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A classification method for power-quality disturbances using hilbert–huang transform and LSTM recurrent neural networks

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Abstract-

Power quality disturbances are one of the main problems in an electric power system, where deviations in the voltage and current signals can be evidenced. These sudden changes are potential causes of malfunctions and could affect equipment performance at different demand locations. For this reason, a classification strategy is essential to provide relevant information related to the occurrence of the disturbance. Nevertheless, traditional data extraction and detection methods have failed to carry out the classification process with the performance required, in terms of accuracy and efficiency, due to the presence of a non-stationary and non-linear dynamics, specific of these signals. This paper proposes a hybrid approach that involves the implementation of the Hilbert–Huang Transform (HHT) and long short-term memory (LSTM), recurrent neural networks (RNN) to detect and classify power quality disturbances. Nine types of synthetic signals were reproduced and pre-processed taking into account the mathematical models and their specifications established in the IEEE 1159 standard. In order to eliminate the presence of mode mixing, the ensemble empirical decomposition (EEMD) and masking signal methods were implemented. Additionally, based on the successful benefits of LSTM RNNs reported in the literature, associated to the high accuracy rates achieved at learning long short-term dependencies, this classification technique is implemented to analyze the sequences obtained from the HHT. Based on the experimental results, it is possible to show that the ensemble recognition approach using the EEMD yields a better classification accuracy rate (98.85%) compared with the masking signal and the traditional HHT approach.

Index Terms-

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