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A Comprehensive Evaluation of Supervised Machine Learning for the Phase Identification Problem

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Abstract : Power distribution circuits undergo frequent network topology changes that are often left undocumented. As a result, the documentation of a circuit’s connectivity becomes inaccurate with time. The lack of reliable circuit connectivity information is one of the biggest obstacles to model, monitor, and control modern distribution systems. To enhance the reliability and efficiency of electric power distribution systems, the circuit’s connectivity information must be updated periodically. This paper focuses on one critical component of a distribution circuit’s topology - the secondary transformer to phase association. This topology component describes the set of phase lines that feed power to a given secondary transformer (and therefore a given group of power consumers). Finding the documentation of this component is call Phase Identification, and is typically performed with physical measurements. These measurements can take time lengths on the order of several months, but with supervised learning, the time length can be reduced significantly. This paper compares several such methods applied to Phase Identification for a large range of real distribution circuits, describes a method of training data selection, describes preprocessing steps unique to the Phase Identification problem, and ultimately describes a method which obtains high accuracy (> 96% in most cases, > 92% in the worst case) using only 5% of the measurements typically used for Phase Identification.

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