**Fine-Tuning ResNet50, MobileNetV2 & VGG16 for Precision Pest Control!** 🎯

As part of my project **"Precision Pest Control Via Object Detection,"** I successfully fine-tuned **ResNet50, MobileNetV2, and VGG16** using **TensorFlow** to enhance pest detection accuracy and improve model generalization. This project applies deep learning to **smart agricultural pest control**, ensuring optimized intervention strategies for healthier crops. 🌱🐛

**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 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.

**Next Steps for Model Enhancement**

✅ Reduce **Dropout** slightly (**0.5 → 0.3**) to improve training accuracy.  
✅ Compare performance on **augmented vs. real validation data.**  
✅ Fine-tune **learning rate** to enhance stability.  
✅ Explore **Batch Normalization** for smoother convergence.

This milestone brings us closer to **AI-driven precision agriculture!** 🌾🚀

A huge thanks to **AMDARI** for providing the platform to explore and refine these deep learning techniques. Let’s keep pushing the boundaries of **AI for sustainability!** 💡

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