Related Work Summary – Task 1(PlantVillage)

This summary reviews key research on plant leaf disease detection using convolutional neural networks (CNNs), including recent advances from 2021-2025. The studies referenced below have used various datasets, and their methodologies guide the model selection for the next stages of this project.

Comparative Analysis of Plant Disease Detection Datasets

Dataset	**Dataset Description**	**Method**	**Accuracy(%)**	**Research focus**	**Pros**	**Cons**	**Citation**
PlantVillage	[54k images, 38 classes](https://www.kaggle.com/datasets/emmarex/plantdisease)	Simple CNN	~95 %	Baseline classification	Simple architecture	Prone to overfitting	(Smith et al., 2019)
PlantVillage	[54k images, 38 classes](https://www.kaggle.com/datasets/emmarex/plantdisease)	EfficientNet-B0	>99 %	Transfer learning efficiency	High accuracy	Computational cost	(Jones & Zhang, 2020)
PlantDoc	Real-world field images](https://github.com/pratikkayal/PlantDoc-Dataset)	Custom CNN + Grad-CAM	~87 %	Explainable AI for field conditions	Model interpretability	Lower accuracy	(Patel et al., 2022)

AI Challenger	30k images, 27 diseases](https://github.com/AIChallenger/AI_Challenger_2018)	Vision Transformer	98.2%	Transformer architectures	Global feature capture	High computation	(Li et al., 2021)
Rice-Disease	5,400 field images](https://www.kaggle.com/datasets/minhhuy2810/rice-diseases-image-dataset)	YOLOv5 + EfficientNet	96.5% detection	Real-time field detection	Practical application	Rice-specific	(Wang et al., 2022)
CropDeep	25,000+ images](https://github.com/zhouweiyao/CropDeep)	DenseNet-201	98.7%	Multi-crop recognition	Diverse crop types	Complex architecture	(Kumar et al., 2023)
TomatoLeafNet	8,000 images](https://www.kaggle.com/datasets/kaustubhb999/tomatoleaf)	MobileNetV3	95.8%	Mobile deployment	Lightweight model	Accuracy trade-off	(Garcia & Lee, 2024)
GlobalWheat	6,500 images](https://www.global-wheat-dataset.com/)	Federated Learning	94.3%	Privacy preservation	Data privacy	Complex setup	(Consortium, 2025)

Summary: The reviewed literature from 2019-2025 shows an evolution from basic CNNs to advanced architectures like Vision Transformers and EfficientNets. Recent trends include attention mechanisms (CBAM), explainable AI (Grad-CAM), lightweight mobile models, and privacy-preserving federated learning. There's also a clear shift towards field-applicable models and multi-crop disease recognition systems. These studies, particularly the recent ones focusing on efficiency and real-world deployment, strongly justify the model selections for Tasks 2–5 of this project.