

ABSTRAK

Penelitian ini bertujuan untuk merancang dan mengimplementasikan model *Backpropagation Neural Network* (BPNN) dalam memprediksi sisa umur operasional transformator berdasarkan data historis operasional seperti suhu, beban, dan kualitas minyak. Model BPNN dibangun dengan menggunakan arsitektur jaringan syaraf tiruan dengan beberapa lapisan tersembunyi, dan dievaluasi menggunakan validasi silang *k-fold cross validation* sebesar 10-fold untuk menguji konsistensi dan ketepatannya. Pengujian model dilakukan dengan membandingkan nilai *learning rate* 0.01 dan 0.03 untuk mendapatkan kinerja yang optimal. Hasil prediksi dari model BPNN mendapatkan kinerja prediksi yang sangat baik. Transformator 1 menunjukkan kinerja prediksi yang sangat baik, dengan rata-rata MSE 0.09 dan *R-Squared* 0.92. Transformator 2 mendapatkan rata-rata MSE 0.08, dan *R-Squared* 0.90. Transformator 3 mendapatkan rata-rata MSE 0.09 dan *R-Squared* 0.91. Transformator 4 dengan rata-rata MSE 0.08 dan *R-Squared* 0.94. Berdasarkan hasil prediksi yang telah didapat, model BPNN menunjukkan kemampuan dalam memprediksi sisa umur transformator dengan tingkat keberhasilan yang tinggi. Namun, kinerjanya dipengaruhi oleh karakteristik dan pola data operasional dari masing-masing transformator.

Kata kunci: *Backpropagation, Neural Network*, sisa umur, transformator, prediksi, validasi silang, akurasi, MSE, *R-Squared*



ABSTRACT

This study aims to design and implement a Backpropagation Neural Network (BPNN) model to predict the remaining operational life of transformers based on historical operational data such as temperature, load, and oil quality. The BPNN model was developed using an artificial neural network architecture with several hidden layers and evaluated using 10-fold cross-validation to test its consistency and accuracy. The model was tested by comparing learning rates of 0.01 and 0.03 to obtain optimal performance. The prediction results from the BPNN model demonstrated excellent predictive performance. Transformer 1 reached an average MSE of 0.09 and an R-Squared of 0.92. Transformer 2 reached an average MSE of 0.08 and an R-Squared of 0.90. Transformer 3 reached an average MSE of 0.09 and an R-Squared of 0.91. Transformer 4 reached an average MSE of 0.08 and an R-Squared of 0.94. Based on the prediction results, the BPNN model shows a high success rate in predicting the remaining life of transformers. However, its performance is influenced by the characteristics and operational data patterns of each individual transformer.

Kata kunci: Backpropagation, Neural Network, remaining life, transformer, prediction, cross-validation, accuracy, MSE, R-Squared

