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Smart Defect Detection in XLPE Cables Using Convolutional Neural Networks

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Abstract : Power cables play a crucial role in the transmission and distribution of electrical energy. As the electricity generation, transmission, distribution, and storage systems become smarter, there is a growing emphasis on incorporating intelligent approaches to ensure the reliability of power cables. Various types of electrical cables are employed for transmitting and distributing electrical energy, with cross-linked polyethylene (XLPE) cables being widely utilized due to their exceptional electrical and mechanical properties. However, insulation defects can occur in XLPE cables due to subpar manufacturing techniques during production and cable joint installation. To address this issue, experts have proposed different methods for monitoring XLPE cables. Some suggest the use of interdigital capacitive (IDC) technology for online monitoring, while others propose employing continuous wave (CW) terahertz (THz) imaging systems to detect internal defects in XLPE plates used for power cable insulation. In this study, we have developed models that employ a custom dataset collected locally to classify the physical safety status of individual power cables. Our models aim to replace physical inspections with computer vision and image processing techniques to classify defective power cables from non-defective ones. The implementation of our project utilized the Python programming language along with the TensorFlow package and a convolutional neural network (CNN). The CNN-based algorithm was specifically chosen for power cable defect classification. The results of our project demonstrate the effectiveness of CNNs in accurately classifying power cable defects. We recommend the utilization of similar or additional datasets to further enhance and refine our models. Additionally, we believe that our models could be used to develop methodologies for detecting power cable defects from live video feeds. We firmly believe that our work makes a significant contribution to the field of power cable inspection and maintenance. Our models offer a more efficient and cost-effective approach to detecting power cable defects, thereby improving the reliability and safety of power grids.

Keywords : artificial intelligence, computer vision, defect detection, convolutional neural net
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