Solar cell detection classification

Solar cell defects exhibit significant variations and multiple types, with some defect data being difficult to acquire or having small scales, posing challenges in terms of small sample and small target in defect detection for solar cells. In order to address this issue, this paper proposes a multi-step approach for detecting the complex defects of solar cells. First, ...

Nowadays, silicon solar plants consist of hundreds of thousands of panels. The detection and characterization of solar cell defects, particularly on-site, is crucial to maintaining high productivity at the solar plant. Among the different techniques for the inspection of the solar cell defects, luminescence techniques provide very useful information about the spatial ...

An adaptive approach to automatically detect and classify defects in solar cells is proposed based on absolute electroluminescence (EL) imaging. We integrate the ...

Feed Sabeeh Hanoon, Mesut Çevik, Mustafa Sabah Taha; A fault classification for defective solar cells in electroluminescence imagery based on deep learning approach. AIP Conf. Proc. 7 May 2024; 3097 (1): 050006.

Defect detection in solar cells plays a significant role in industrial production processes [3]. Conventional methods of solar cell testing require contact with the samples, which can easily cause secondary pollution on the surface of the solar cells during production and processing [4]. In order to avoid this phenomenon, non-destructive testing methods based on ...

Aim at the characteristics of the glass-upside-down defects of solar cells, the lightweight target classification network MobileNetV2 is employed to ensure detection ...

Micro defect detection in solar cell wafer based on hybrid illumination and near-infrared optics 2013 9th Asian Control Conference (ASCC) 10.1109/ascc.2013.6606013

In this study, an automatic solar defect detection and classification system using deep learning was proposed. This study focuses on solar faults in photovoltaic systems identified through ...

It proposed new customized CNN architecture to select the effective features for each cracked solar image. Then, multiple classification support vector machine technique was used to group the extracted features of the cracked solar cells and identify the abnormal cells. In, deep two-dimensional CNN method was proposed to extract the most effective features from ...

This paper uses Mosaic and MixUp fusion data enhancement, K-meansCC clustering anchor box algorithm, and CIOU loss function to enhance the model performance and shows that the improved YOLO v5 algorithm can complete the solar cell defect detection task more accurately while meeting the real-time requirements. A

solar cell defect detection method with an ...

Recently, CNN-based approaches caught an increasing attraction in the field of PV cells detection and fault classification. On the other hand, EL imaging analysis has been recognized as a powerful tool for addressing malfunctions in PV models. In this work, an effective fault detection and classification approach is developed using multi-scale CNN-based ...

multiple uses of morphological and Canny edge detection with adjusted parameters to extract and highlight objects on a solar cell surface. Subsequently, the detected objects undergo classification, enabling the identification of different defect types and components through their features and a classification algorithm. Experimental results ...

In this study, a novel automatic defect detection and classification framework for solar cell EL images is proposed. Feature extraction, selection and classification of ...

This study presents an advanced defect detection approach for solar cells using the YOLOv10 deep learning model. Leveraging a comprehensive dataset of 10,500 solar ...

Both require fast and accurate detection and classification of defects in solar cells and modules [2]. In this study, we investigate the effectiveness of deep learning algorithms for detection and classification of defects using luminescence images of silicon (Si) solar cells. Electroluminescence (EL) [3] and photoluminescence (PL) [4] imaging are high-throughput ...

Traditional vision methods for solar cell defect detection have problems such as low accuracy and few types of detection, so this paper proposes an optimized YOLOv5 model for more accurate and comprehensive identification of defects in solar cells. The model firstly integrates five data enhancement methods, namely Mosaic, Mixup, hsv transform, scale transform and ...

In view of the surface defect characteristics in the manufacturing process of solar cells, the common surface defects are divided into three categories, which include ...

Classification of solar cells Solar cells can be classified as: monocrystalline silicon and polycrystalline silicon as shown in figure 1, on the basis of the production materials used for ...

of defects in solar cells. The dataset includes five classes of defects and the pre-trained ResNext50 network reaches 0.07 Hamming Distance. Keywords: Solar energy · Solar modules · Electroluminescence imaging · Convolutional neural networks · Deep learning · Visual inspection · Defect detection · Defect classification 1 Introduction

This work introduces neural architecture search to the field of PV cell defect classification for the first time and proposes a novel lightweight high-performance model for automatic defect detection of PV cells in

electroluminescence(EL) images based on Neural architecture search and knowledge distillation.

However, considering that the micro-crack detection task is a binary classification task, and the information contained in the solar cell images is relatively simple, we believe that the current micro-crack detection models based on the common convolutional neural networks are too redundant for the micro-crack detection task. Therefore, we propose ...

Surprisingly, the suggested PV fault detection model outperformed commercially available PV fault detection systems by resolving existing challenges. The proposed model was further evaluated in ...

Electroluminescence technology is a useful technique in detecting solar panels" faults and determining their life span using artificial intelligence tools such as neural networks and others.

Photovoltaic (PV) fault detection and classification are essential in maintaining the reliability of the PV system (PVS). Various faults may occur in either DC or AC side of the PVS. The detection, classification, and localization of such faults are essential for mitigation, accident prevention, reduction of the loss of generated energy, and revenue. In recent years, ...

Electroluminescence Images for Solar Cell Fault Detection Using Deep Learning for Binary and Multiclass Classification Rawad Ahmed Ibrahim Almashhadani1,2*, Goh Chin Hock2, Farah Hani Bt Nordin1 ...

mechanism through which solar cell defects are detected. Such detection could improve the solar panels" reliability and durability and help manage their deterioration and enhance their ...

There is an increasing interest towards the deep detection of defects in several industrial products (e.g. Sarpietro et al. [] developed a deep pipeline for classification of defect patterns applied in Silicon technology).This interest motivated us to propose a new dataset and its benchmark for the classification of defects in solar cells.

Automated defect detection in electroluminescence (EL) images of photovoltaic (PV) modules on production lines remains a significant challenge, crucial for replacing labor ...

In this work, we proposed a compact classification framework based on hybrid data augmentation and deep learning models for detection of the defective solar cells. In the proposed method, the limited and imbalanced EL datasets were augmented through various Generative Adversarial Networks (GAN), and defect detection was achieved by customized ...

To improve the defects classification and detection results in raw solar cell EL images, Su et al. 19 proposed a novel complementary attention network and a region proposal attention network, and ...

Solar cell detection classification

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