

Kalasalingam Academy of Research and Education  
Deemed university in Krishnankoil, Tamil Nadu  
**Research Proposal**

**Proposed Title:** *Plant Disease Detection Based on Deep Learning Techniques*  
**Candidate Name:** S.VIDHYA

Agriculture remains the backbone of food production, yet farmers still struggle with timely and accurate identification of crop diseases and overall field health monitoring. Manual visual inspection is slow, subjective, and often fails to detect early-stage diseases, leading to significant yield losses. With the advancement of digital agriculture, there is a great opportunity to use deep learning-based image processing to support farmers with intelligent and timely decision-making.

The first aim of this research is to develop a deep learning model for automated plant disease detection using agricultural images. The model will be trained on both publicly available datasets and real farm images. Recent architectures such as Convolutional Neural Networks (CNNs) and Vision Transformers (ViT) will be explored, along with data augmentation and transfer learning to improve performance across multiple crop types and disease patterns.

To further enhance accuracy in real-field conditions, advanced techniques such as attention mechanisms, feature enhancement modules, and domain adaptation will be integrated. These techniques will help the model focus on disease-specific regions and handle challenges like varying lighting, backgrounds, and leaf textures that commonly occur in agricultural environments.

Another major focus of this work is on-field deployment, making the system usable by farmers in real time. For this purpose, lightweight and optimized models will be developed through model compression, pruning, and quantization, enabling deployment on smartphones and edge devices. This ensures the solution remains affordable, accessible, and suitable for rural agricultural settings.

The final step will be real-world evaluation to test accuracy, usability, and reliability in farm environments. Performance will be measured using practical metrics, user feedback from farmers, and field tests. This research is expected to deliver a cost-effective, portable, and farmer-friendly AI solution for early plant disease detection, contributing to sustainable agriculture, reduced crop loss, and improved productivity.

#### References

1. Zhang R., et al., *Vision Transformers in Agriculture: A Review*, Frontiers in AI, 2025.
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3. Wang S., et al., *Plant Disease Recognition Using Synthetic Images*, Frontiers in Plant Science, 2023.
4. Silva J.A.O.S., *Deep Learning for Agricultural Weed Detection*, Remote Sensing, 2024.
5. Khan M., et al., *Lightweight Edge-AI Model for Crop Disease Diagnosis*, Agronomy, 2024.