

# **Black Litterman's Strategy for Portfolio Optimization by Utilizing Fuzzy Neural Network Predictions**

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## **ABSTRACT**

The Elman Recurrent Neural Network (FERNN) Fuzzy model has been empirically proven by researchers having a good degree of accuracy in various forecasting problems. The FERNN model is an integration of fuzzy logic on the ERNN model. The ERNN model uses feedforward connections on the hidden layer to the input layer which means the output in the hidden layer is reused as input on the model.

The FERNN modeling step begins with the determination of input by seeing a significant lag of the autocorrelation plot so that the number of input variables is selected. Then the input data is divided into 2 with the composition of 75% training data and 25% data testing. The next step is fuzzification by using triangle membership function, followed by best model estimation process with bipolar sigmoid activation function in hidden layer and linear activation function on output layer so that selected best model containing information of input variable number, number of neuron in hidden layer, amount neurons in additional layers and outputs. The FERNN model has been applied to stock price data with four selected stocks namely PTBA, MYRX, LSIP, and PWON. Difference of FERNN result return prediction with actual return data then becomes views in Black Litterman model. The results of views obtained are used to determine the weight of each share in the portfol

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