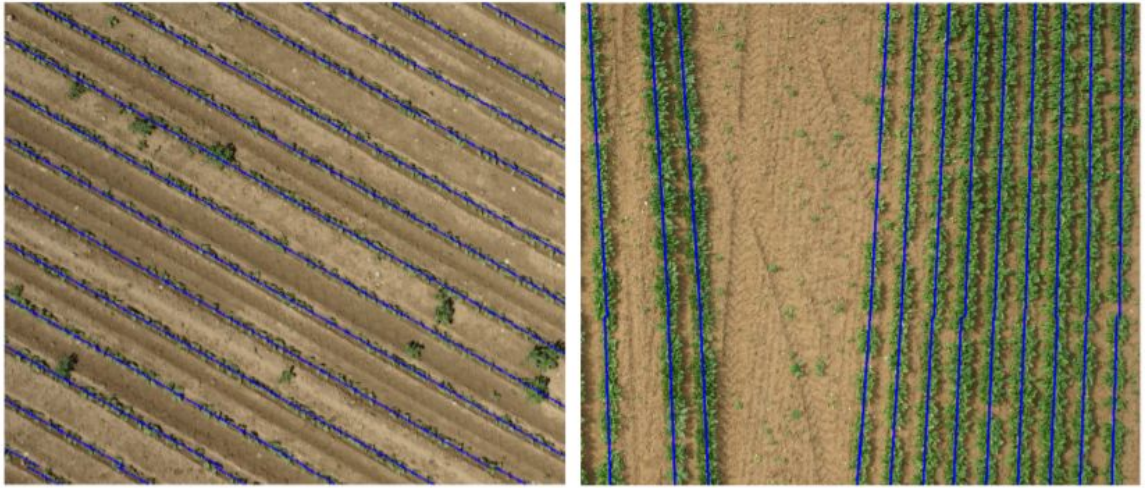


Figure 1. Flowchart of the proposed method.

Step 1 : Detection of Crop Lines



Step 2 : Unsupervised Training Data Labelling



(a) (b)

Figure 3. From left to right: line detection in bean (**a**) and spinach (**b**) fields. Detected lines are in blue. In the spinach field, inter-row distance and the crop row orientation are not regular. The detected lines are mainly located in the center of the crop rows.

Detection of Inter-row weeds

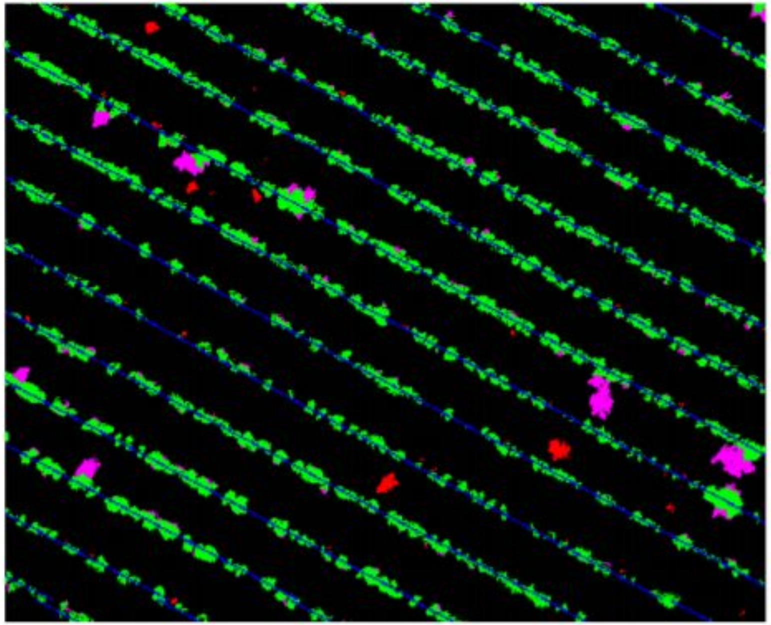
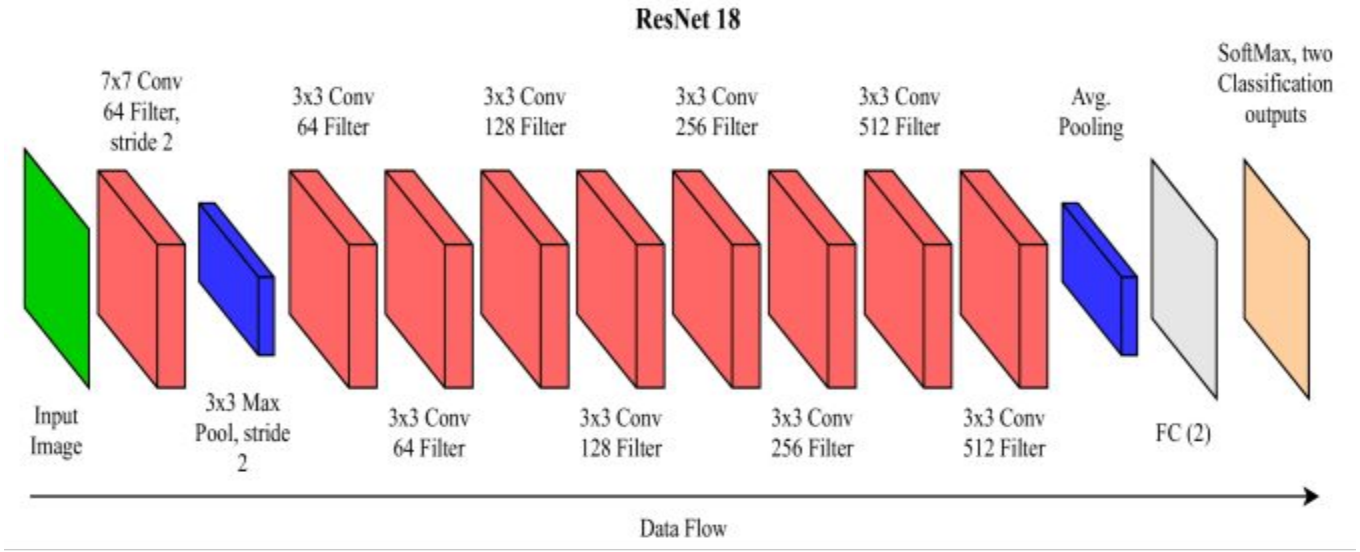


Figure 5. Detection of inter-row weeds (red) after line detection (blue) in a bean image. The crop mask is represented in green and the potential weeds in magenta.

Step 3 : Generate a deep learning model

- ResNet18 Convolutional Neural Network
- Transfer Learning



Result and conclusions

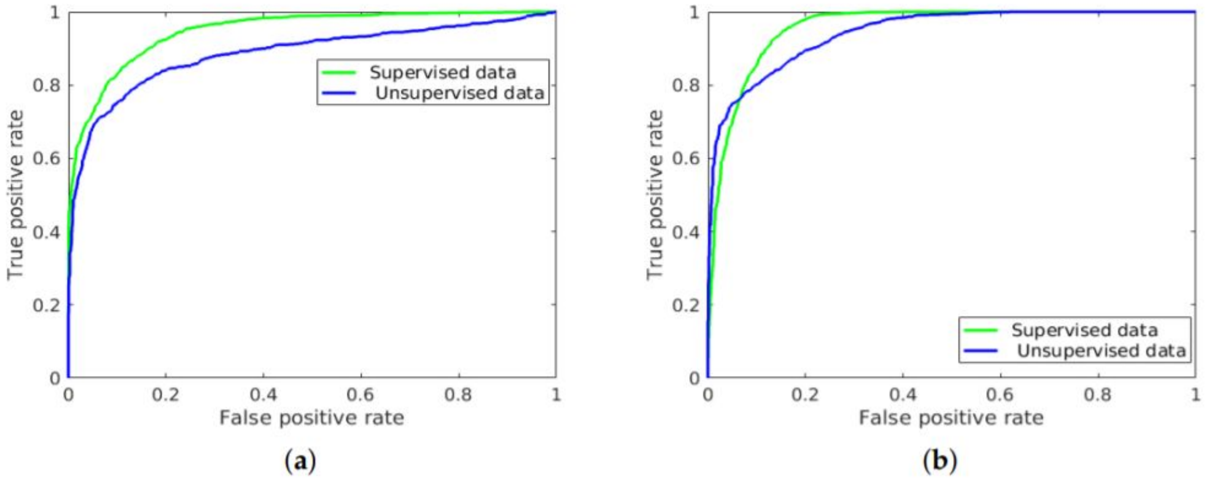


Figure 10. Receiver operating characteristic (ROC) curves of the test data with unsupervised and supervised data labeling. From left to right, the ROC curves computed on the bean (**a**) and spinach (**b**) test data. In the bean field, the areas under the curve (AUCs) are 88.73% for unsupervised data and 94.84% for supervised data. In the spinach field, the AUCs are 94.34% for unsupervised data and 95.70% for supervised data. Supervised and unsupervised data mean, respectively, data labeled in supervised and unsupervised ways.

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AI Drones in Spray Control Systems

Intro

Spray rates for drone systems are around 1-2L/ha, which is 25-50 times lower than conventional spray application systems

Manual pesticide spraying causes many harmful side effects to the person involved in the spraying process

Background

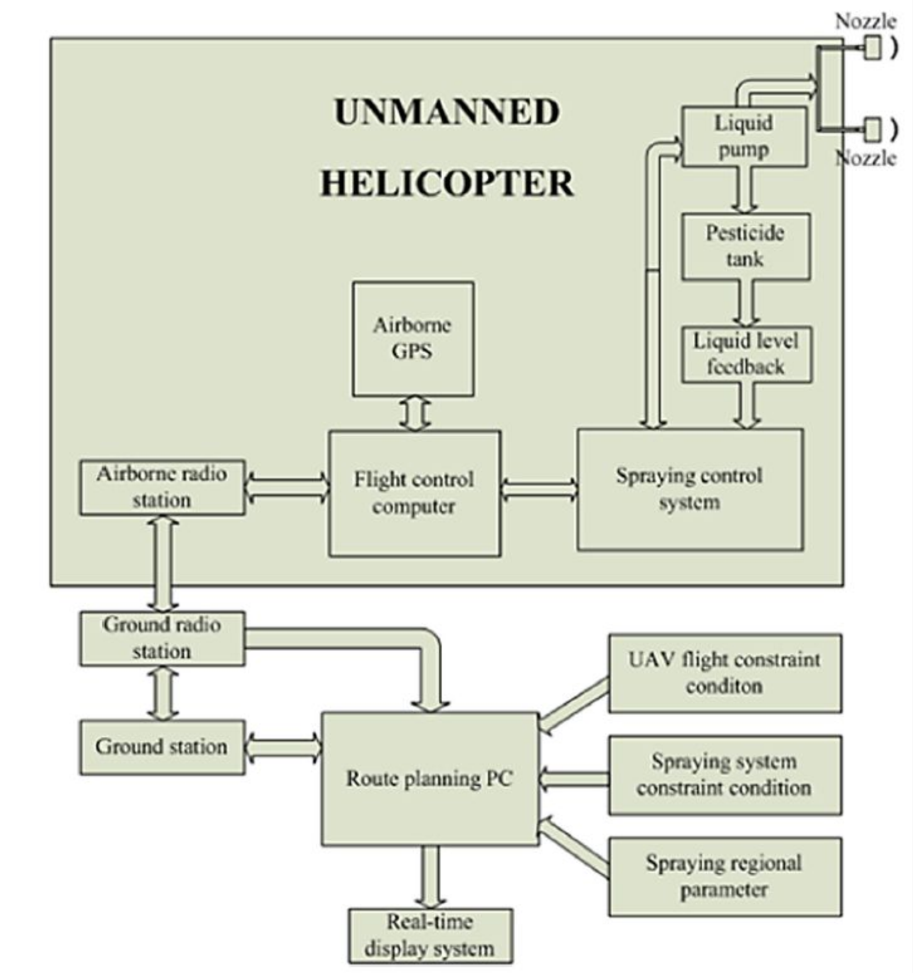
To leverage drone technology fully as a spraying platform, the spraying needs to be paired and synchronized with imaging, processing & automated analytic capabilities in order to address the affected areas with precision.

Such an approach would lead not only to the improvement of dosage in the affected areas, but also leads to a reduction in the overall use of chemicals within the area.

Based on force required to atomize the shower liquid, sprayers are arranged into

- Hydraulic Energy Sprayer
- Gaseous Energy Sprayer
- Centrifugal Energy Sprayer
- Kinetic Energy Sprayer

Spray Control System Architecture



Drones in Crop Monitoring

Intro

A close eye on crop growth

Spread Analysis

Time and Resources

Future Planning

Yield Mapping and Monitoring

A drone with a microcontroller to manage two Cameras one RGB and other sensitive to Infrared

These assist farmer in maximising their harvest by detecting problems early, and managing the crops by passing above captured data to detect Pests and Water Shortage

Technologies Incorporated in Harvesting

Grain Flow Sensor

Grain Moisture Content Sensor

GPS Receiver and Odometer

Header Position Sensor

Yield Calculation and Calibration

Yield is characterized as harvest weight (lbs for cotton) or volume (grains) reaped per unit region, which is in a roundabout way estimated by the yield sensor

Stream rate/(speed x swath width)

Yield stream rate is commonly determined each 1–2 s during collecting

Further Steps

Data Transfer and Storage

Match it with collected from Drone

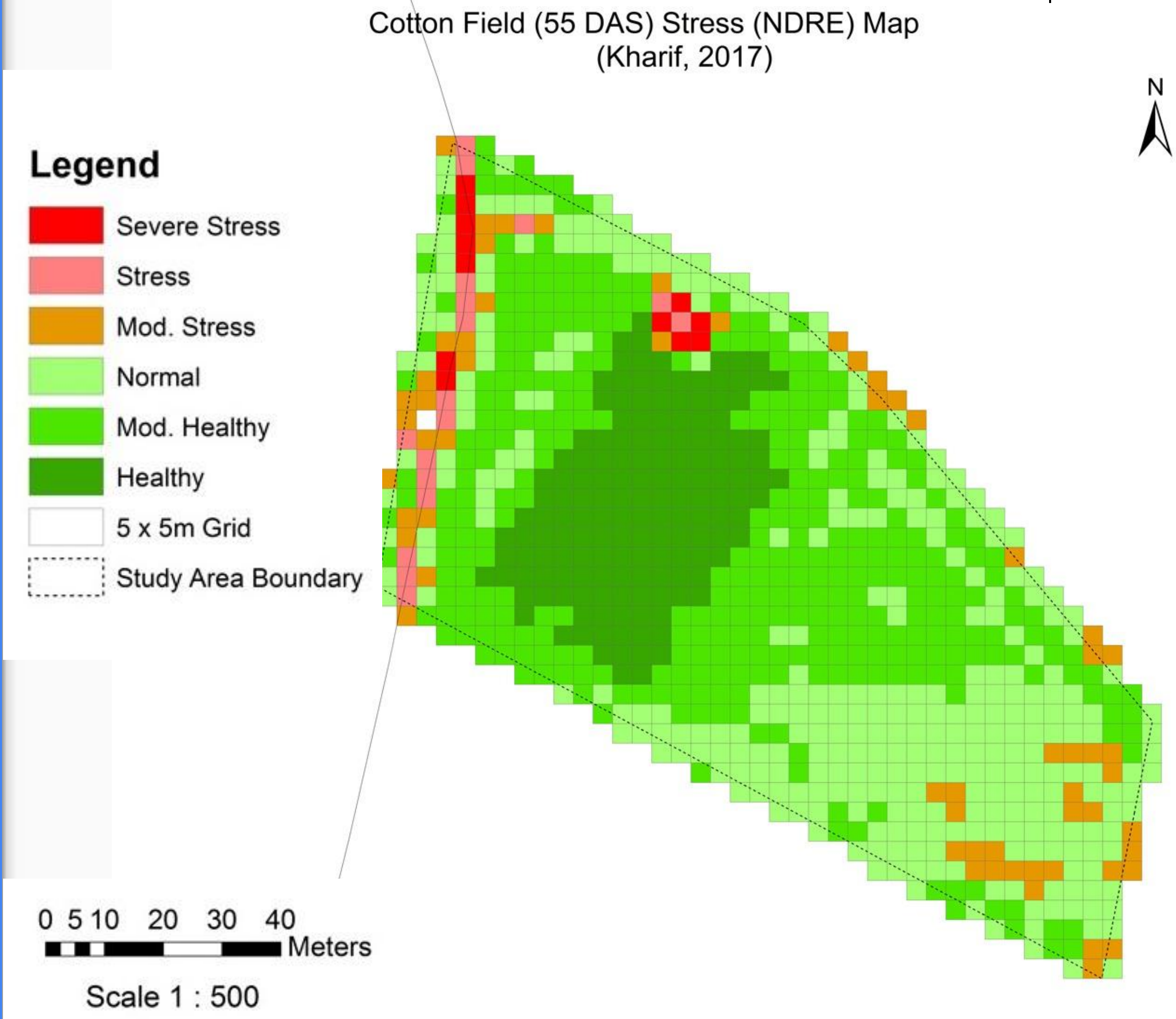
Machine Learning to Train and Test

Prediction for Next Year

Yield Maps

Geographical Information System

The yield determined at each field areas can be shown as--



CONCLUSION

- AI can be appropriate and efficacious in agriculture sector as it optimises the resource use and efficiency.
- It solves the scarcity of resources and labour to a large extent. Adoption of AI is quite useful in agriculture.
- Artificial intelligence can be technological revolution and boom in agriculture to feed the increasing human population of world.
- Artificial intelligence will complement and challenge to make right decision by farmers.

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THANK YOU