NDVI Change Detection Using Drone-Based Imagery and Streamlit Web App

Noel Dominic

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Abstract

Monitoring vegetation health is critical for precision agriculture. This project presents a lightweight web application using drone-captured NDVI images to visualize temporal plant health changes. Using image comparison between Day 1 and Day 6 NDVI screenshots, our system highlights areas of crop growth, stress, or no change. The app is developed in Python with Streamlit and hosted via ngrok for real-time visualization. This solution offers an easy-to-use, low-cost alternative for early detection of agricultural trends without needing geospatial metadata.

Scope

The primary scope of this project is to:

- Detect vegetation health changes using NDVI image comparisons.
- Visualize growth and stress zones over time.
- Build a web interface for ease of use by farmers and researchers.
- Utilize publicly available NDVI screenshots without requiring raw geospatial data.

Dataset

Input Data:

- NDVI screenshots from PIX4Dfields software.
- Captured using DJI Mavic 3M drone.
- Fields covered: Kesari Mango and Fig.
- Temporal capture: Day 1 and Day 6.
- Screenshot Format: PNG or JPEG.

Image Sources:

- Screenshots taken directly from NDVI maps.
- No spatial coordinates required (2D comparison only).

Methodology

1. Upload NDVI screenshots for Day 1 and Day 6.
2. Preprocess images: resize and convert to grayscale.
3. Normalize images for intensity-based comparison.
4. Compute pixel-wise difference:

$$\Delta NDVI = NDVI_{Day6} - NDVI_{Day1}$$

5. Classify each pixel:
   - Growth: $\Delta NDVI > 0.05$
   - Stress: $\Delta NDVI < -0.05$
   - Stable: $-0.05 \leq \Delta NDVI \leq 0.05$
6. Visualize result using color heatmap (RdYlGn).
7. Compute area percentages for growth, stress, and no change.

Output

Text Output:

- Percentage of pixels indicating growth, stress, and stability.

Visual Output:

- NDVI Change Map (Day 6 - Day 1) using matplotlib heatmap.

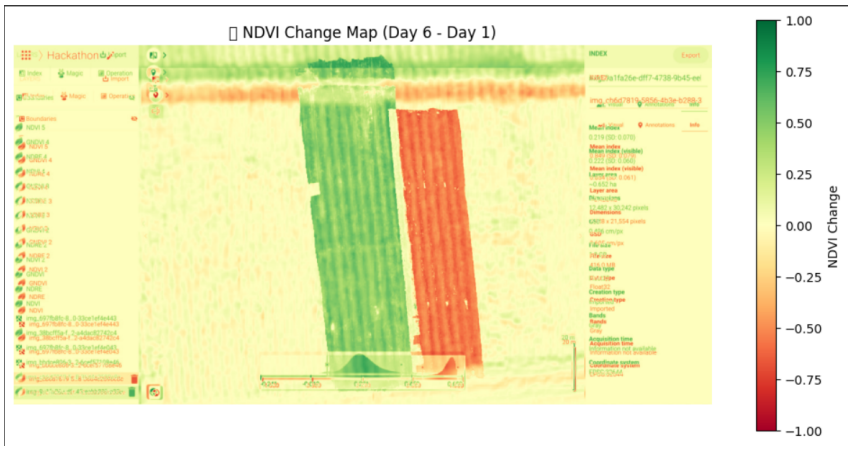

Figure 1: NDVI Change Map (sample visualization)

Conclusion

This project successfully demonstrates a fast and intuitive method to analyze plant health over time using NDVI screenshots. By using a simple grayscale comparison, valuable insights can be drawn without requiring full GIS data. The user-friendly Streamlit web interface allows users with minimal technical background to use the tool.

Future Scope

- Integration with real NDVI .tif or .geotiff raster data.
- Automatic screenshot alignment using image registration.
- Include vegetation indices like SAVI, EVI, etc.
- Create mobile-friendly version for field usage.
- Persistent hosting using Streamlit Cloud or Hugging Face Spaces.

Annexure

Drone Mission Summary:

- DJI Mavic 3M drone used for RGB + multispectral capture.
- Overlap configuration: 80% front, 70% side.
- NDVI generated using PIX4Dfields.

References

- PIX4Dfields: `https://www.pix4d.com/product/pix4dfields`
- Streamlit: `https://streamlit.io`
- NDVI Principles: `https://en.wikipedia.org/wiki/Normalized_difference_vegetation_index`
- OpenCV Documentation: `https://docs.opencv.org/`
- Ngrok Tunneling: `https://ngrok.com`