ISSN: 2414-1895 DOI: 10.6919/ICJE.202304_9(4).0050

# Traffic Accident Prediction based on IBWO-LSTM

Yedi Wu

School of Chongqing Jiaotong University, Chongqing 400000, China

nbty988@163.com

## Abstract

**Road traffic safety is a major concern. Traffic accidents can have many knock-on effects, such as traffic paralysis, economic loss and waste of human time and energy. Every year, countless numbers of people have serious consequences from traffic accidents for various reasons, causing great harm to every family and adding enormous pressure on society, such as the cost of treatment, the need to take time off work to care for students or productivity generated by the injured and those who lose their workforce due to car accidents. Traffic accidents are an important part of road safety research, including accident cause analysis and accident prediction.This thesis optimises the LSTM model based on the Beluga algorithm and finds the optimal parameters of the LSTM model. Traffic accidents are then predicted with good results.**

## Keywords

**Beluga Optimization Algorithm; LSTM; Traffic Accident Prediction.**

## 1. Introduction

And Hochreiter S et al[1]Introduce LSTM, and LSTM can selectively process previous information, which is a kind of neural network for long and short-term memory. And Tang L et al[2]An advanced prediction method for effectively predicting lane change intention based on multi-short-term memory (Multi-LSTM) is proposed. The results show that the prediction model can accurately predict the vehicle lane change intention in the highway scenario, with the maximum prediction accuracy of 83.75%, which is higher than the common method SVM (Support Vector Machine). Zhang Yankong et al[3]We propose a method to predict short-term traffic accidents in urban areas based on road network structure. Using the multilayer convolutional artificial neural network and bidirectional LSTM to build the prediction model, we found that the spatial and temporal features have a great impact on the final prediction performance of the model, but the model has many data sources and lack of factor analysis. This paper uses the improved algorithm to optimize the model to improve the accuracy of the model.

## 2. Beluga Whale Optimization Algorithm

Beluga whales are highly social animals that can cluster in groups with 2 to 25 members and an average of 10 members. In Figure 1 (b) below, in fig, the fish are omnivorous, including but not limited to shrimp, worms, cod, trout, and salmon. When summer comes, many creatures gather in some estuaries, so beluga whales gather to eat. Because beluga whales do not have sharp teeth, they usually carry their prey into their mouths by suction. Sometimes beluga whales will coordinate teams to attack the fish, guiding the fish into shallow water. Moreover, beluga whales are threatened by killer whales, polar bears, and humans during the summer months. Some beluga whales may die during migration and fall into the deep sea, known as "beluga fall", providing ample food for a large number of organisms without sun and oxygen, as shown in Figure 1 (c) below. Inspired by the

ISSN: 2414-1895 DOI: 10.6919/ICJE.202304_9(4).0050

behaviors of beluwhale swimming, hunting, and whaling, Zhong C[4] A new meta-heuristic algorithm, the Beluga optimization algorithm (BWO), was developed.

## 3. LSTM Model

LSTM is an extended ANN structure whose hidden layer has an additional set of state modules, called cell unit states, that can be used to study a long-term dependent relationship. LSTM uses a special grid structure that allows it to store input data with a long history, with the same requirements as RNN input data, that is, the input data must be composed of coherent upstream and downstream data to better understand and analyze the complex relationships between cell states.

And thus often used for modeling and predicting data. The LSTM structure consists of a series of interconnected neural network nodes, also known as units, which are marked with the letter A in the horizontal direction. In the vertical direction, the flow direction of the input and output parameter interaction is unidirectional. The structure of the LSTM model is shown in Figure 1:

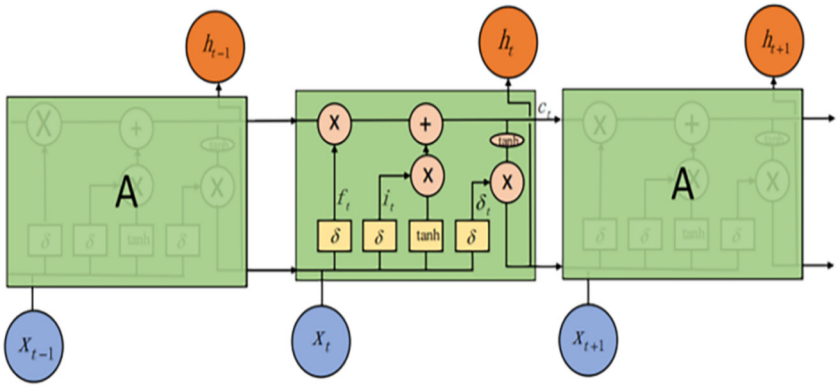


**Figure 1.** Structural diagram of the LSTM

## 4. Traffic Accident Prediction based on BWO-LSTM

The default parameters of LSTM are often based on the user's empirical preferences, and its high stochasticity will cause the prediction accuracy is not particularly high and even fall into the range of local optimal solutions. To address these problems, we used a modified Beluga algorithm to optimize the LSTM model. The main core task of the optimization using the Beluga algorithm is to optimize the number of neurons focused on the hidden layer, the learning rate, and the number of iterations. Therefore, the LSTM model optimized by beluga whale algorithm is used to predict traffic accidents. The main optimization parts include the following aspects:

(1) Initialize all the parameters contained in the network, and define the topology structure;

(2) Select the parameter search space based on the random value defined, and the parameters to be optimized;

(3) Calculate the fitness of individual beluga whale and use it to verify the model. If the calculated adaptation value is the smallest, it is defined as the best value of this time. The value is compared with the global best value. If this value is less than the global best value, a substitution will be generated;

(4) For iteration, constantly replace the hyperparameters of LSTM and repeat steps (3) and (4) until the maximum number of iterations is completed.

In this paper, the number of traffic accidents in a city from 2016 to 2020 is used to predict, and the ratio is 8:2. The prediction results are shown in Figure 2:

ISSN: 2414-1895 DOI: 10.6919/ICJE.202304_9(4).0050

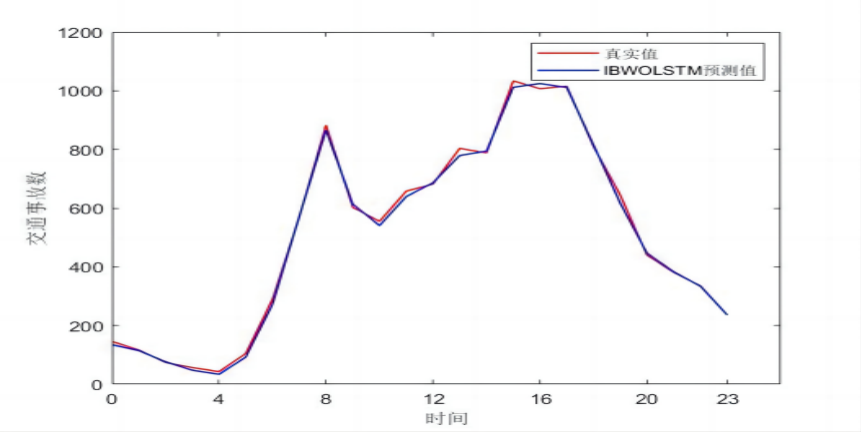


**Figure 2.** The BWO- -LSTM traffic accident prediction results

## 5. Conclusion

This paper illustrates the advantages of the Beluga optimization algorithm to optimize the LSTM model and find the optimal parameters of the LSTM model. Then to the traffic accident prediction and achieved very good results.

## References

[1] Hochreiter S, Schmidhuber J. Long short-term memory[J]. Neural computation, 1997, 9(8): 1735-1780.

[2] Tang L, Wang H, Zhang W, et al.Driver lane change intention recognition of intelligent vehicle based on long short-term memory network[J].IEEE Access, 2020, 8: 136898-136905.

[3] Zhang Yanchang, Lu Jiabin, Zhang Shuichao, Ji Xiaopeng, Luo Yuetong, Chen Wei. Short-term risk prediction method of urban traffic accidents based on road network structure [J]. Journal of Intelligent Systems, 2020,15 (04): 663-671.

[4] Zhong C, Li G, Meng Z.Beluga whale optimization: A novel nature-inspired metaheuristic algorithm[J]. Knowledge-Based Systems, 2022, 251: 109215.