

Mapping Farmed Landscapes from Remote Sensing

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Introduction

To overcome the critical lack of detailed ecological maps needed for managing agricultural landscapes, we developed **Farmscapes**: the first large-scale, high-resolution map that identifies ecologically vital rural features, including often overlooked elements like **hedgerows** and **stone walls**. We achieved high accuracy in mapping key habitats with a deep learning model trained on aerial imagery and expert annotations. As a result, this work enables data-driven planning for habitat restoration, supports the monitoring of key initiatives like the EU Biodiversity Strategy, and lays a foundation for advanced analysis of landscape connectivity.



Figure 1. Typical English landscape elements, hedgerows (left), stone walls (centre), and patches of trees (right).

Data Collection

The landscape elements dataset was created using human annotations, leveraging high-resolution (25cm) imagery and 1m LiDAR-based elevation data. Approximately 1,000 tiles (512m × 512m) were generated, with annotation locations strategically selected to capture rural landscapes while excluding dense urban areas and forests.

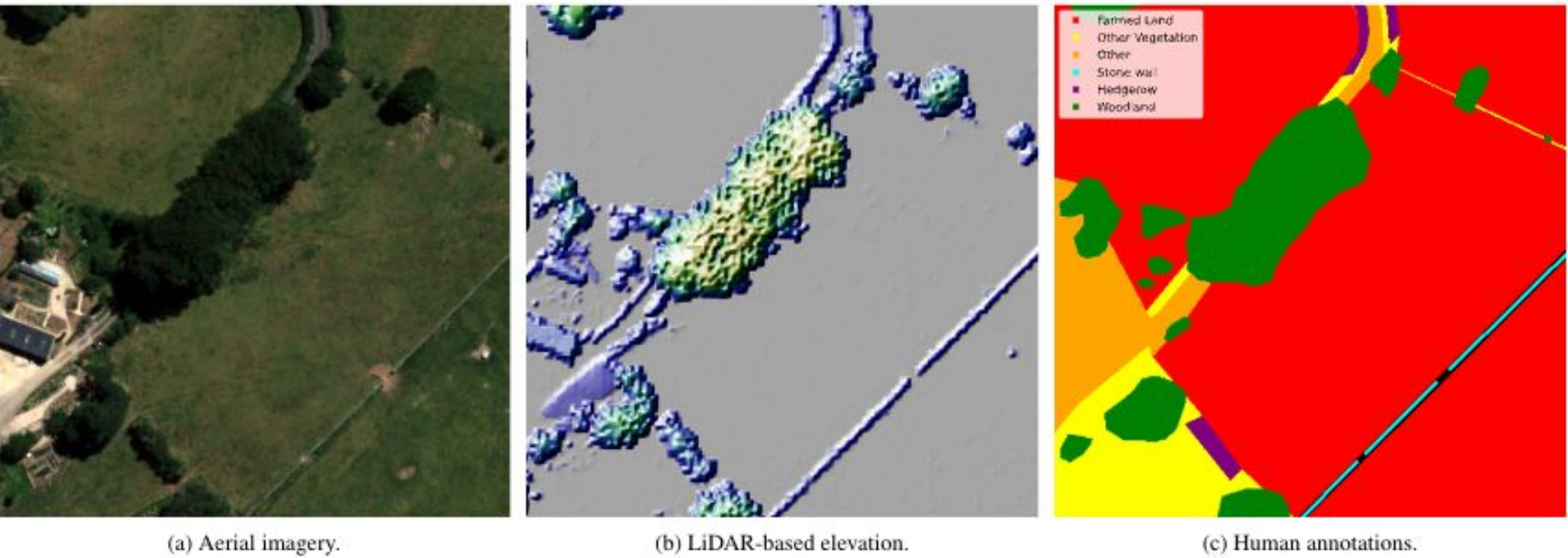
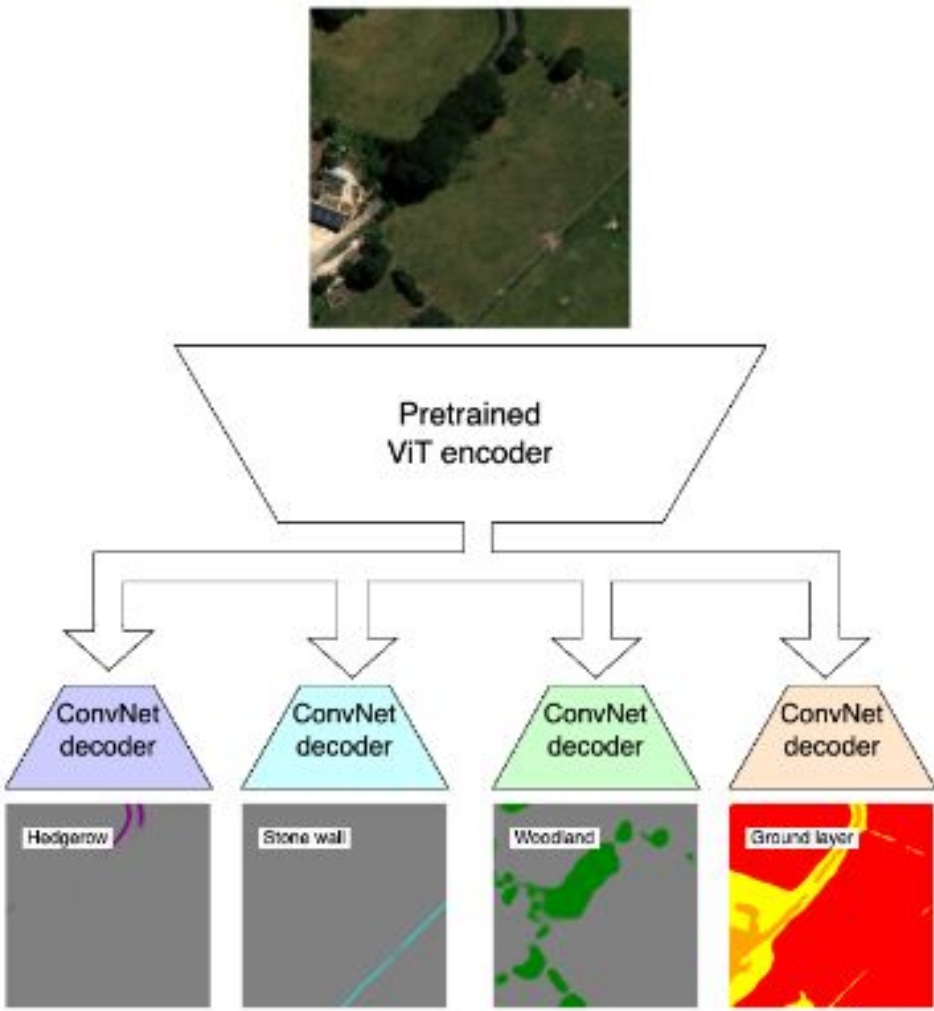


Figure 4. Example of human annotations drawn based on aerial and LiDAR-based elevation data.

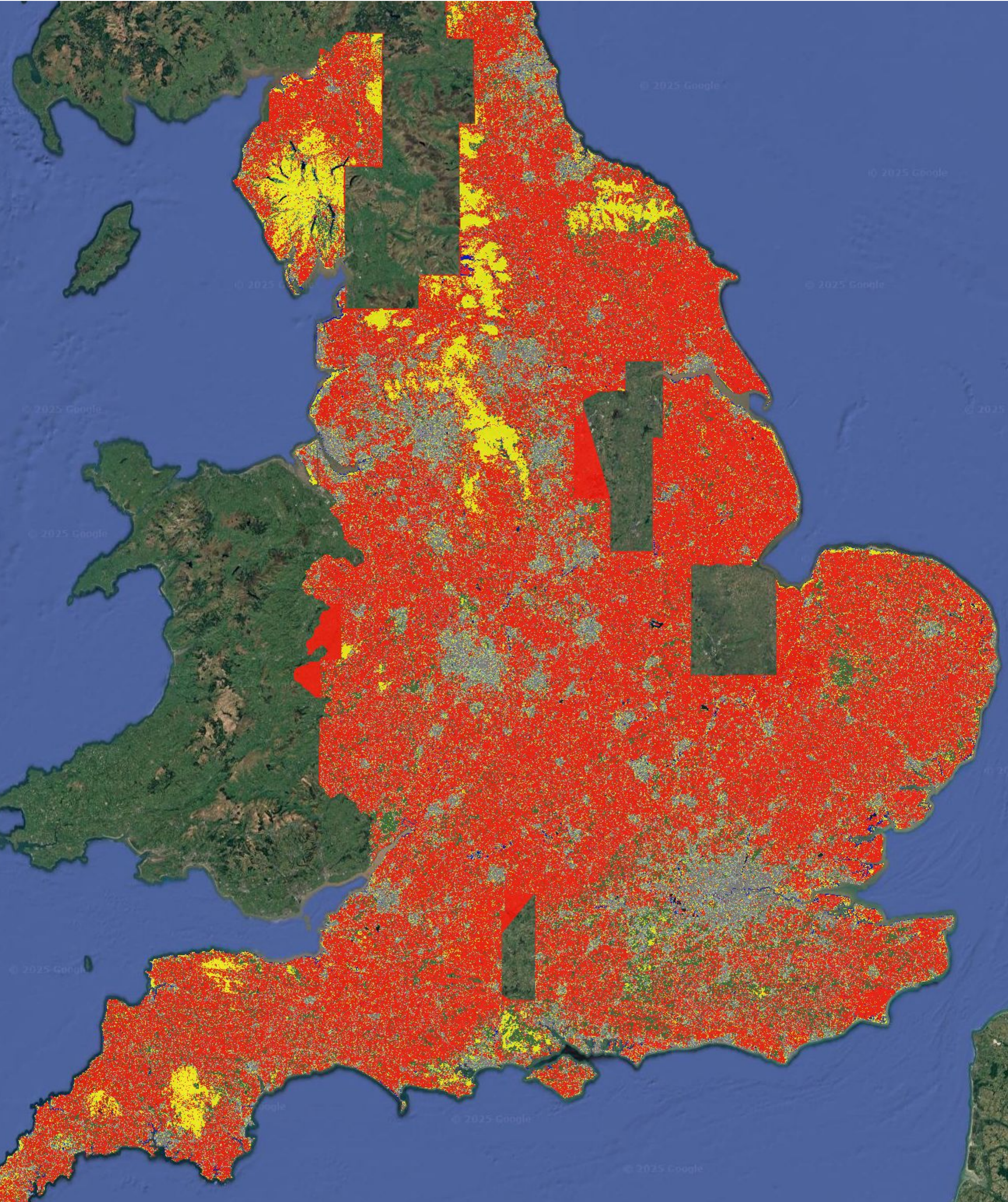
Method

Our model is a segmentation transformer with a vit encoder and multiple convnet decoders. The model segments mutually exclusive ground classes (**farmed land**, **vegetation**, **other**) and overlapping above-ground features (**hedgerows**, **trees**, **stone walls**). Trained on 742 tiles and validated on carefully selected 200 tiles, the model achieves high segmentation accuracy, with F1-scores of 95.5% for farmed land, 85.4% for vegetation, 92.7% for trees, 72.5% for hedgerows, and 61.8% for stone walls.



Conclusion

This research provides a powerful tool for landscape management, using deep learning and high-resolution aerial imagery to map rural features across England and beyond. Our model accurately distinguishes between farmed land, vegetation, and trees while detecting hedgerows and stone walls, key elements for biodiversity. These maps aid conservation efforts, supporting **habitat restoration**, **agroforestry**, and **sustainable land use planning**. Publicly available for England, with European maps upon request, this work aligns with biodiversity goals like the “30 by 30” initiative. Future improvements will focus on refining detection of hedgerows and stone walls, increasing geographical and temporal coverage, and applying landscape connectivity analysis to inform conservation priorities.



Earth Engine
Collection Link

