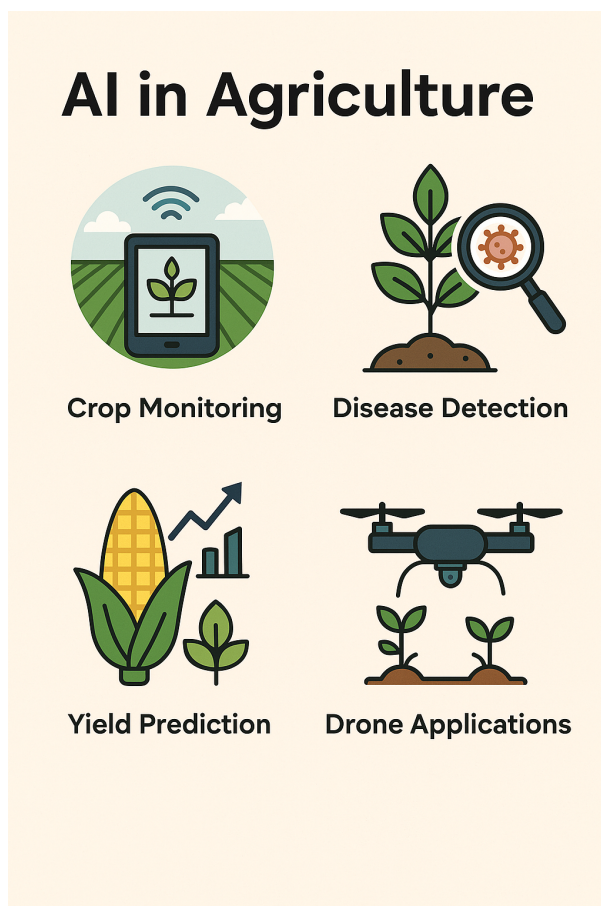


AI Applications in Agriculture

Session Overview

Title: AI Applications in Agriculture **Duration:** 1.5 hours **Instructor:** Prof. Tarachand **Mode:** Lecture + Hands-on Demonstrations + Q&A

This session introduced how AI technologies can address some of the major challenges faced by Indian agriculture. It balanced theoretical concepts, practical examples, and hands-on demos using tools like Google Earth Engine and Jupyter Notebooks.



1. Introduction to AI in Agriculture

Agriculture in India is a vital sector but often plagued by:

- Unpredictable weather (monsoons, droughts, floods)
- Pest infestations

- Soil degradation
- Market price fluctuations
- Water scarcity

AI in agriculture refers to the use of algorithms and data-driven systems to:

- Improve crop productivity
- Monitor and predict plant diseases
- Forecast yields
- Optimize resource usage (like water and fertilizers)
- Assist farmers with market intelligence

2. AI-Based Agricultural Solutions

Key Applications

1. **Crop Monitoring:** Using image data (satellite or drone) to track plant health.
2. **Disease Detection:** Classifying leaf images using CNNs to detect early signs of disease.
3. **Yield Prediction:** Estimating the expected harvest using historical weather and crop data.
4. **Irrigation Management:** Recommending optimal watering schedules based on soil moisture data.

Precision Agriculture

Precision agriculture aims to:

- Apply the right input (seeds, water, pesticides) at the right time and place
- Maximize yield while minimizing resource usage
- Increase profitability and sustainability

It's like personalized farming — treating every field, or even every plant, differently based on its unique condition

3. Remote Sensing and NDVI

Remote Sensing

Remote sensing involves capturing data about crops from a distance using:

- Satellites (e.g., Sentinel, Landsat)
- Drones with mounted sensors

What is NDVI?

NDVI (Normalized Difference Vegetation Index) is a numerical measure used to monitor plant health. It's computed as:

$$\text{NDVI} = \frac{(NIR - RED)}{(NIR + RED)}$$

Where:

- **NIR:** Near-infrared reflectance
- **RED:** Red-light reflectance

Interpretation:

- NDVI > 0.6: Healthy, green vegetation
- NDVI around 0.2–0.4: Stressed or sparse vegetation
- NDVI < 0: Barren land, water, or urban regions

4. Drone Applications in Agriculture

- Drones can scan large farms quickly using multispectral cameras.
- Help in precision spraying of pesticides or fertilizers.
- Allow real-time mapping and crop health assessments.

Challenge: Drones are expensive.

Solution discussed: Share drone resources at village-level centers and access analytics via mobile apps to make the tech affordable and scalable

5. Market Forecasting and Price Prediction

AI models can help predict:

- Market demand and supply trends
- Optimal time to sell crops for best prices
- Likely future prices using regression models and time-series forecasting

These predictions assist farmers in planning harvest and sales to maximize profits.

6. Hands-On Demonstrations

- **Google Earth Engine:** Used to visualize NDVI maps of agricultural regions.
- **Jupyter Notebook Demos:** Included basic code for visualizing vegetation indices, classifying disease-infected crops, and exploring yield datasets.
- Emphasis on open-source and cloud-based tools to democratize access.

7. Q&A and Interactive Components

- Every 15 minutes, Prof. Tarachand paused for Q&A, making the session interactive and accessible.
- Students asked about the scalability, cost, and model reliability in rural conditions.

Key Insight: AI must be not just accurate, but usable and affordable by the average farmer.

8. Conclusion and Takeaways

- AI is a game-changer for Indian agriculture.
- It can help solve deep-rooted problems like low yield, disease spread, and market volatility.
- The focus should be on:
 - Accessibility via mobile platforms
 - Training local communities
 - Cost-effective models
- Collaboration between data scientists, farmers, and government is essential.

Closing Message: “Empowering farmers with AI doesn’t just boost productivity — it nurtures sustainability and rural empowerment.”

Cheatsheet:

AI APPLICATIONS IN AGRICULTURE



INTRODUCTION TO AI IN AGRICULTURE

- Unpredictable weather
- Pest infestations
- Water scarcity

AI-BASED AGRICULTURAL SOLUTIONS

- Crop Monitoring
- Disease detection
- Yield prediction
- Irrigation management

DRONE APPLICATION IN AGRICULTURE

- Drones can scan large farms

MARKET FORE- CASTING AND PRICE PREDICTION

- Predicting demand, supply, and tools

HANDS-ON DEMONSTRATIONS

AI-BASED AGRICULTURAL SOLUTIONS

- Crop monitoring
- Disease detection
- Yield prediction
- Irrigation management

$$\text{NDVI} = \frac{\text{NIR} - \text{RED}}{(\text{NIR} + \text{RED})}$$

INTERPRETATION

- Healthy (NDV > 0.6)
- Stressed or sparse (IND 0.2-0.4)
- Barren or urban (0)

MARKET FORECASTING AND PRICE PREDICTION

- Predicting demand, supply, and
- Future prices

Q&A AND INTERACTIVE CONS

- Regular 15-minutes

CONCLUSION AND TAKEAWAYS

- AI as a gamechanger for Indian agriculture
- Focus on; accessibility and cost-effectiveness