

Global Crop Field Delineation with SAM-Base Segmentation and LSTM-Based Pixel Classification

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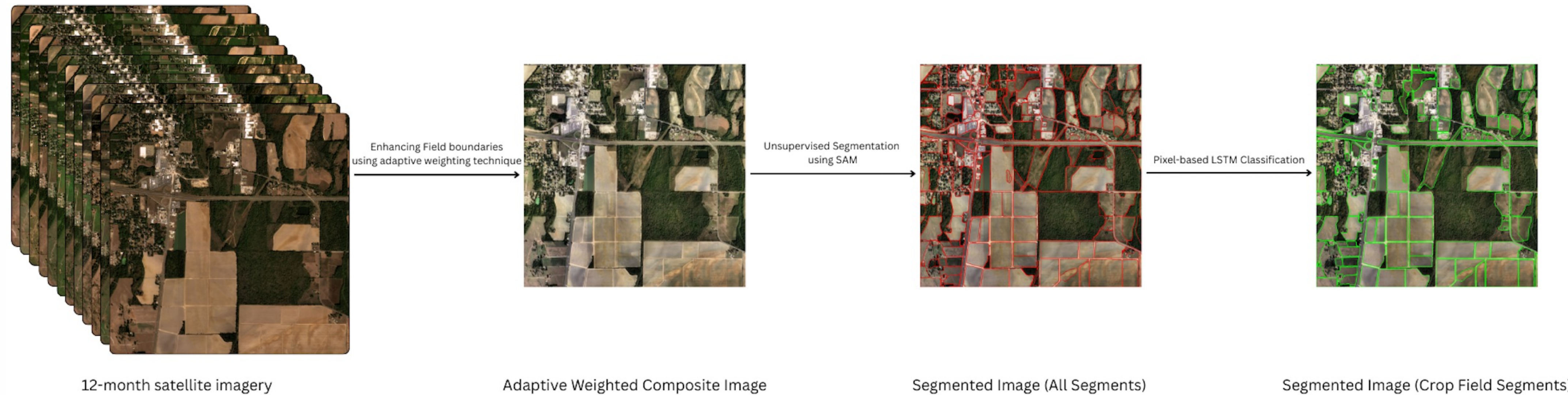
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Introduction:

Field boundary delineation is critical for global agricultural monitoring. Existing methods often depend on region-specific training data, limiting scalability. This approach combines multi-temporal 3m Planet imagery, edge-enhanced composites, SAM2 segmentation, and LSTM classification trained on global ESA WorldCover data—enabling accurate, region-independent field mapping.



Methodology:

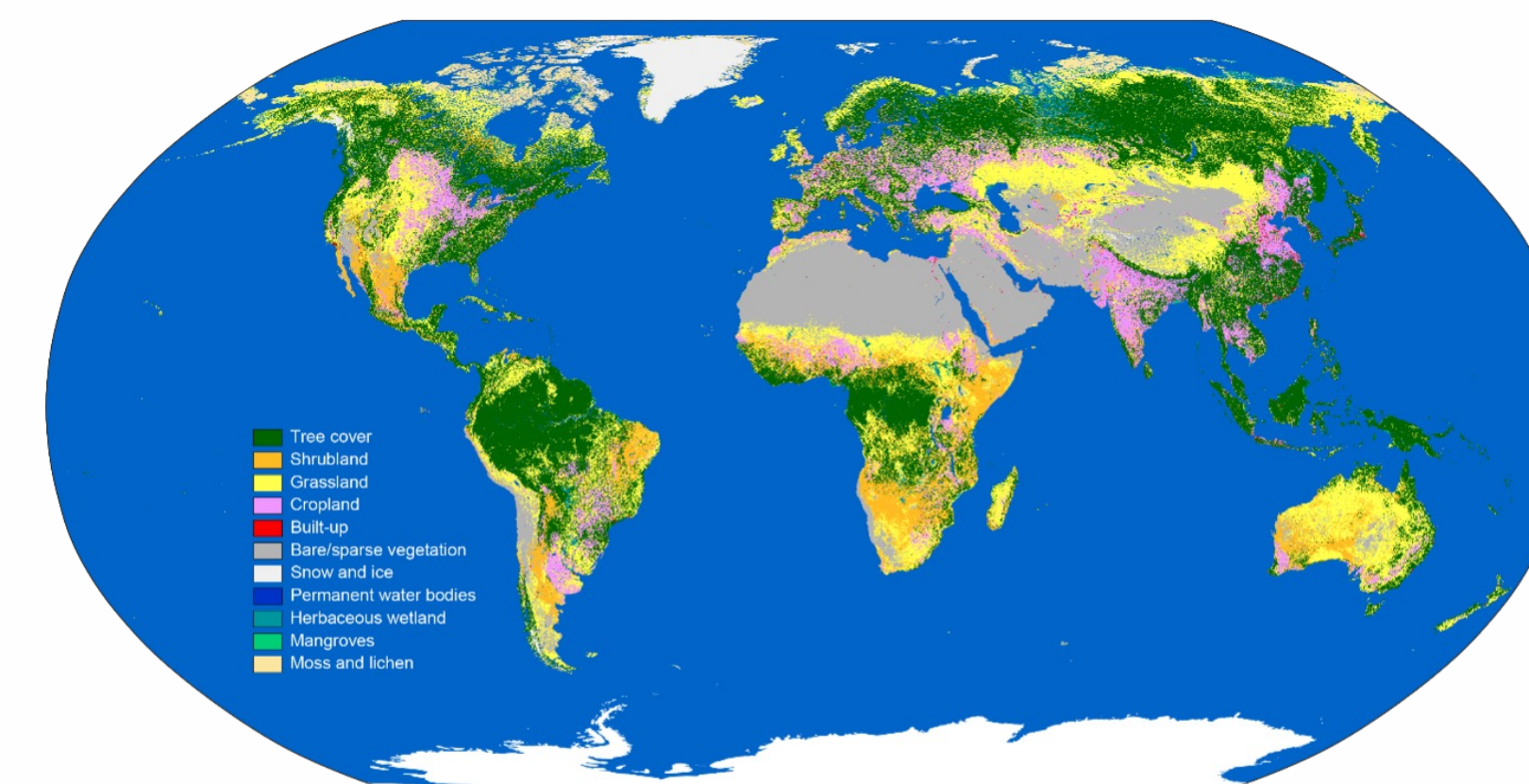
- 1. Composite Image Generation:** Multi-temporal image stack with adaptive cloud weighting and contrast enhancement.
- 2. Segmentation:** Meta’s SAM2 applied to composite for boundary extraction.
- 3. Classification:** LSTM model classifies segments using 12-month temporal pixel features.

Results:

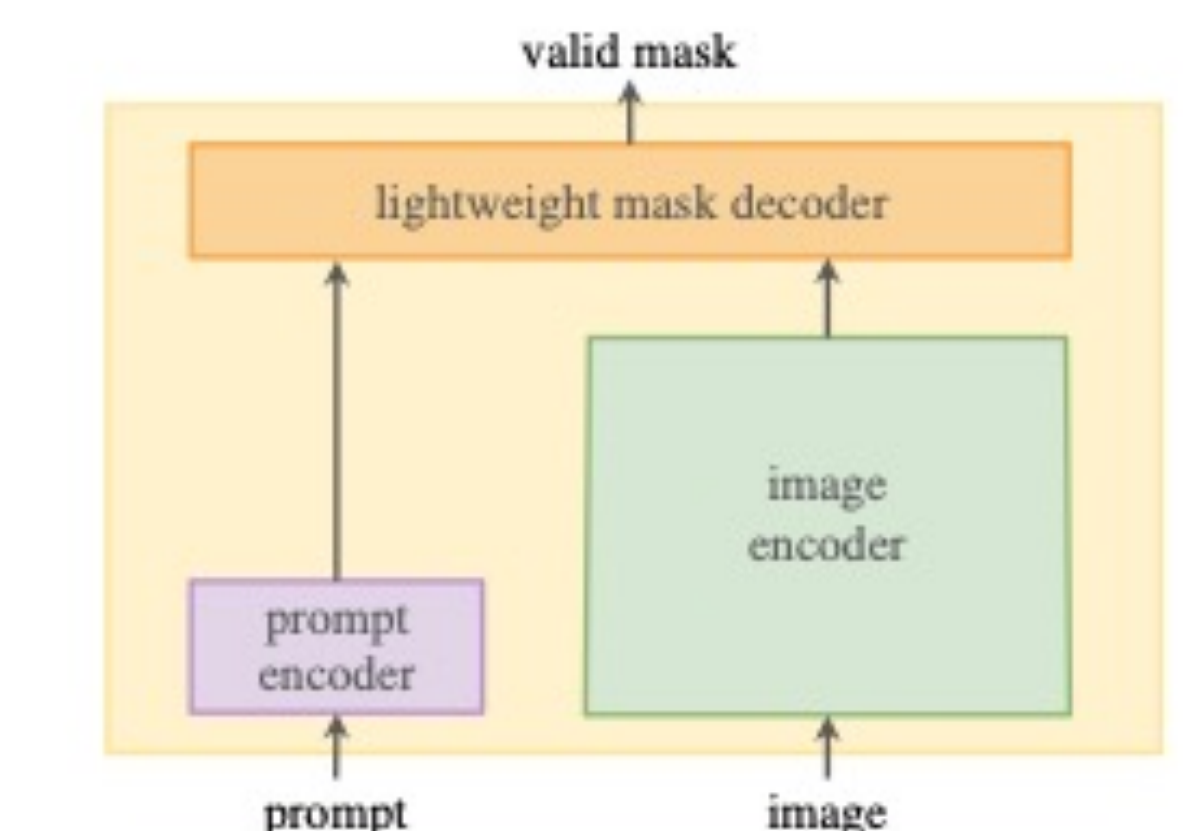
1. Enhanced boundaries and reduced cloud artifacts in composite.
2. Accurate segmentation across diverse regions with SAM2.
3. 84% classification accuracy with globally trained LSTM.

Obstacles Faced / Overcome:

- 1. Challenge:** Inconsistent field visibility due to clouds and seasonal variation.
Solution: Dynamic cloud-weighted composite generation.
- 2. Challenge:** Region-specific model limitations.
Solution: Use of SAM2 and globally trained LSTM for generalization.
- 3. Challenge:** Temporal variability across climates.
Solution: Feature engineering with full-year temporal pixel patterns.



ESA WorldCover 10m 2021



(b) Model: Segment Anything Model (SAM)