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Optimizing Anomaly Detection in Printed Circuit Boards Using Machine Learning: The Critical Role of Data Volume for Enhanced Accuracy

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In the era of Industry 4.0, ensuring the quality of Printed Circuit Boards (PCBs) is essential for maintaining high product quality, reliability, and reducing manufacturing costs. Anomaly detection in PCB production lines plays a critical role in this process. However, imbalanced datasets and the complexities of diverse data types pose significant challenges. This study explores the impact of data volume on anomaly detection accuracy by utilizing machine learning techniques, including Generative Adversarial Networks (GANs) and Synthetic Minority Oversampling Technique (SMOTE) to generate additional data. By addressing dataset imbalance through synthetic data augmentation, we aim to enhance model performance. Our experiments reveal that increasing data volume, particularly through GAN-generated and SMOTE-augmented data, significantly improves the accuracy of anomaly detection models. Interestingly, we also find that adding a large amount of data does not necessarily enhance model accuracy and that, beyond a certain point, accuracy actually drops.

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Talk

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