***Precision Pest Control Via Object Detection***

***Overview***

*This project focuses on leveraging deep learning models for smart agricultural pest control, improving detection accuracy and model generalization. The main objective is to facilitate optimized intervention strategies for healthier crops through precise pest identification using object detection.*

***Models Used***

* ***ResNet50***\*: For deep feature representation.\*
* ***MobileNetV2***\*: For computational efficiency and deployment feasibility.\*
* ***VGG16***\*: For strong hierarchical feature learning.\*

***Key Techniques Adopted***

*✅* ***Transfer Learning with ResNet50, MobileNetV2 & VGG16*** *– Leveraging pre-trained models for feature extraction.*  
*✅* ***Data Augmentation*** *– Enhancing model robustness with image transformations.*  
*✅* ***Dropout Regularization*** *– Encouraging generalization by deactivating random neurons.*  
*✅* ***Early Stopping*** *– Preventing overfitting for efficient training.*  
*✅* ***Optimized Compilation & Evaluation*** *– Fine-tuning hyperparameters for peak performance.*

***Training Configuration***

* ***Framework***\*: TensorFlow\*
* ***Epochs***\*: 100\*
* ***Callbacks***\*: EarlyStopping (patience=10)\*
* ***Loss Function***\*: Categorical Crossentropy\*
* ***Optimizer***\*: Adam (learning rate tuning performed)\*
* ***Metrics***\*: Accuracy, Precision, Recall\*

***Training Insights & Observations***

\*📌 \****Validation Accuracy > Training Accuracy***

* *Unusual but expected due to dropout and data augmentation.*
* *Dropout forces the model to generalize, making training more challenging.*
* *Augmented data increases training complexity while validation data remains unchanged.*

\*📌 \****Upward Trend Without Overfitting***

* *Validation accuracy stabilized at ~80%.*
* *No sharp validation accuracy drop, confirming strong generalization.*

\*📌 \****Performance Across Models***

* ***ResNet50***\* provided deep feature representations.\*
* ***MobileNetV2***\* was computationally efficient, making it suitable for deployment.\*
* ***VGG16***\* showed strong hierarchical feature learning.\*

***Impact***

*By applying deep learning to pest detection, this project contributes to smart agricultural practices. It helps reduce pesticide overuse, protect crops efficiently, and increase yield potential using AI-powered precision agriculture.*