Abstract-

Agriculture is a fundamental pillar of human society, vital for ensuring food security, economic stability, and sustainable development. As global populations continue to rise, the demand for efficient and precise agricultural practices has never been more critical. In this context, modern technologies such as remote sensing and machine learning offer unprecedented opportunities to enhance agricultural productivity and sustainability. This project aims to leverage these technologies to predict crop types for the year 2024 using historical data from the USA National Agricultural Statistics Service (NASS) Cropland Data Layer (CDL) for the years 2022 and 2023.

The CDL dataset provides comprehensive, high-resolution, pixel-level information on land cover and crop types across the United States. This rich dataset is pivotal for developing accurate and reliable predictive models. To further enhance our predictive capabilities, we integrated several advanced vegetation indices into our analysis. Specifically, the Normalized Difference Vegetation Index (NDVI), Enhanced Vegetation Index (EVI), and the Red Edge Chlorophyll Index were utilized. These indices are critical for monitoring vegetation health, providing insights into various physiological and structural characteristics of crops, such as photosynthetic activity, canopy density, and chlorophyll concentration.

NDVI is widely used for its ability to measure vegetation vigor and biomass, making it a staple in agricultural monitoring. EVI offers additional sensitivity to areas with dense vegetation, improving our understanding of crop health in such regions. The Red Edge Chlorophyll Index is particularly effective in detecting variations in chlorophyll content, which is closely related to crop health and productivity. By incorporating these indices, our project aims to develop a sophisticated model that not only predicts crop types but also assesses the overall health and viability of crops.

The integration of historical CDL data with these vegetation indices enables a comprehensive approach to crop prediction. This methodology supports a wide range of applications, including resource allocation, yield estimation, risk management, and strategic planning for farmers, policymakers, and stakeholders in the agricultural sector. Accurate crop type predictions can lead to better-informed decisions, ultimately enhancing agricultural productivity and sustainability.