Artificial Neural Networks and Their Application in Weather Forecasting

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***Abstract*—This thesis explores the application of artificial neural networks (ANN) in weather forecasting, comparing them with other forecasting methods. The study highlights the complexity of weather forecasting and the potential of ANN in providing accurate predictions. The author discusses the initialization of weights, learning rate, and the selection of network structure for ANN in weather forecasting. The implementation involves using a Java program to train the ANN with specific parameters such as the number of input, hidden, and output layers, and the learning rate. The initialization of weights is done randomly within a specified range. The results show that the ANN model can provide accurate predictions, especially during the season and at the transition of seasons. However, the model requires a large amount of training data that is specific to the season. The performance of the model is not explicitly quantified in the thesis.**

***Index Terms*—Artificial Neural Networks, Weather Forecasting, Machine Learning, Seasonal Data, Fuzzy Logic**

I. Introduction

Weather forecasting is a complex task that has attracted significant attention globally. Various advanced technologies have been applied in this field, achieving substantial success. However, due to economic and technical limitations, these technologies have not been widely adopted in Vietnam. This thesis aims to investigate and experiment with the application of artificial neural networks (ANN) in weather forecasting, a relatively new and promising method. The study compares ANN with other forecasting methods such as statistical, expert systems, and synoptic methods. The author discusses the initialization of weights, learning rate, and the selection of network structure for ANN in weather forecasting. The implementation involves using a Java program to train the ANN with specific parameters such as the number of input, hidden, and output layers, and the learning rate. The initialization of weights is done randomly within a specified range. The study highlights the challenges in applying ANN for weather forecasting, such as the need for a large and season-specific dataset. The author suggests further research on fuzzy neural networks and optimization methods for ANN. [1]

II. Methods

The study involves the initialization of weights, setting the learning rate, and selecting the network structure for ANN. The author uses a Java program to implement the ANN, with specific parameters such as the number of input, hidden, and output layers, and the learning rate. The initialization of weights is done randomly within a specified range. The study also discusses the selection of the learning rate, which is crucial for the convergence of the network. The network structure is chosen based on the complexity of the weather data and the desired accuracy of the predictions. The implementation involves training the ANN with a dataset that includes various weather parameters such as temperature, humidity, and wind speed. The training process is iterative, with the network adjusting its weights based on the error between the predicted and actual values. The author does not explicitly quantify the performance of the model in the thesis. [1]

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III. Results

The results show that the ANN model can provide accurate predictions, especially during the season and at the transition of seasons. The model is trained with a dataset that includes various weather parameters such as temperature, humidity, and wind speed. The performance of the model is not explicitly quantified in the thesis. The model requires a large amount of training data that is specific to the season. The author suggests further research on fuzzy neural networks and optimization methods for ANN. The implementation involves using a Java program to train the ANN with specific parameters such as the number of input, hidden, and output layers, and the learning rate. The initialization of weights is done randomly within a specified range. The study highlights the challenges in applying ANN for weather forecasting, such as the need for a large and season-specific dataset. The author suggests exploring fuzzy neural networks and other optimization techniques. [1]

IV. Discussion

The thesis discusses the challenges in applying ANN for weather forecasting, such as the need for a large and season-specific dataset. The author suggests further research on fuzzy neural networks and optimization methods for ANN. The study highlights the potential of ANN in providing accurate predictions, especially during the season and at the transition of seasons. However, the model requires a large amount of training data that is specific to the season. The author suggests exploring fuzzy neural networks and other optimization techniques. The implementation involves using a Java program to train the ANN with specific parameters such as the number of input, hidden, and output layers, and the learning rate. The

initialization of weights is done randomly within a specified range. The study also discusses the selection of the learning rate, which is crucial for the convergence of the network. The network structure is chosen based on the complexity of the weather data and the desired accuracy of the predictions. [1]

V. Conclusion

The study concludes that ANN can be a promising method for weather forecasting, but more research is needed to optimize the model and improve its performance. The author suggests exploring fuzzy neural networks and other optimization techniques. The implementation involves using a Java program to train the ANN with specific parameters such as the number of input, hidden, and output layers, and the learning rate. The initialization of weights is done randomly within a specified range. The study highlights the challenges in applying ANN for weather forecasting, such as the need for a large and season-specific dataset. The author suggests further research on fuzzy neural networks and optimization methods for ANN. [1]

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