

PROBLEM STATEMENT ON SUSTAINABILITY

Agriculture is one of the most significant economic sectors, and is paramount to global food systems, sustaining human needs while simultaneously facing the dual challenge of increasing productivity and mitigating environmental degradation. Factors like pollution and greenhouse gas emissions threaten natural resources and contribute to the decline of vital crops, such as **tomatoes**, which are a crucial source of nutrients. Furthermore, agricultural output is severely compromised by diverse **leaf diseases** caused by pathogens like fungi, bacteria, and viruses, which significantly reduce both yield and quality. Historically, disease identification relies on subjective and time-consuming **visual analysis** of symptoms like discoloration and lesions.

To overcome these limitations and enhance **crop sustainability**, modern techniques are imperative. The evolution of **Convolutional Neural Networks** (CNNs) has led to highly effective Deep Learning algorithms for automated leaf disease categorization. Utilizing established transfer learning architectures—including **VGG-16, ResNet, VGG-19, and Inception V3**—trained on datasets like **Plant Village**, these systems are designed to classify tomato leaf diseases automatically. The focus on developing models with few parameters and lightweight structures, such as those employing depth-wise convolutional layers, is essential for creating efficient classification systems capable of operating effectively in real-world agricultural environments.