Preface:

In the ever-evolving landscape of agriculture, precise delineation of farm boundaries has emerged as a cornerstone for enhancing land management, optimizing resource allocation, and improving overall agricultural efficiency. Traditional methods of boundary identification, heavily reliant on manual inputs, are not only time-consuming but also prone to inaccuracies and inconsistencies. As the demand for more sustainable and efficient agricultural practices grows, there is a pressing need for innovative solutions that leverage advanced technologies to automate and refine this crucial process.

This project report delves into the utilization of cutting-edge geospatial analysis and machine learning models to automatically detect and delineate farm boundaries from satellite imagery. The focus is on the agricultural landscapes of Rajasthan, a region where accurate field boundary data is vital for both small-scale farmers and large agribusinesses. By implementing models such as Res-UNet, YOLOv5, and Single Shot Detection (SSD), this study aims to demonstrate the effectiveness of these technologies in providing precise, reliable, and scalable boundary identification.

The core of this research is the Res-UNet model, an advanced iteration of the U-Net architecture enhanced with deep residual learning. This model has shown remarkable accuracy in image segmentation tasks, making it a prime candidate for automated field boundary detection. The project compares the performance of Res-UNet with YOLOv5 and SSD, highlighting its superior capabilities in accurately delineating farm boundaries.

Beyond the technical exploration, this report underscores the broader implications of automated boundary detection in agriculture. It discusses how precise mapping can significantly improve agricultural planning, resource allocation, market access, and disaster management. The ability to integrate comprehensive, real-time data into the decision-making processes of farmers, agribusinesses, government agencies, and financial institutions can lead to more informed and effective agricultural practices.

This report aims to contribute to the growing body of knowledge on digital agriculture and remote sensing technologies. It provides insights into the potential of AI and machine learning in transforming traditional agricultural practices, emphasizing the importance of scalability and adaptability across different regions and agricultural contexts. Through this research, we hope to pave the way for more efficient, sustainable, and data-driven agricultural ecosystems.