**Title Mathematical and Numerical Analysis of .....**

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**Abstract.** The abstract should provide a brief summary of the main findings of the paper, such as: Based on a ... method and a ... method, a ... algorithm is designed to solve a ... problem in this paper. This ... problem is an ... problem with .... Usually, such a ... problem can be ... problem by using the ... methods. We use a ... technique to ..., which is really effective .... To overcome the difficulties ..., we .... By ..., this ... can be .... Moreover, we .... Our proposed algorithm is ..... The results of numerical examples

show the ..., while they ..... In addition, our .....

**AMS subject classifications:** 62M20, 92B20

**Key words:** keywords 1, keywords 2, keywords 3, keywords 4.

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**1 Introduction**

The introduction should briefly place the study in a broad context and highlight why it is important. It should define the purpose of the work and its significance. The current state of the research field should be reviewed carefully and key publications cited. Please highlight controversial and diverging hypotheses when necessary. Finally, briefly mention the main aim of the work and highlight the principal conclusions. As far as possible, please keep the introduction comprehensible to scientists outside your particular field of research.

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In order to verify the new model effectively, this paper selected Badong Station in Hubei province to conduct an empirical study of daily precipitation prediction. In terms of prediction accuracy, compared with existing precipitation prediction models, this model has the best performance in three evaluation indexes: root mean square error (RMSE), mean absolute error (MAE) and determination coefficient (). In terms of stability, by analyzing the influence of time step size of 1, 3 and 5 d on the prediction accuracy of each model, it is proved that although the prediction accuracy of all models will decrease with the increase of time step size, the model in this paper still performs best in three evaluation indexes of RMSE, MAE and R2 under different time step size. In terms of operational efficiency, the LSTM-WBLS model added with WBLS has no decrease in operational efficiency compared with the LSTM model because of its convenient and fast computation.

**2 Model principle and structure**

In this paper, the basic structure and principle of LSTM and WBLS are presented first, and then the LSTM-WBLS prediction model based on multiple factors is presented.

**2.1 LSTM principle and structure**

The structure of LSTM is shown in Figure 1. In Figure 1, is the input vector, is the input state in time step , is the forgotten state in time step , is the output state in time step , and are respectively the hidden state and cell state in time step , and and are respectively the hidden state and cell state in time step . Nonlinearity is added in the form of tanh and sigmoid activation functions .

The LSTM principle is as follows:

(2.1)

(2.2)

(2.3)

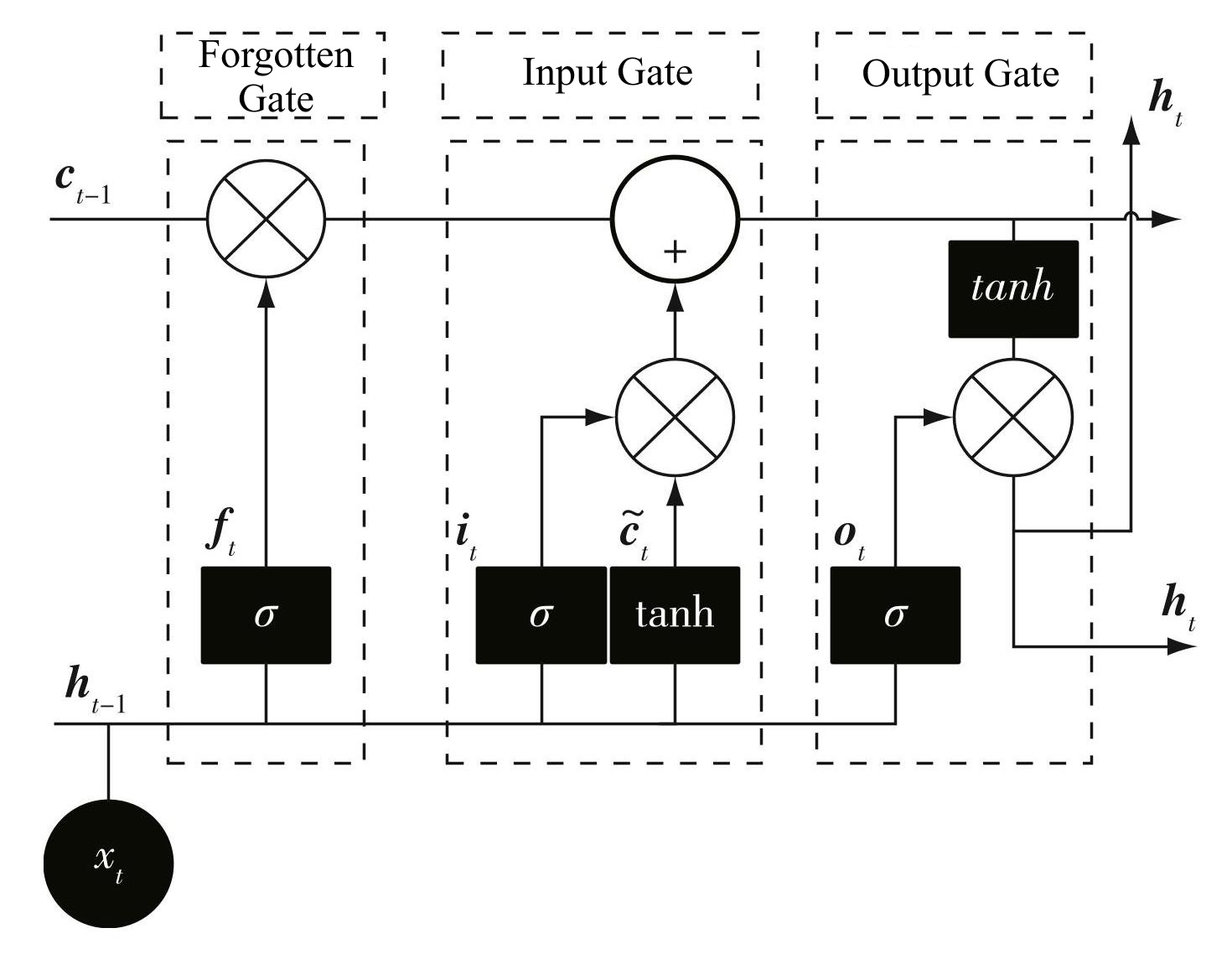


Figure 1: Structure principle of LSTM

(2.4)

(2.5)

(2.6)

where represent the corresponding weight vectors of the forgetting gate, input gate, memory unit and output gate respectively; represent the deviation variables of the forgetting gate, input gate, memory unit and output gate respectively; is the Hadamard product of the matrix.

**2.2 WBLS principle and structure**

Chen et al. [8] proposed BLS in early 2019 and WBLS in 2020 to reduce the impact of abnormal samples on modelin.

Suppose contains samples, each with dimensions, and is the output matrix belonging to , where is the dimension of the output. The structure of WBLS is shown in Figure 2.

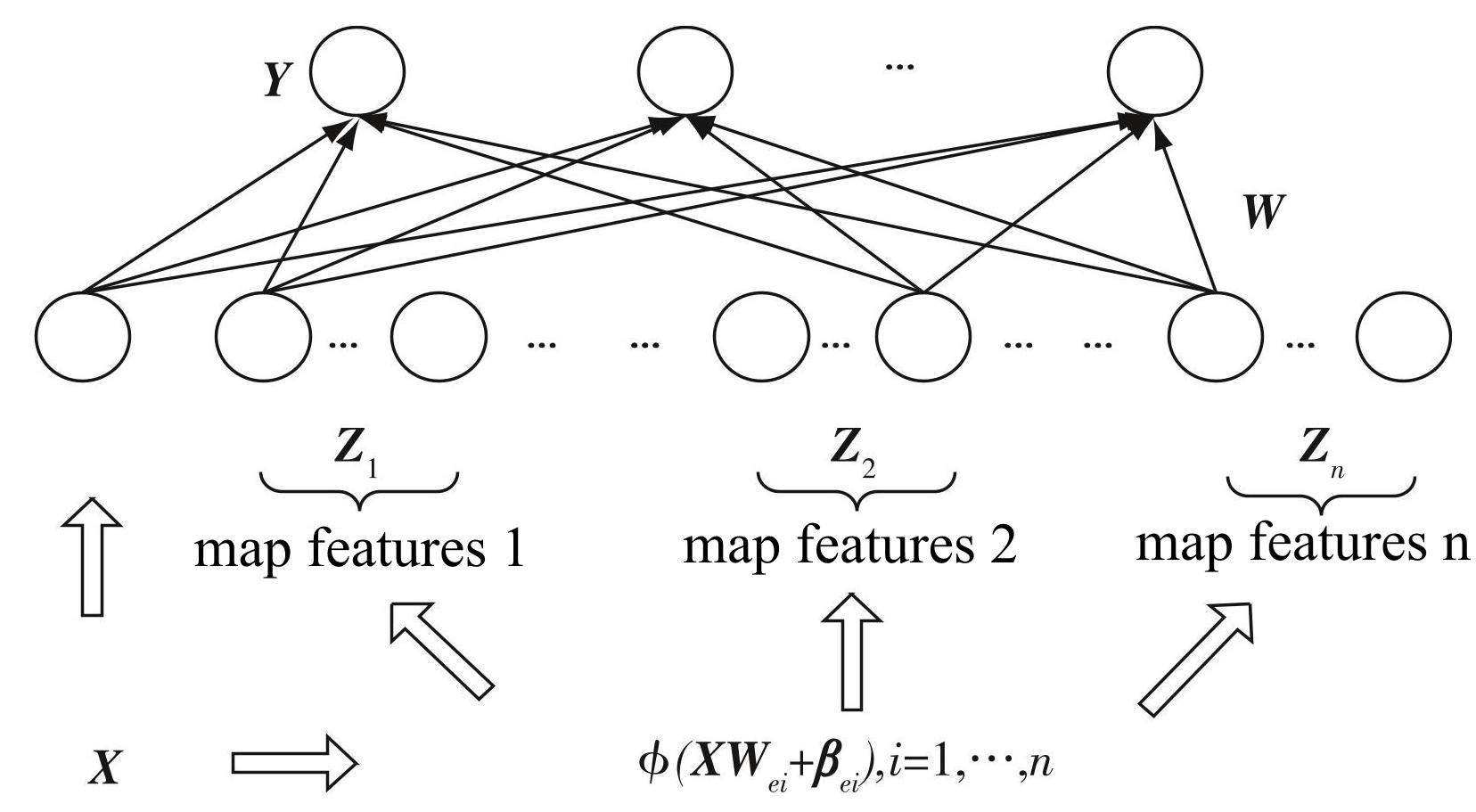


Figure 2: Structure principle of WBLS

… …

**4 Conclusions**

In view of the shortcomings of existing daily precipitation prediction models, a new LSTM-WBLS daily precipitation prediction model is proposed in this paper. Through empirical research, the model in this paper solves the lag problem in LSTM prediction by means of the characteristics of WBLS, which does not require a lot of training and calculates weights directly by pseudo-inverse, and the operation efficiency does not decrease. By automatically assigning appropriate weights to each sample, the samples with high reliability are given higher weights, while the suspicious outliers are given lower weights, which reduces the influence of abnormal samples and improves the prediction accuracy and stability. This paper discusses the possibility of combining the advantages of deep learning and width learning in precipitation prediction, which provides a new idea for precipitation prediction. In this model, only historical meteorological data and specific daily precipitation data are considered, and geographical and geomorphic features will be added in the future to further improve the forecast accuracy of daily precipitation.

**Acknowledgments**

This work is supported by National Natural Science Foundation of China (Grant Nos. xxx and xxx) and XXX Excellent Ph.D. Students Foundation (Grant No. xxx). The author(s) would like to thank Prof. Wxxx Axxx and Dr. WxxX Bxxx for their valuable discussions. The author(s) also thank all of the editors and reviewers for their very important suggestions.

**Conflicts of Interest**

Declare conflicts of interest or state ``The author(s) declare no conflict of interest.'' Author(s) must identify and declare any personal circumstances or interest that may be perceived as inappropriately influencing the representation or interpretation of reported research results. Any role of the funders in the design of the study; in the collection, analyses or interpretation of data; in the writing of the manuscript; or in the decision to publish the results must be declared in this section.

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