Solar Panel Defect Classification Project

This project aims to classify solar panel images into six categories: Bird-drop, Clean, Dusty, Electrical-damage, Physical-Damage, and Snow-Covered. Using a MobileNetV2-based transfer learning approach, the model effectively identifies defects for proactive maintenance.

Approach

- Dataset: 6-class image dataset of solar panel conditions with an 80/20 train-validation split.
- Preprocessing: Image augmentation techniques including rotation, shift, shear, zoom, and horizontal flips to enhance robustness.
- Model Architecture: MobileNetV2 pre-trained on ImageNet, with custom dense layers for classification.
- Training Strategy: Two-phase training—initial feature extraction followed by fine-tuning the last 40 layers for improved performance.
- Class Imbalance Handling: Applied class weights to mitigate skewed class distributions.

Key Findings

The model demonstrated strong classification performance with high accuracy across all classes. Fine-tuning significantly improved the detection of subtle defects such as bird droppings and electrical damage. Class weighting effectively balanced predictions for underrepresented classes.

Actionable Insights

- Deploying the model can enable real-time monitoring of solar farms to detect panel defects early.
- Automated defect classification can reduce maintenance costs and improve energy efficiency.
- Future improvements could include training with more diverse environmental conditions to enhance robustness.