WEED GROWTH ESTIMATION USING TRANSFORMERS

Group 13
Maosheng Jiang
Artin Sanaye
Moegiez Bhatti

A Deep Learning Approach to Predict Future Weed Growth from Temporal Image data

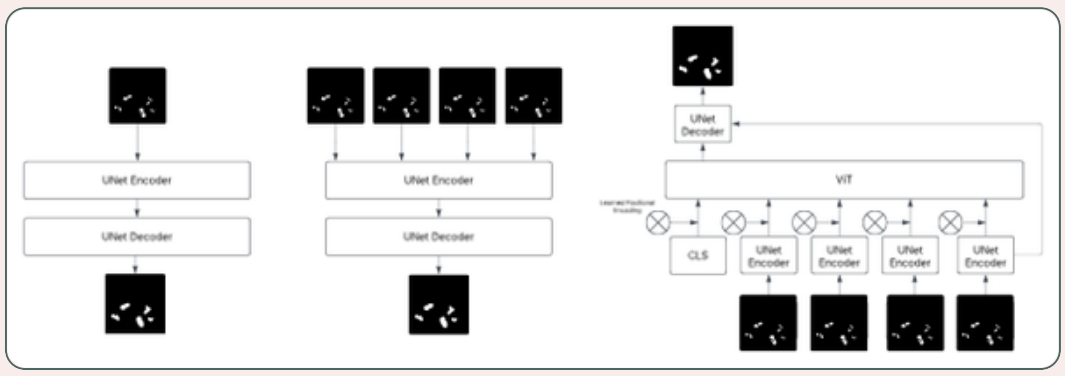
🔍 INTRODUCTION

Weeds compete with crops for nutrients and reduce yields.
Traditional management relies on:
- 🧍 Manual inspection (laborious)
- 🧪 Herbicides (harmful to environment & health)

We propose a multi-modal model that combines:
- Visual weed images
- Segmentation masks

To predict future weed growth using past temporal data — enabling sustainable, intelligent weed control.

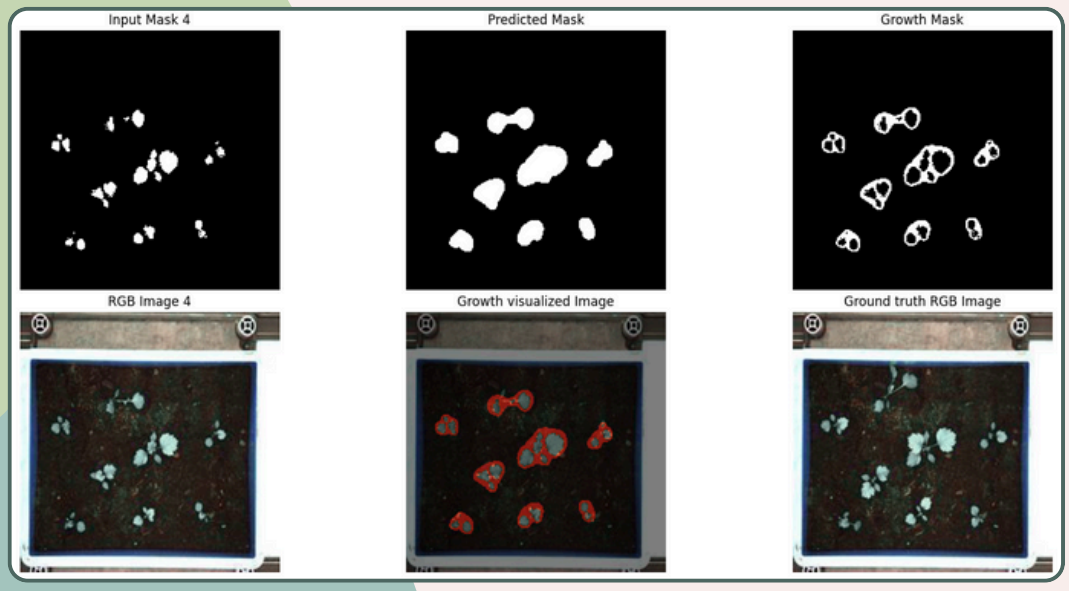
EXPERIMENTAL SETUP



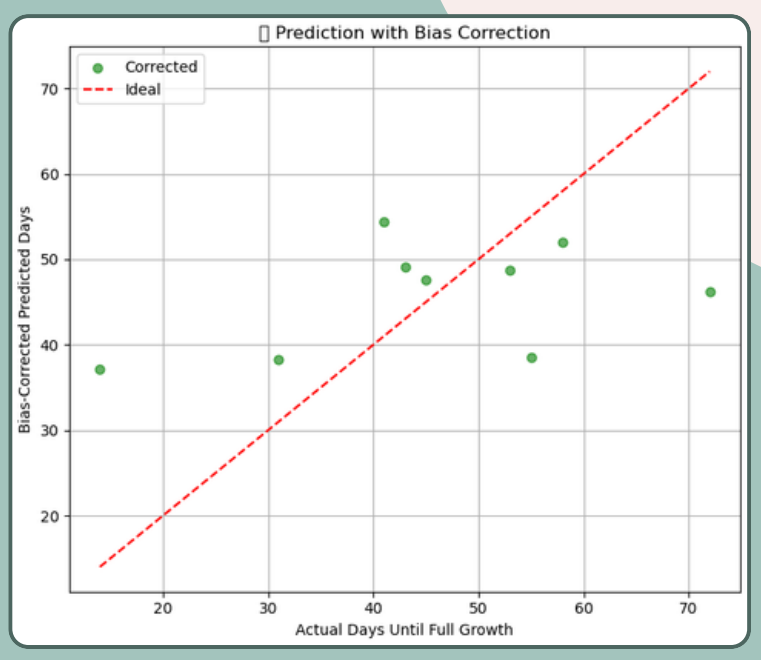
RESULTS

MODEL 1

Model	accuracy dt = 1	accuracy dt = 4
UNet_ViT	0.5947	0.4078
UNet_4	0.5690	0.4197
UNet_1	0.6029	0.4586



MODEL 2



🗂️ DATASET: MFWD

- 📍 94,321 images of 28 weed species
- 🌱 High-res + time-sequenced data
- 🔬 We focus on ARTVU and THLAR species
- ✅ Input: image + mask over time
- 🎯 Target: future weed mask prediction

MODELS

We explore two models tackling weed growth from different angles.

Why Both?
- Model 1: What will it look like?
- Model 2: How fast will it grow?

🌱 Model 1: Mask Prediction (UNet-based)

Goal: Predict future segmentation mask of a weed.
- Input: Past images + masks (1 or 4 time steps)
- Variants:
- UNet_1: Single input
- UNet_4: 4-sequence input
- UNet_ViT: 4-sequence input UNet + Vision Transformer
- Output: Binary mask of future weed shape
- Metric: IoU
- Use: Shape & size forecasting

🌿 Model 2: Growth Time Regression (EfficientNet + LSTM)

Goal: Predict days until full growth.
- Input: Sequence of RGB images (up to 15)
- Architecture:
- EfficientNet-B0 for feature extraction
- LSTM for temporal modeling
- Output: Scalar (log days)
- Loss: Quantile loss
- Use: Growth speed estimation

CONCLUSION

- Just These results provide a solid starting point for smarter weed monitoring, but real-world application will need further tuning and validation.
- Weed growth estimation results are very interesting for further research and optmization.