Weed Detection in Agriculture

Innovating Farming Practices

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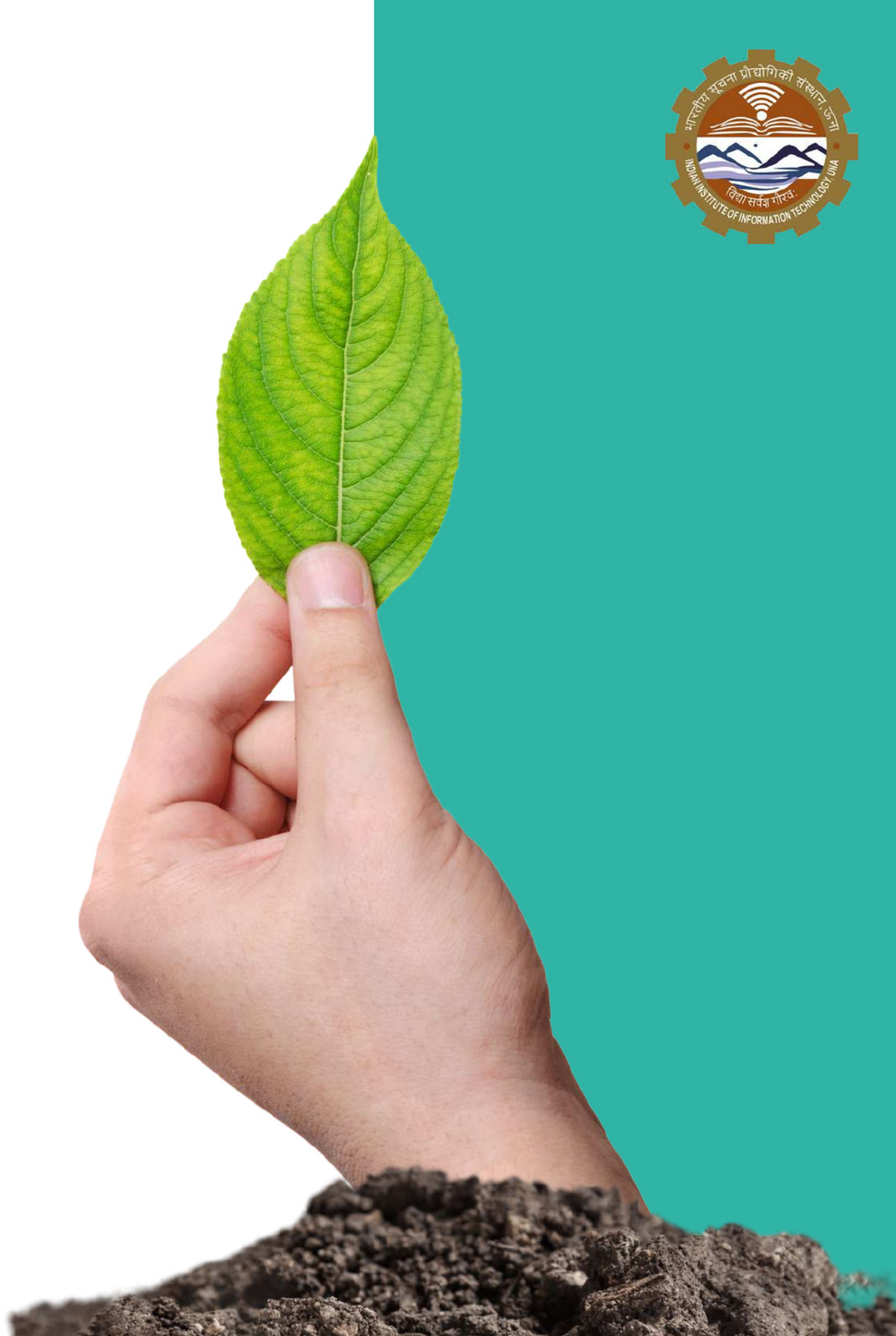
Introduction

Importance Of Efficient Weed Management In Agriculture:

Optimal crop growth and yield requires efficient weed handling techniques.

Effective weed control techniques for promotion of sustainable farming practices.

Weeds compete with crops for essential resources like water, nutrients, and sunlight. Thus, reducing agricultural productivity.



Problem Statement

Inefficient Weed Handling

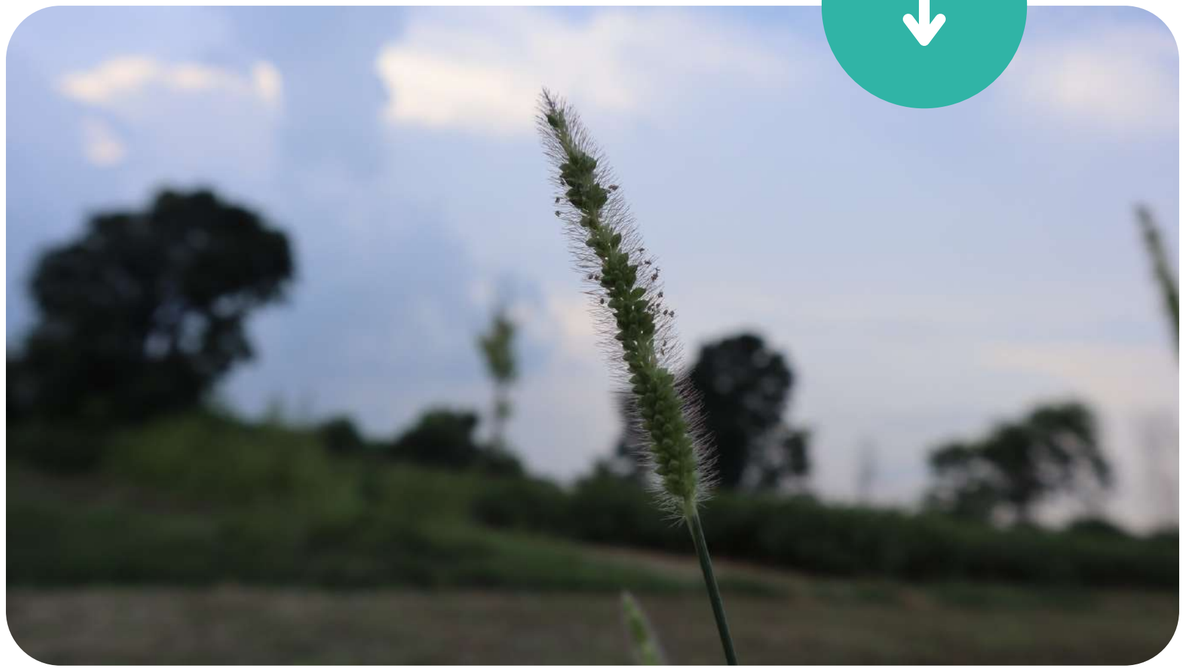
- **Leading to Reduced Crop Yield & Increased Labour Costs**

  Results in diminished crop yields due to competition for nutrients & sunlight.
  Hampers productivity of crops with increased labour efforts.
  Raises production costs while lowering overall agricultural output.

- **Adverse Economic & Environmental Impacts**

  Reducing crop yields, and increased production costs.
  Promotes weed resistance, soil erosion, and decreased biodiversity..
  Use of pesticides results in poor nutrients in grains.

Objective



https://s3-ap-southeast-1.amazonaws.com/he-public-data/Weed_Detection5a431d7.zip

01 To collect crop and weed database from farms.

02 To propose novel, intelligent Farm- NET algorithm for multi weed classification amongst different crops

03 To train and test the model over 300 samples.

04 To Field-test and optimize the model for personalized weed recommendation using real time data

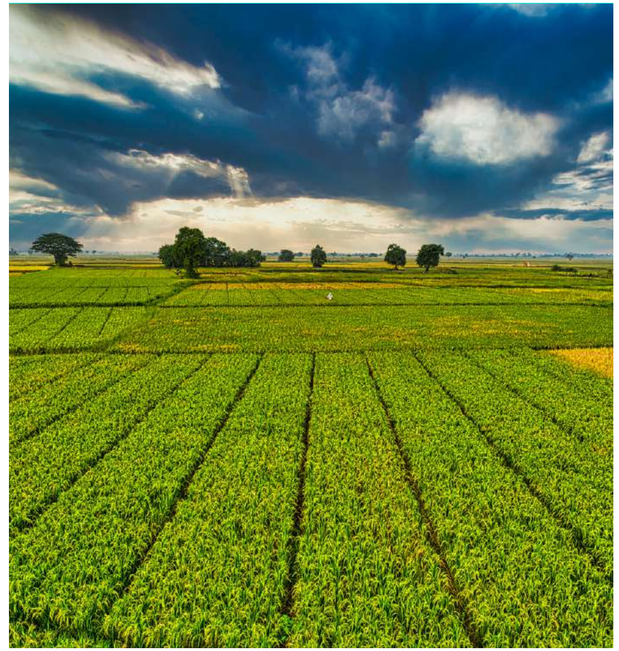
Novelty of Idea

Architectural changes

Testing support on real time data: tested the model on weeds in nearby fields at UNA.

Classification measures.

Precision of **75.65 %** and also the **recall** of **61.09 %** is observed for 3000 samples.



Feasibility

Technological Fesasibility:
Can be embedded in drones
Precision Agriculture tools can be enhanced and the impact on non-weed vegetation can be minimized

Social Feasibility:
Farmers' willingness to adopt new technologies and methods will play a significant role in the success of the system.

Environmental Feasibility:
Reduces the need for widespread pesticide use should protect the native plant species that contributes in a healthier ecosystem

Workflow

1. Problem Statement & Overview
2. Data Collection, Augmentation, & Annotation
3. Models Training
4. Model Testing on live dataset
5. Future Integration with Agro-Tech

Results

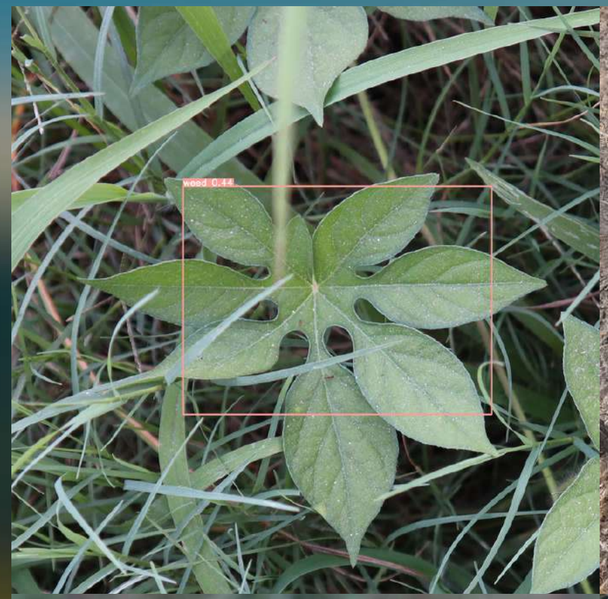
Model	Precision	Recall	Box Loss
FARM_NET	72	65	0.040
YOLO v5 (RGB Channel)	68	57	1.55
YOLO v5 (CMYK Channel)	60	51	0.045

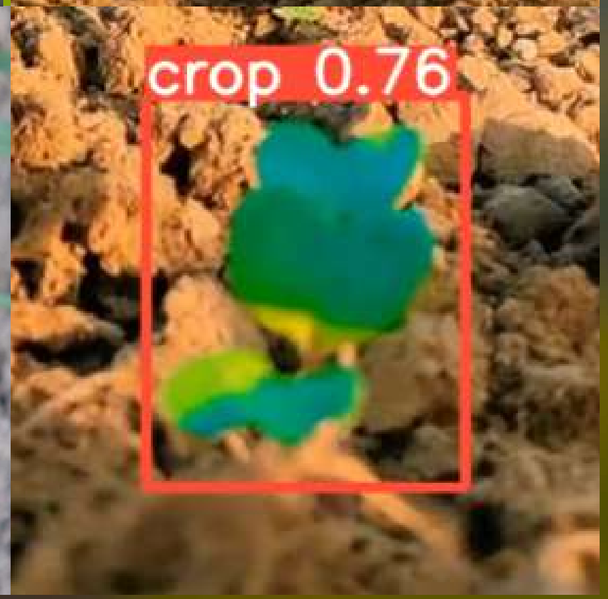
Results

For 6000 Iterations :

Model	Training Loss	Training Box Loss	Training Class Loss	Validation Loss	Validation Box Loss	Validation Class Loss
Detectron	0.57	0.35	0.28	0.71	0.35	0.36

Real Time Weed Detection





Complexity

Collection of datasets having diverse images of weeds and crops.

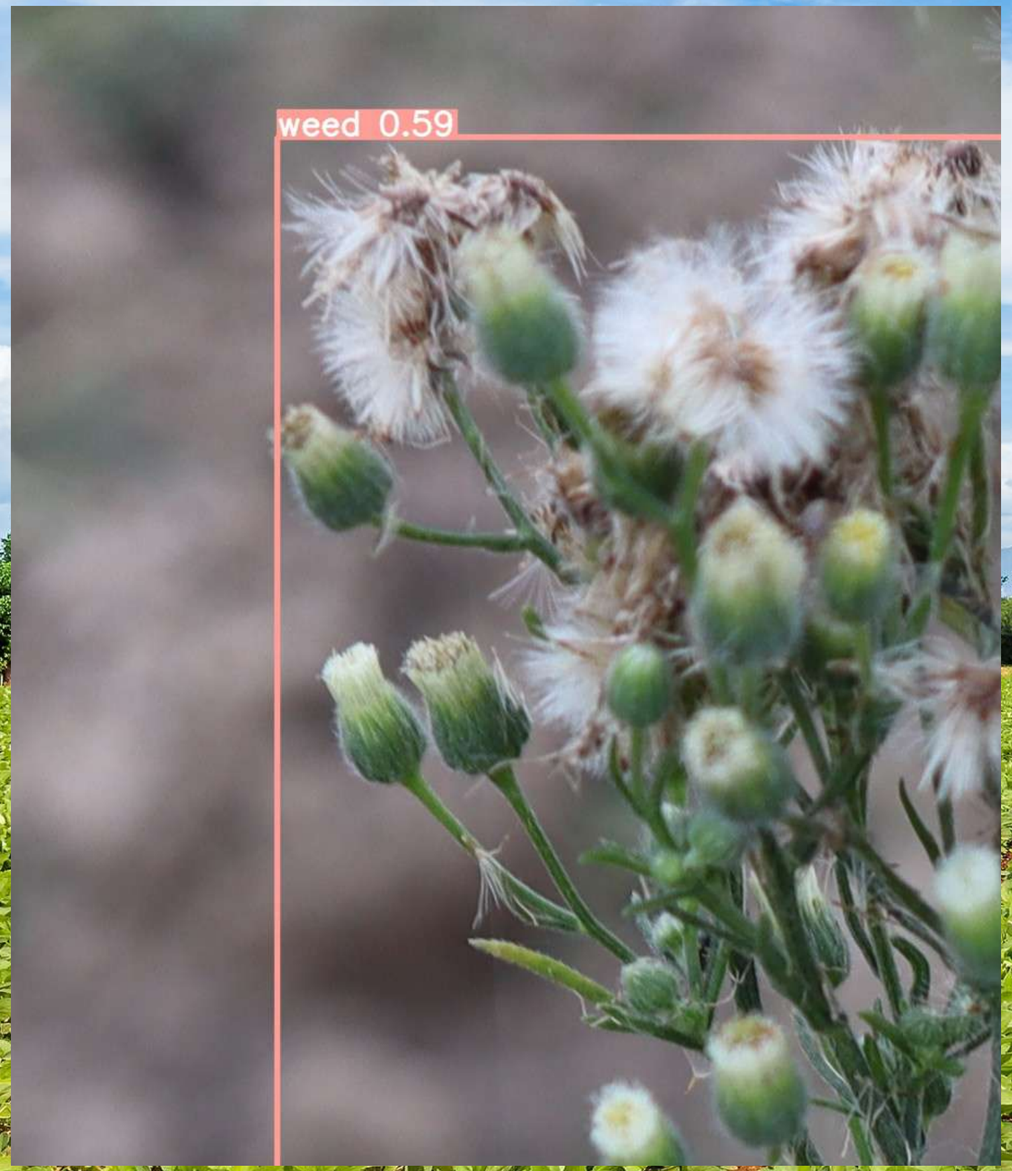
Sensitivity towards both crops and weeds.

System's scalability, adaptability to new weed types.

Minimising the false positive and false negative detections.

Sustainability

- Reduced Chemical Usage
- Preservation of Biodiversity
- Reduced Health Risks
- Minimized Non-Target Effects



Business Aspects

Increased demand of organic products.

Flexibility:
Autonomous weed eradication: **using robots**
Density based mapping of weeds: **selective spraying**

One Time Investment:
no recurring labour charges for farmers

Support and Maintenance:
technical assistance, updates and warranty

Scale of Impact

Improved food security by enhancing crop productivity

- Reduction of Herbicide Usage
- Optimized Resource Usage and Reduction in losses

Positive economic outcomes for both small & large-scale farming

- Reduced Labour
- Risk Management

Potential for Future Work

- Merging precision ag-tech, autonomous farming, & IoT enables full automation of weed control.
- Algorithm refinement through user feedback and data enhancement.


Thank You