INFLUENCE ANALYSIS OF WATERLOGGING BASED ON DEEP LEARNING MODEL IN WUHAN

Yin Pan [a], Zhenfeng Shao [a, *], Tao Cheng [a], Zhiqiang Wang [b], Zhaoyu Zhang [b]

[a] State Key Laboratory for Information Engineering in Surveying, Mapping and Remote Sensing, Wuhan University, Wuhan 430079, China
[b] School of Remote Sensing Information Engineering, Wuhan University, Wuhan 430079, China
Email: shaozhenfeng@whu.edu.cn

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ABSTRACT:

This paper analyses a large number of factors related to the influence degree of urban waterlogging in depth, and constructs the Stack Autoencoder model to explore the relationship between the waterlogging points' influence degree and their surrounding spatial data, which will be used to realize the comprehensive analysis in the waterlogging influence on the work and life of residents. According to the data of rainstorm waterlogging in 2016 July in Wuhan, the model is validated. The experimental results show that the model has higher accuracy than the traditional linear regression model. Based on the experimental model and waterlogging points distribution information in Wuhan over the years, the influence degree of different waterlogging points can be quantitatively described, which will be beneficial to the formulation of urban flood control measures and provide a reference for the design of city drainage pipe network.

1. INTRODUCTION

The rapid development of the city and the dramatic changes in the global climate has led to the increased risk of sudden rainstorms in urban areas, and their impacts have gradually expanded. The waterlogging caused by heavy rainstorms in the city always makes public traffic paralysis, public travelling inconvenience, or brings a serious threat to the safety of people's life and property.

At present, the most of researches on urban waterlogging are mainly aimed at the problems of waterlogging reasons, model prediction, risk assessment, prevention and control decisions, etc. However, the architecture methods of waterlogging prediction model are complicated, such as Flood Area Model (Xue et al., 2016), Storm Water Management Model (Liao et al., 2014; Chen et al., 2010). Otherwise, the related researches in risk assessment usually establish a system or model to evaluate the threat of waterlogging, such as Simplified Urban Waterlogging Model (Quan et al., 2010), Network Information System (Rahadianto et al., 2015). The realization of these complicated models or systems often requires longer time and more funds, so they are more suitable for long-term planning in urban waterlogging disaster prevention and control work.

To solve the problem of urban waterlogging disaster, the most direct method is to replace the city drainage system. However, in the urban short-term waterlogging disaster prevention and control work, the overall change of the city drainage system is not realistic. Therefore, this paper makes a statistical analysis of a large number of relevant data around the waterlogging points, and combined with the principle of the Stacked Autoencoder network, to dig out a hidden deep relationship between these numerous data and realize the quantitative analysis of the waterlogging influence on the residents' work and life. The analysis results of the waterlogging influence degree can be used as a reference for whether this region is given a priority in the waterlogging prevention and control work.

* Corresponding author: Shao Zhenfeng, professor, Ph.D supervisor. E-mail: shaozhenfeng@whu.edu.cn

2. FRAMEWORK

In order to analyse the influence degree of waterlogging in the urban areas, this paper quantifies the waterlogging impact. Based on the actual data acquired from the urban management department, the spatial data related to waterlogging influence degree will be comprehensively analysed. As the living density, educational facilities, transportation network, service facilities and other spatial data around the waterlogging point are closely related to the influence degree, the statistical analysis function of ArcGIS software can be used to calculate the relevant data within a certain buffer range. After the statistical data is normalized, a data series related to influence degree of each waterlogging point will be obtained.

In the study of the waterlogging influence analysis, the data volume is large, and the relationship between these spatial data and waterlogging influence degree is complex, which is difficult to describe with simple linear function. Therefore, based on the principle of deep learning model, the Stacked Autoencoder network constructed by multi-layer Sparse Autoencoder can be adopted to excavate the complex relationship, so as to realize quantitative analysis of urban waterlogging effect.

After determining the algorithm model and input data, the labels need to be required for the process of model's parameters training. At present, the relevant index system comprehensively evaluating waterlogging impact has not yet formed, so the labels of waterlogging influence degree cannot be obtained directly. In