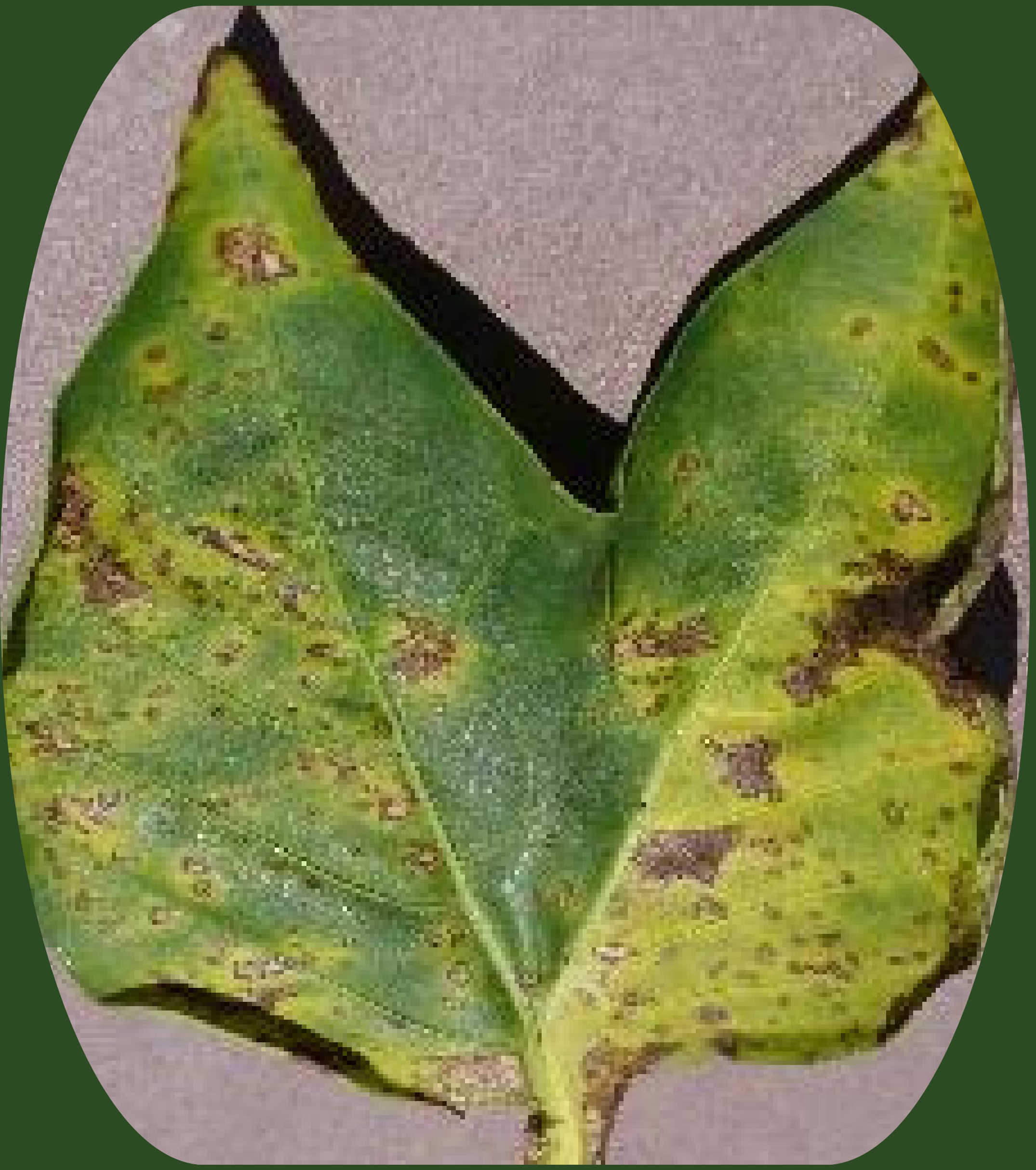
OPTIMIZING PLANT DISEASE DETECTION USING CNN & PSO



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INTRODUCTION

Problem Statement:

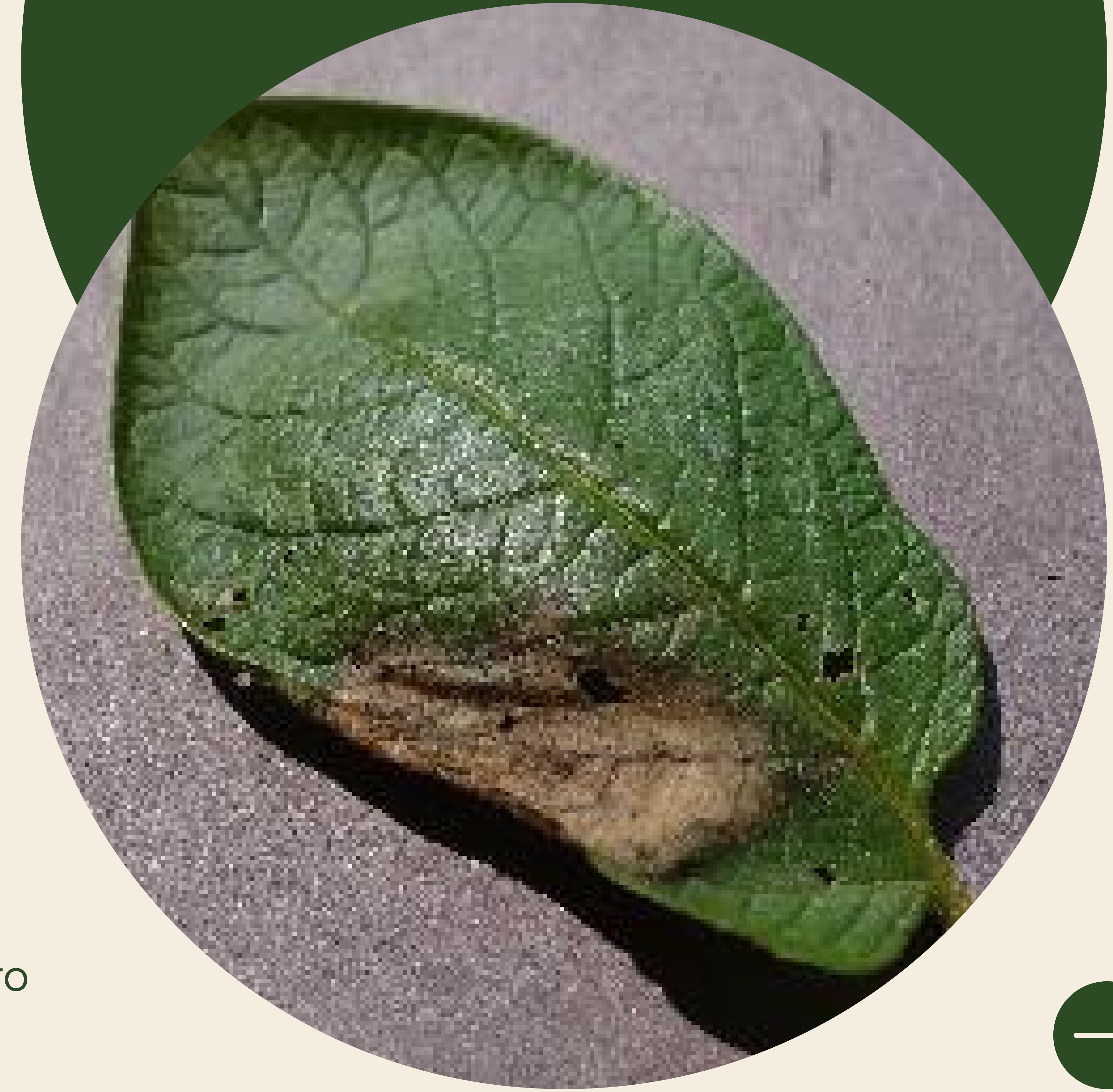
- Plant diseases threaten global food security.
- Manual detection is slow and subjective.

Solution:

- Automated detection using CNN + PSO for hyperparameter optimization.

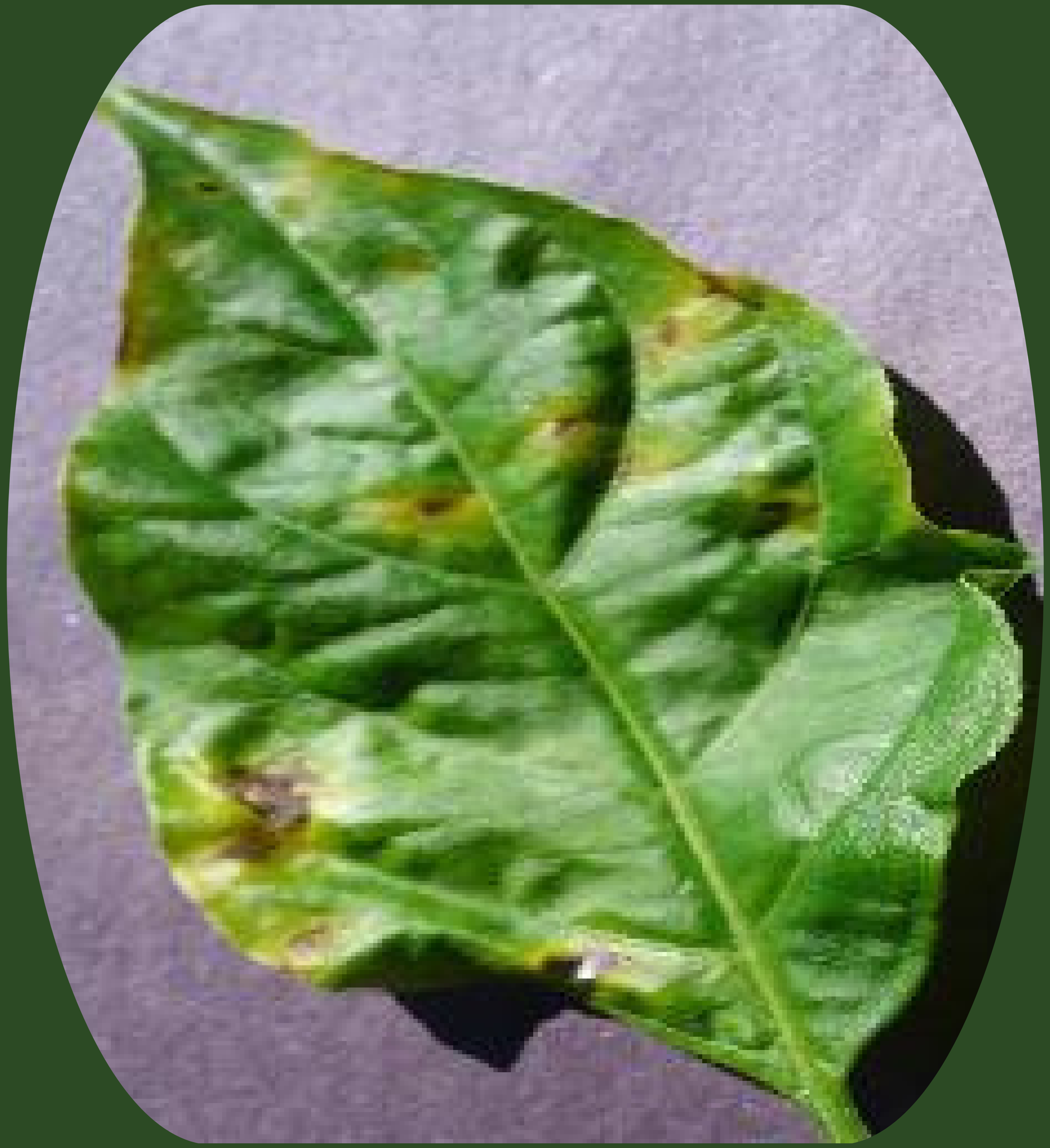
Key Benefit:

- Higher accuracy, efficiency, and scalability compared to traditional methods.



OBJECTIVE

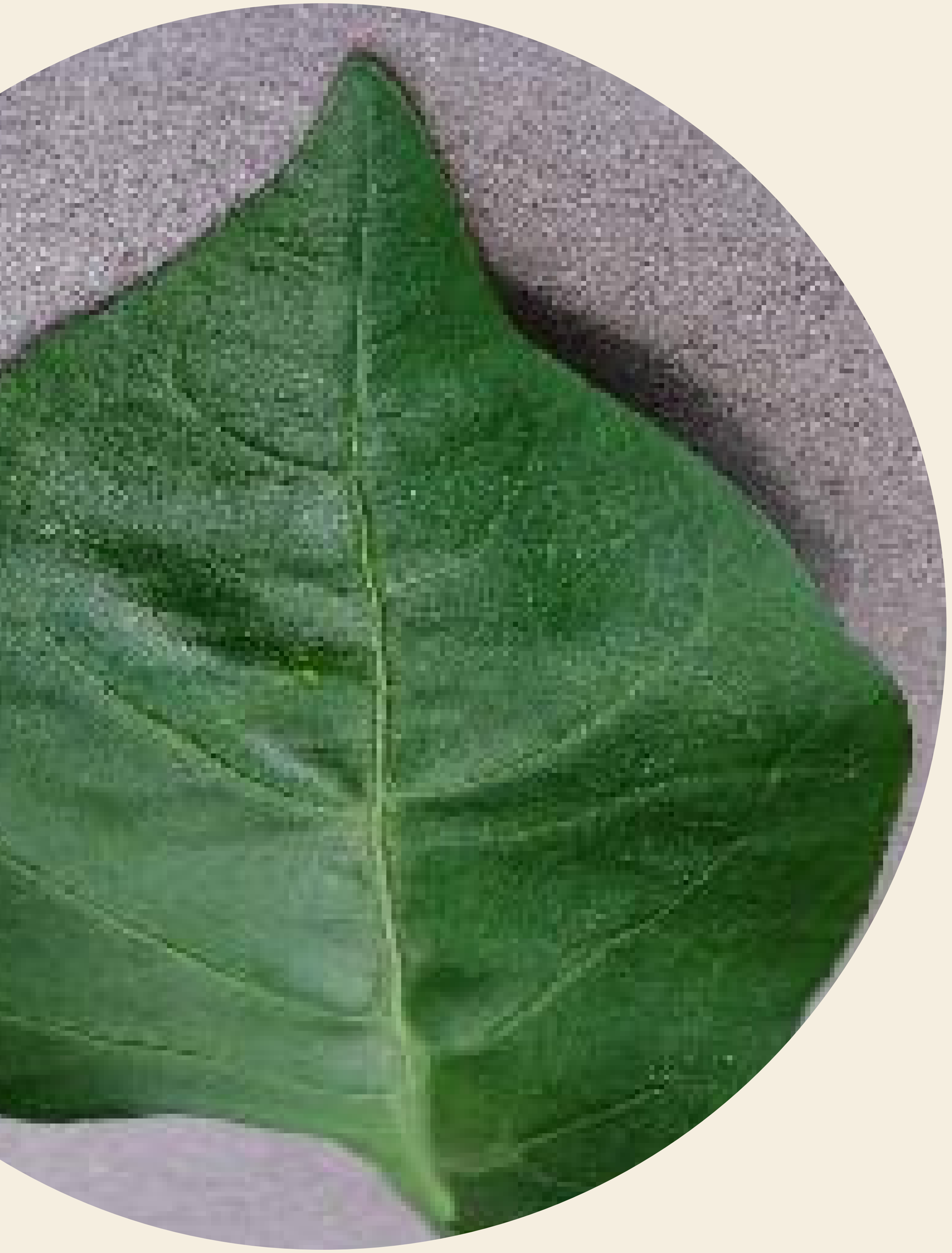
1. Design a CNN model for plant disease classification.
2. Optimize hyperparameters using Particle Swarm Optimization (PSO).
3. Evaluate improvements in accuracy and training efficiency.
4. Demonstrate the role of optimization in deep learning.



METHODOLOGY

Workflow:

1. Data Preparation:
- PlantVillage dataset + augmentation (flips, rotations).
2. Base CNN Model:
- Configurable layers (convolutional/dense).
3. PSO Optimization:
- Particles explore hyperparameter space.
- Fitness = validation accuracy.
4. Train Optimized Model.



MATHEMATICAL FORMULATION

Decision Variables:

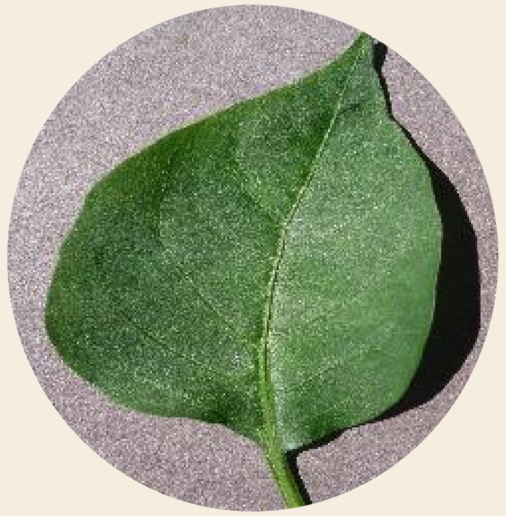
- Batch size, learning rate, dropout rate.

Objective:

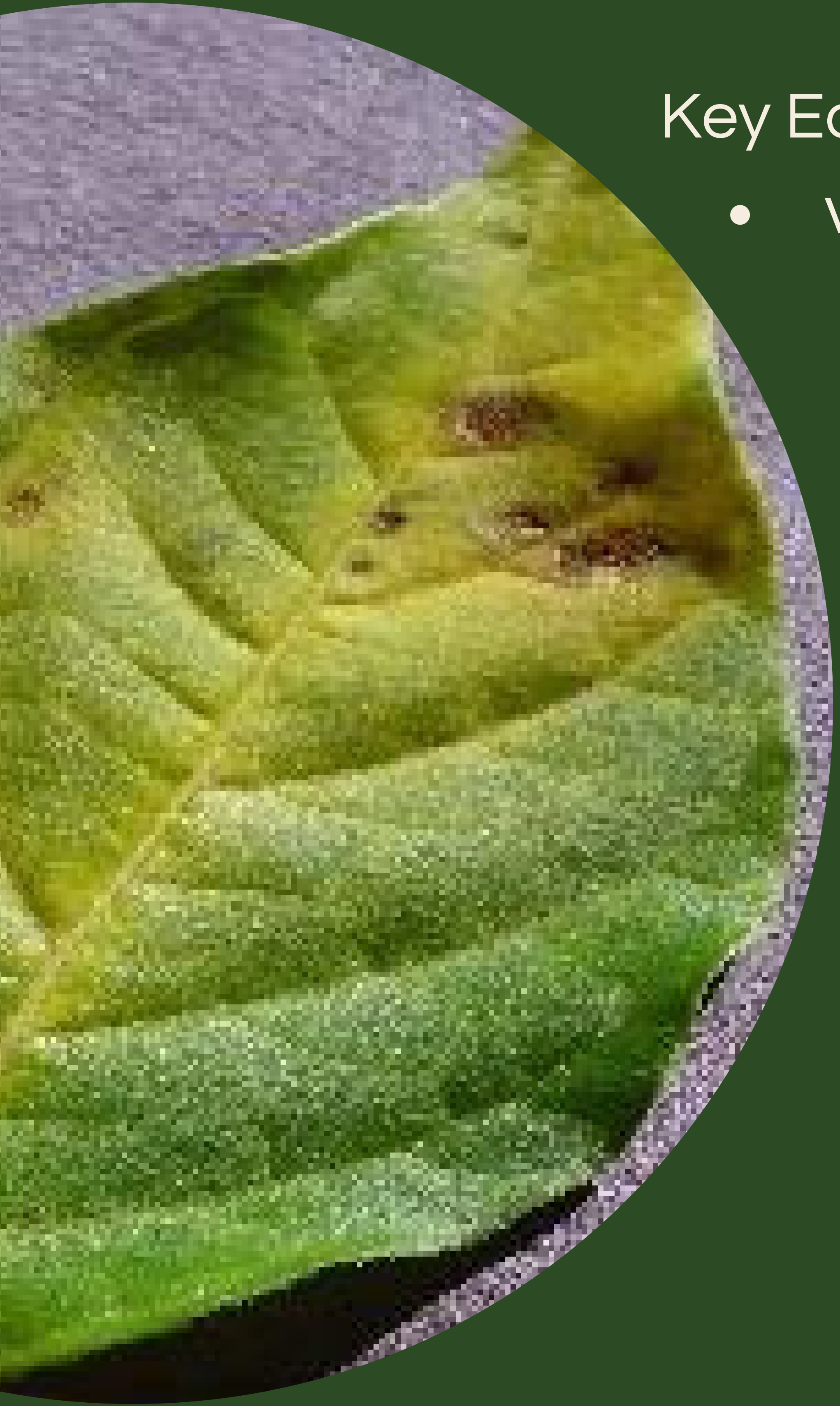
- Maximize validation accuracy:
- Maximize A(b,lr,d,c,fc)Maximize A(b,lr,d,c,fc)

Constraints:

- Ranges for each hyperparameter (e.g., 0.0001≤lr≤0.010.0001≤lr≤0.01).



PSO ALGORITHM



Key Equation (Velocity Update):

- $vi(t+1)=w \cdot vi(t)+c1r1(pi-xi)+c2r2(g-xi)vi(t+1)=w \cdot vi(t)+c1r1(pi-xi)+c2r2(g-xi)$

WHY PSO?

No gradients needed.

Escapes local optima via social learning.

Efficient for mixed-variable problems.

RESULTS

Performance Comparison:

- Baseline Accuracy: 84.7% → Optimized Accuracy: 98.1%.

Best Hyperparameters:

- Learning rate: 0.0001 | Batch size: 61 | Conv layers: 5.

Training Time: 6 hours.

DISCUSSION

Insights:

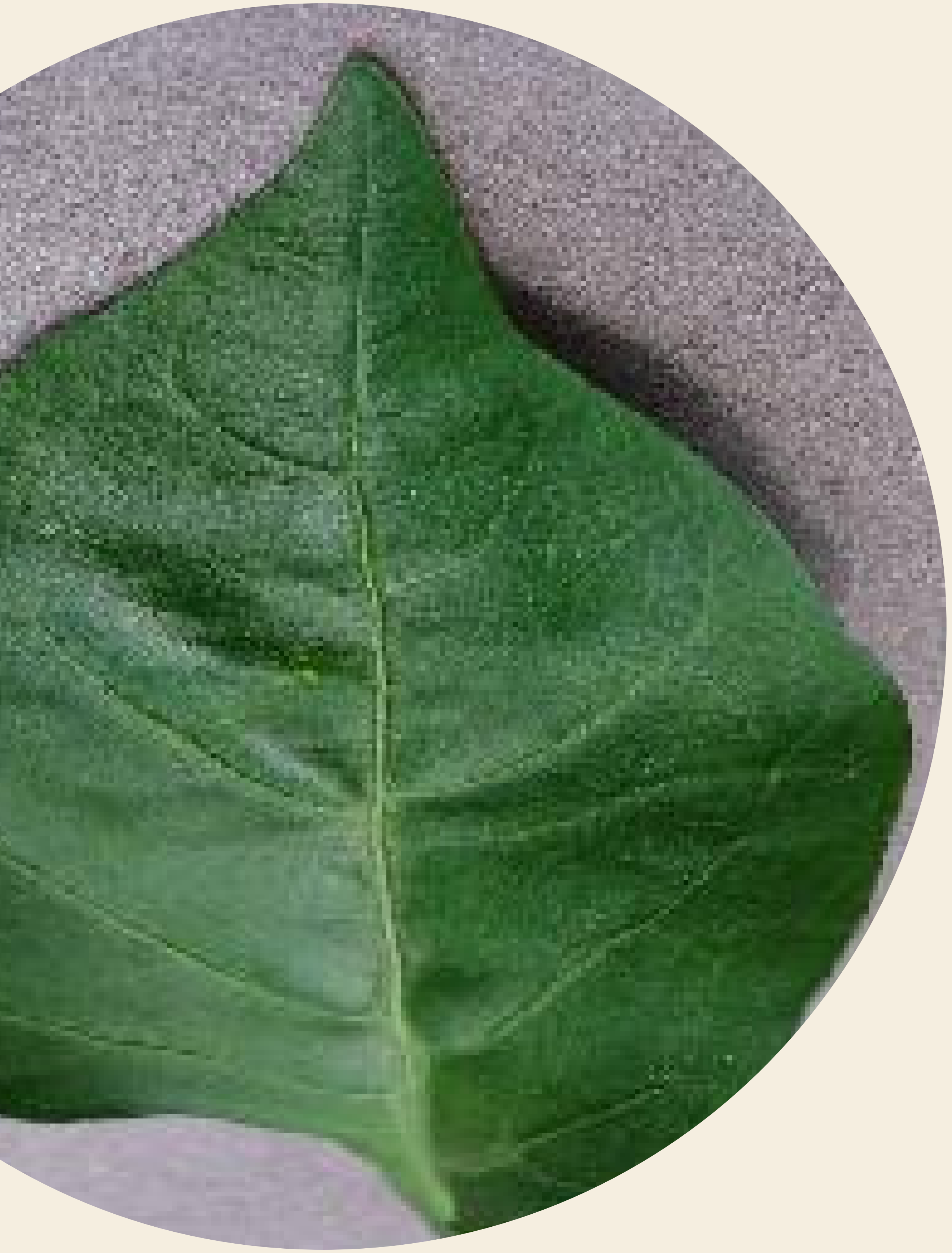
- PSO avoids manual grid search; finds optimal config faster.

Limitations:

- Computational cost (full training per particle).

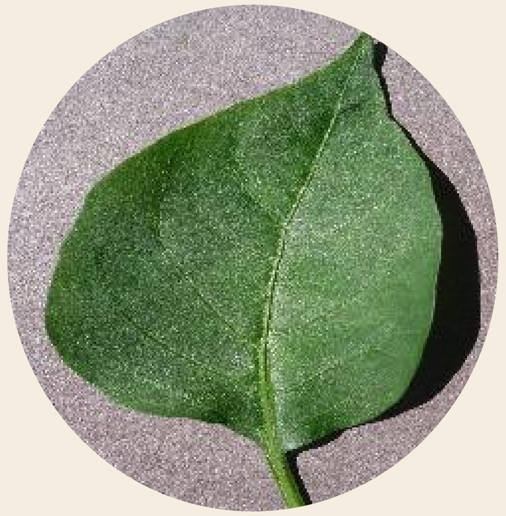
Future Work:

- Hybrid optimization (PSO + GA).
- Mobile app for field deployment.



CONCLUSION

- Summary:
  - CNN + PSO significantly improves disease detection accuracy.
- Impact:
  - Supports agricultural automation and food security.



THANK YOU