Feature Studies for PV Fault Classification Using Nonlinear Principal Component Analysis

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ABSTRACT

- Neural networks can be used to classify solar faults
- Nonlinear principal component analysis can show redundancies in input features.
- Reducing the dimensions of the input features can simplify the neural network.
- The simplified network maintains accuracy.

MOTIVATION

- The current model has difficulty distinguishing between STC and shaded faults.
- Passing the data through a kernel function or encoder NN may be able to separate these classes.
- Not all features may be necessary for the network.
- PCA can inform us to which features are most important.
- Nonlinear PCA methods may be more effective if the input features are nonlinearly dependent.

PROBLEM STATEMENT

- The importance of PV features in classifying faults is unknown, and the current NN model is unable to distinguish between STC and shaded faults with the current dataset.

EXPERIMENTAL METHODS

Kernel PCA
- Pass the feature data through multiple kernel functions.
- Select different numbers of input features and pass the modified data into a NN for fault classification.

Autoencoder
- Train a neural network than encodes the data to a specified number of dimension then decodes it.
- Take the output of the encoded layer and pass it into a fault classification NN

PRELIMINARY RESULTS

- Kernel PCA
  - Linear Kernel Function is the most accurate
  - Classification accuracy levels for 5+ features

- Autoencoder
  - The autoencoder was less accurate overall with <80% accuracy

REFERENCES


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