Intelligently Identifying and Locating Electronic Components in Power System Circuit Diagrams

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Intelligently Identifying and Locating Electronic Components in Power System Circuit Diagrams is an AI-driven machine learning project developed to address the inefficiencies of manual analysis in power companies. Given the vast number of diagrams these companies process, traditional manual analysis is both inefficient and prone to errors. The project leverages artificial intelligence and image processing techniques to build a robust machine learning model that automates the detection of electronic components within these diagrams.

The methodology is structured into three primary layers. The SPPF layer is responsible for detecting components at various scales, ensuring both small and large objects are accurately identified. The C2PSA layer then refines this process by isolating the most critical details of the image and filtering out extraneous data to enhance precision. Finally, the C3K2 layer accelerates processing without sacrificing accuracy, allowing the model to operate in near real-time. The output is a comprehensive labeling system where each detected component is assigned a confidence score and enclosed within a precise bounding box. The training process utilizes a carefully curated dataset, divided into test, train, and validation sets, containing 47 unique components.

By automating this process, the project promises to enhance efficiency in power system design, planning, analysis, and troubleshooting. The reduction in manual intervention not only accelerates workflow but also minimizes human errors, ultimately leading to this approach streamlining diagnostic procedures and contributing to more effective power management practices.

Keywords: Artificial Intelligence, Machine Learning, Image Processing, Electronic Component Detection

Class	Images	Instances	Box(P	R	mAP50	mAP50-95):
all	660	660	0.959	0.983	0.991	0.695
25FP	5	5	1	0.87	0.995	0.735
30FP	8	8	0.953	1	0.995	0.672
35FP	4	4	0.45	1	0.995	0.73
38BRKR_ATT	10	10	0.963	1	0.995	0.76
40FP	6	6	0.945	1	0.995	0.824
45FP	7	7	0.954	1	0.995	0.774
50FPUP	12	12	0.969	1	0.995	0.841
AIRGAP	7	7	0.992	1	0.995	0.792
ARROW	20	20	0.921	0.95	0.946	0.615
AUTOXFMR	18	18	0.981	1	0.995	0.804
BRKR_ATT	27	27	0.988	1	0.995	0.666
CAP	15	15	0.978	1	0.995	0.637
CKTSW	15	15	0.976	1	0.995	0.725
CONNPT	17	17	1	0.734	0.995	0.666
CT	20	20	0.984	1	0.995	0.671
CTASSY	12	12	0.952	1	0.995	0.767
DDE	19	19	0.977	1	0.995	0.666
DIPPOLE	16	16	0.982	1	0.995	0.71
FRGNP	9	9	0.969	1	0.995	0.699
FUCLSP	13	13	0.974	1	0.995	0.726
FUCOMGO	11	11	0.979	1	0.995	0.616
GEN	8	8	0.949	1	0.995	0.74
GEN1	18	18	0.977	1	0.995	0.78
GND	17	17	0.982	1	0.995	0.541
WAVETRAP_POT	17	17	0.897	1	0.995	0.902
XFMR	16	16	0.98	1	0.995	0.773