

Solar Panel Fault Detection Based on Yolo Version 11 using Deep Learning

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Abstract: *In the era of increasing reliance on renewable energy, the efficiency and reliability of solar power systems have become paramount. Faults in solar panels, such as cracks, hotspots, and dirt accumulation, can significantly degrade energy output and system performance. This project presents an advanced fault detection framework titled “Solar Panel Fault Detection Based on YOLO Version 11 Using Deep Learning”, which leverages the capabilities of the latest YOLOv11 object detection algorithm for real-time, accurate fault diagnosis. The system utilizes high-resolution thermal and visual imagery datasets to train a custom deep learning model capable of identifying multiple types of anomalies with high precision. YOLOv11’s improved detection speed and accuracy allow for scalable deployment in large solar farms through drone-based or stationary camera surveillance. The model is optimized using transfer learning techniques and augmented datasets to enhance its generalizability across varying environmental conditions. Detected faults are logged and visualized through a user-friendly dashboard, enabling predictive maintenance and reducing operational downtime. This intelligent monitoring solution contributes to sustainable energy management by maximizing panel efficiency and extending their operational lifespan through timely fault intervention.*

Keywords: Solar panel monitoring, Fault detection, YOLOv11, Deep learning, Computer vision, Thermal imaging, Predictive maintenance, Renewable energy

