Groundwater level change based on edge computing and translation accuracy of urban English

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Abstract
For China, water resources are very scarce, mainly because of the rapid economic development. Especially in the north of China, in order to meet the needs of local social development, groundwater in North China has been overfished for many years, resulting in serious environmental problems. The plain area of S city is a typical groundwater overfishing area in North China Plain. Long-term overexploitation of groundwater disturbs the balance between recharge and drainage. The groundwater level in the plain of S city decreased rapidly, forming a large number of groundwater depression funnels in this area. In the past few decades, the scale of groundwater drawdown funnel has been expanding, causing geological and ecological problems such as cracks and collapses. In view of the fact that the groundwater level in S city has been declining and the scope of groundwater depression funnel has been continuously extended, comprehensive management has been implemented. Two governance methods can be used through edge computing. First, we should speed up the construction of the South-to-North Water Diversion Project and use the river water allocated by the South-to-North Water Diversion Project to replace the groundwater extracted from the receiving area. The second is underground water pressure mining. Control the intensity of water extraction, improve the efficiency of industrial and agricultural water use, and reduce the use of groundwater. On the basis of the analysis of language and usage standards, combined with examples, we can take the city English of Los Angeles as a reference, expand the analysis of language use and social pragmatics, and check the mistranslation of Chinese city English, so as to improve the accuracy of translation. Based on the study of groundwater level change and the accuracy of urban English translation, this paper applies it to edge computing, which promotes the development of groundwater treatment and urban English translation.

Keywords Edge computing · Groundwater level change · Urban English · Translation accuracy

Introduction

Water resources have always been an important resource for the world, especially for the economic development of the country. There is a more important element in water resources, which is groundwater resources. It is not only a part of water resources but also plays an important role in the ecological environment. In China, the development and utilization of groundwater has a long history (Loo and Du Verle 2016). Before the mid-1960s, groundwater use was relatively rare. From the mid-1960s to the late 1970s, China began to develop and utilize groundwater on a large scale (Maleczewski 2006). By the end of 1979, China’s groundwater use had reached about 40 billion cubic meters. Since 1985, the economy has developed rapidly and the water consumption has risen sharply. By 2020, groundwater consumption will reach 106.9 billion cubic meters. This paper collects the historical data of groundwater in S city plain from 1985 to 2020 and analyzes the relationship between the characteristics of groundwater level change and groundwater level change (Motlagh et al. 2020). Using multiple linear regression analysis of edge calculation and BP genetic algorithm of the neural network, we create a prediction model for groundwater depth in S city plain.
and simulate the average ditch depth of groundwater in S city plain (Schlossberg and Brown 2004). After comparison, genetic BP and neural network prediction models are selected to comprehensively deal with the groundwater overfishing in S city from 2016 to 2021. The average depth of groundwater in the plain of S city is predicted and analyzed (Singh and Singh 2017). There are significant differences in the speed and degree of groundwater level decline in different areas of S-class city. In the small areas of west, north, northeast, and southwest, the decline of groundwater level is relatively small, while in the middle, south, and east, the decline of groundwater level is relatively large. The water level in the southeast is the worst (Singh et al. 2017). According to the investigation and comparison, compared with the situation without comprehensive treatment of groundwater overfishing, the comprehensive treatment of groundwater overfishing in city S can effectively reduce the decline rate of groundwater level and achieve better treatment effect in the future. With the continuous development of China’s economy and gradual integration into international standards, it is very important to improve the accuracy of city English translation and deepen the cultural exchanges between China and the west (Singh et al. 2014). Therefore, in the process of improving the accuracy of English translation in the process of urbanization, China should pay attention to the process of combining Chinese local culture with Western English culture, build a new urban English culture, integrate English culture into people’s daily life, and meet people’s needs for English culture and the requirements of English culture for economic development. This paper introduces the progress of English culture construction in cities and how to strengthen the construction of English culture (Zhao et al. 2018).

Materials and methods

Overview of study areas

S city is located in the south-central direction of H province, including two main geological units of T mountain range and North China Plain. The land structure of the area is between Shanxi and North China fault zone. According to the geomorphological origin and morphological characteristics, the 100-meter-high profile can be divided into two types: the western mountainous area and the eastern plain. In the west, there are hills and highlands in the T mountain area, with an average altitude of about 1000 m. The highest peak of P county in northwest China is Nantouliang, 2281 m above sea level, which is the fifth peak of H province. The mountainous area is 7320 km², accounting for 52.0% of the whole city, as shown in Fig. 1.

Research methods

Edge calculation

In addition to the definition of MEC, ETSI is also very involved in the standardization of MEC integration into cellular networks. In this part, the paper summarizes the standardization of MEC in ETSI, describes the ETSI reference architecture, and explains the various choices of the current MEC regulations.

ISGMEC first issued a standard solution to develop a (POC) framework to help MEC. The basic purpose of this document is to explain the POC activity process to promote MEC development, explain important aspects of MEC, and build confidence in MEC’s technical feasibility.

MEC is divided into a server layer and virtualization platform, which is mainly responsible for computing and storage, while the service layer is responsible for program operation, authorization, and traffic rules.

In this part, we will analyze the current situation of task unloading strategies in different countries. From the perspective of task sharing strategy, we can study in different directions according to different perspectives. There are two types according to the number of users. One is a task unloading strategy in a single-user scheme, and the other is a multiuser one. In these two parts, many scientists have proposed and explored many ideas and different unloading algorithms have been developed for different scenarios. According to the optimization factors, it can be divided into three types. The first is to limit the delay of task execution to optimize energy consumption, the second is to limit energy consumption and optimize the delay of task execution, and the last step is to fully consider these two optimization factors.

Prediction model of groundwater level change

To establish a model for multivariate linear regression, we need to determine the dependent variables and independent variables and have certain confidence when establishing the multivariate regression equation. In this study, the annual GDP of city S, the long-term groundwater extraction of S city, and the precipitation area of many regions were reviewed as independent variables from 1985 to 2019. From 1981 to 2019, S city, on March 26, used the average groundwater depth as independent variable, and confidence level was set at 95%. The multivariate regression equation is established as follows:

\[
Y = -0.0140198x_1 + 0.005186x_2 + 1.65636x_3 - 26.132137
\]

where \(Y\) is the average buried depth, \(x_1\) is the rainfall, \(x_2\) is the GDP, and \(x_3\) is the mining volume. The parameter table of the
The multivariate linear regression equation is shown in Table 1.

In order to speed up the network training, we need to standardize the original data. In this study, we use the premmx function to normalize the input and output of the original data samples and distribute them evenly in the range of \([-1,1]\). The conversion formula is

\[
PN = \frac{2(a-mina)}{maxa-mina} - 1
\]

The initial population size of this study was 40, using real coding. The length of encoding is

\[
l = \frac{r \times y + y \times c + y + c}{x}
\]

The significance F (F significance statistic)

\[
F = 2.97E-14.9
\]

Table 1 Parameter table of multivariate linear regression equation

| Variables | Regression coefficient | Statistic | P value |
|-----------|------------------------|-----------|---------|
| Multiple R (multiple correlation coefficient) | 0.950196352 | 0.0064 |
| Adjusted R square (adjusted remeasurement coefficient \(R^2\)) | 0.84568159 | X2 | 1.32E-14.9 |
| Significance F (F significance statistic) | 2.97E-14.9 | X3 | 0.000103 |
$C$ is the number of nodes in the output layer. The fitness function is defined as the sum of squares of neural network deviations:

$$f = \sum (x_i - \bar{x})^2 \quad (5)$$

The individual’s choice can be made according to the probability value, and the formula is as follows:

$$P_i = \frac{f_i}{\sum_{i=1}^{k} f_i} \quad (6)$$

**Results**

**Historical changes of groundwater level**

It can be seen from Fig. 2 that the groundwater level of the plains in the west, north, northeast, and southwest of city S has decreased slightly in 35 years, but it has decreased significantly in the middle, south, and east of city S. The decrease in groundwater level is the largest in the southeast. Because the groundwater level changes in different areas of the southern city are different, six monitoring points with long-term observation data are selected as the representative locations of groundwater level changes in different areas, and the characteristics of groundwater level changes in flat areas are studied.

The annual fluctuation of groundwater depth and average groundwater depth (annual groundwater depth, March 26) of six representative monitoring points in S city plain from 1984 to 2020 is listed as shown in Fig. 3. The average groundwater depth of each representative location and level shows a relatively stable fluctuation pattern. In recent years, the groundwater depth is increasing and the groundwater level is rising. In 35 years, the average groundwater depth of the plain increased from 8.23 m in 1985 to 33.47 m in 2020, the total depth increased by 26.35 m, and the annual average increased by 1.02 m. The Handai station increased from 4.76 m to 20.48 m, with a total increase of 17.32 m. The average annual growth is 470000. Station I increased from 12.36 m to 29.21 m. The cumulative increase was 18.94 million, with an average annual increase of 490000. The Xixiaoting station increased from 9.36 m to 47.13 m, with a total increase of 38.27 m and an average annual increase of 1.36 m; the F station increased from 12.86 m to 49.37 m, one of which increased by 36.25 m, with an average annual increase of 0.93 m. The Xinji station increased from 8.85 m to 42.38 m, with a total revenue of 34.53 m. The average annual revenue of the Mayu station was 840000, an increase of 7.35 m. A total increase is 41.37 meters, with an average annual increase of 0.91 meter.

Figure 4 shows the variation curve of average groundwater depth increase in each representative monitoring station and plain area.

Table 2 shows the variation of average groundwater depth of each representative monitoring station and plain area.

The variation of groundwater depth in S plain is highly consistent year by year, and the variation of groundwater depth in different months is also highly consistent year by year. For the year-on-year fluctuation in different months, it follows the law of year-on-year fluctuation of groundwater depth, as shown in Fig. 5. The maximum average depth of groundwater appears in January or March, mainly in March.
and the minimum value appears in July. Compared with July, the groundwater level rose in September and November.

**Groundwater level prediction**

For the purpose of this study, the future groundwater extraction in S plain is estimated in two cases.

1. Assuming that there is no overfishing of groundwater in S city, the groundwater extraction amount of S city plain in the next five years is calculated according to the average annual pumping amount. From 2016 to 2020, 2.26 billion cubic meters of groundwater will be extracted from the plain of S city every year.

2. According to the actual situation, consider the effect of the measures for excessive water extraction in the north-south water transfer project, the estimated value of groundwater replacement and groundwater pressure water intake project, and the groundwater volume of all levels of exploitation. According to the 13th five-year plan of S city, by 2020, the groundwater intake of S city will be reduced to 1.532 billion cubic meters, 25.8% less than that of 2.187 billion cubic meters in 2020, with an average annual reduction of 128 million cubic meters. Therefore, in this investigation, it is assumed that during the 13th five-year plan period, the groundwater extracted from S city plain is equal to the total groundwater extracted from S city plain. By 2020, groundwater extraction will be reduced by 27.8% compared with that by 2020. By 2020, the exploitation of groundwater in the plain of S city will be reduced from 1.913 billion cubic meters in 2020 to 1.436 billion cubic meters, equivalent to an average annual decrease of 126 million cubic meters. In other words, from 2016 to 2020, the groundwater exploitation of S plain will be...
1.736 billion cubic meters, 17.95 billion cubic meters, 1.628 billion cubic meters, 1.59 billion cubic meters, and 1.428 billion cubic meters, respectively.

Annual rainfall is affected by many factors. Annual rainfall is highly random. Annual rainfall depends on the area and year. The change of underlying surface will also affect the annual rainfall. Therefore, in the long run, it is impossible to make an accurate forecast. It is not easy to accurately predict the annual precipitation, but there is also a rule, that is, the years with rich rainfall and dry rainfall alternate. According to this rule, the precipitation of the forecast year can be estimated in the future. This method also has a certain practical value. In this study, we used two methods to predict groundwater level precipitation. (1) According to the average precipitation of several years, the precipitation of future forecast years is calculated. (2) According to the natural law, the precipitation of the future forecast year is estimated according to the precipitation and height and the precipitation is estimated according to the law of the alternation of drought years, as shown in Fig. 6.

Based on the long-term observation and analysis of the variation of precipitation in S city, it can be determined that the alternate period of shallow water precipitation and dry precipitation is about five years. The average annual rainfall of S city in rainy season is 678.2 mm (in this survey, the annual rainfall is more than 550 mm), while the average annual rainfall in dry season is 358.9 mm (in this survey, the annual rainfall is less than 400 mm), and the average annual rainfall for many years is 469.2 mm. According to the cycle of high, flat, and low rainfall in S city, 2020 is a dry year, while 2020 is a normal year. Rainfall can be estimated from 2016 to 2020. 2016 will be a rainy year, 2017 and 2018 will be a normal year, 2019 will be a dry year, and 2020 will be a normal year.
normal year. Therefore, in this study, the condition is that the change of rainfall depends on the regularity of rainfall, flatness, and drought, so the annual rainfall in 2016 is 618.9 mm and that in 2017 and 2018 is 504.8 mm and 442.3 mm, respectively. The annual rainfall in 2019 and 2020 is 356.8 mm and 492.1 mm, respectively. Figure 7 shows the change of estimated precipitation from 1985 to 2020.

Since the reform and opening up, the social and economic development of city S has been rapid, and the GDP has grown rapidly. At present, the outline of the 13th five-year plan for the national economic and social development of S city has been published. According to the planning objectives, the annual average GDP growth rate of S city will be 6.3% in the 13th five-year plan period. From 2016 to 2020, the GDP of S city and GDP of all levels are estimated. In 2020, the GDP of S city is 557.83 billion yuan, and the GDP of S is 526.39 billion yuan, with an annual growth of 6.8%. From 2016 to 2020, the GDP of the city is 576.43 billion yuan, 61.79 billion yuan, 66.28 billion yuan, 73.47 billion yuan, and 77.26 billion yuan. The GDP of the plain area is 548.24 billion yuan, 589.71 billion yuan, 635.82 billion yuan, 689.96 billion yuan, and 7387.73 billion yuan, respectively.

The estimated groundwater exploitation, rainfall, and GDP in the plain area of S city in the future are shown in Table 3.
Prediction of groundwater level change

The data of precipitation, GNP, average groundwater depth, and average groundwater depth from 1981 to March 26, 2020, were imported into the model as simulation training data, and the estimated groundwater data of S city from 2020 to 2020 were imported into the model to calculate the average groundwater depth. The prediction results of buried depth of S city from 2016 to March 26, 2021, are shown in Table 4.

The change curve of average buried depth of underground level in the plain area of S city from March 26, 2015, to 2021 is shown in Fig. 8.

Based on the analysis of the prediction results of the plain water depth in S city from 2020 to 2021, it is found that under the condition of comprehensive management of excessive groundwater, there are great differences in the changes of groundwater depth, resulting in excessive groundwater. It turns out that there is no overall control over usage. Comprehensive treatment can bring better results. Through the comprehensive management of excessive use of groundwater, the reduction rate of groundwater decreased significantly. In 2021, the average depth of underground ditch in the plain is about 40.98 m, with an average annual growth of 0.53 m; the average burial depth is 42.83 m, with an average annual increase of 0.76 m.

In addition, in the calculation of annual average precipitation and the calculation of precipitation predicted according to the variation law of abundant, normal, and low precipitation, there are great differences between the predicted results. When calculating the average precipitation in several years, the annual decline of groundwater level in the forecast period is more uniform, because the groundwater extraction, GDP, and precipitation in the forecast period are relatively or not changed at all. The trend of lowering groundwater level is relatively stable. When calculating the precipitation, the change rule of groundwater level during the prediction period is the same as the previous groundwater level. If there is a lot of precipitation in a year, the water level on March 26 of the next year will be lower, or in some cases, if there is less precipitation, the water level on March 26 will be very high. The annual decline of groundwater level will be great. In these two cases, the process of changing the water level is very different. The predicted groundwater level in 2021 is relatively close under the two conditions.

Discussion

Analysis of influencing factors of groundwater level change

The change of groundwater level is affected by many factors, which are generally considered natural, direct, and indirect. Each factor will have different degrees of influence on the groundwater level. They connect and interact with each other to determine the change of groundwater level.

The geological conditions of a certain area will not change significantly in a short time and will not significantly affect the change of groundwater level. Therefore, it is not necessary to consider the factors that affect the change of groundwater level in a short time. Meteorological and hydrological factors will obviously affect the change of groundwater level. The main influencing factors are rainfall, water leakage, water evaporation, lateral recharge, and lateral runoff. If the water level rises, it must be taken into account when analyzing the change of groundwater level.

Since 1985, rivers and lakes in S city plain have been in a state of drought all year round. They only fill the groundwater in heavy rain, while the leakage of rivers and lakes will be affected by rainfall, which is closely related to each other. The groundwater depth in the plain of S city is relatively deep, and the influence of groundwater evaporation on the change of

| Year | 2020 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 |
|------|------|------|------|------|------|------|------|
| Depth (1) (a) | 38.78 | 39.38 | 40.03 | 40.98 | 41.71 | 42.92 | 43.88 |
| (b) | 38.78 | 39.8 | 39.59 | 40.04 | 41.01 | 42.7 | 43.72 |
| (2) (a) | 38.78 | 39.59 | 40.18 | 40.67 | 40.98 | 41.42 | 41.62 |
| (b) | 38.78 | 39.7 | 39.32 | 39.51 | 39.85 | 41.12 | 41.77 |
The groundwater level in the western mountainous area of S city has a very obvious influence on the lateral groundwater recharge in the eastern plain. This is an important factor affecting the change of groundwater level in the plain (Habibian and Hosseinzadeh 2018). The recharge is mainly affected by the precipitation in the western mountainous area, but the calculation result of the recharge itself is not accurate, and the water level of the recharge level in the future forecast period is unknown, so it cannot be predicted and calculated (Hollevoet et al. 2011). Due to years of overfishing, the horizontal hydraulic gradient at the boundary between S city plain and other administrative regions is very small, the horizontal flow is very weak, and the movement of groundwater flow is almost vertical upward and downward. And side spills are usually not counted. The impact of biological factors on groundwater level is mainly the impact of virtual water consumption on groundwater level of agricultural products (mainly food). By watering plants with groundwater, part of the irrigation water is stored and transferred to agricultural products. Groundwater is used to irrigate plants, but some water is added to groundwater by osmosis, resulting in changes in groundwater level. This part of the water and the water consumed by agricultural products are provided by artificially extracted groundwater, which is also related to the annual rainfall (Jones 2003).

The main human factors leading to the change of groundwater level are the conversion of surface water for irrigation and the extraction of artificial groundwater. The utilization of groundwater mainly occurs in agriculture, followed by industry, life, and ecology (Kamruzzaman et al. 2014). The city is short of surface water. Agricultural water consumption is affected by rainfall, so it is difficult to predict it effectively in the future. Human beings need water resources as the basic support for the development of various industries. Therefore, in human society, because of the influence of various activities, the demand for water is very strong, because all walks of life are inseparable from water, especially groundwater, which is more important. Of course, we can also see the rapid development of human beings and the great demand for water from GDP.

The selection of influencing factors of groundwater level has a great influence on the prediction accuracy of the model (Canepa 2007). In order to select the factors that will affect the creation of the model, all conditions must be carefully considered. There are significant differences in the nature and degree of the influence of various factors on the change of groundwater level and the difficulty of obtaining effective observation and statistical data of various factors. Considering the extensive management of groundwater overfishing in S city, the groundwater extraction conditions will change in the future, and it will be difficult to obtain the statistical data of some influencing factors in the past (Celik et al. 2014). This study selected S city for simulation, because it is representative, and the data is relatively easy to obtain, which can be well predicted.

**Analysis of the current situation of city English translation**

Common translation errors of public signs mainly include linguistic and pragmatic errors. High-quality and standardized public signature translation should avoid speech errors. In other words, you need to avoid spelling errors, grammatical errors, punctuation errors, and incorrect formatting. Reduce or avoid practical errors, such as Chinese and English, cultural
misunderstanding, ineffective communication, stereotyped style, and other problems (Ewing and Cervero 2010).

Research shows that English translation errors of Chinese public signs are more common and worrying. Speech errors are relatively low-level errors. It has no serious consequences, but it will leave a bad impression on foreign friends. For example, some large shopping centers usually carry public signs, such as “prohibited by relevant government regulations....” In the actual translation, it is spelled “gocerment.” “Improper use” is spelled as “improper use.” Many tourist attractions have logos, such as “a journey of civilization with me.” However, the spelling of “sand by me” in English is amazing, and the correct one is “stand.” Chinese tourists may ignore this “small” mistake, but it will bring confusion to foreign tourists who do not speak Chinese (Bibri 2018).

The common grammatical errors in public signs are singular and plural errors, as well as the abuse of some languages. For example, in crowded public places, warnings may be displayed, such as “hug our children,” which translates into “hug our children.” In another example, “Jagd person” must be an adjective in “Jagd person ense dung,” but it is often incorrectly translated into the verb phrase “look for broadcast” and correctly translated into “Broadcasting service.”

The standardized translation and arrangement of common characters should avoid the problems of more or less word space, improper use of punctuation, and initial capitalization. For example, in some indoor public places, there is a sign saying “pet must be hugged,” and the corresponding English slogan is “Please Carry the pet in Your Arms.” “The pet in” has obvious printing and capitalization problems, which makes people think that “the pet in” is a word.

In large public places, the standard of translating public signs is very important, such as whether the translated name is used consistently and whether a word is translated many times. However, the problem of translation inconsistency is very common in many public places in China. For example, the most common problem of inconsistent translation of “toilet” is that there are several translations of “WC,” “toilet,” and “restrooms” in the same place. It should be translated into the latter two consistently. Another example is the translation of “ticketing office.” In the translation of “Ticket Check” or “Check in” in many railway stations, high-speed railway stations, and airports, the correct translation should be “Check-In.”

**Strategies to improve the accuracy of city English translation**

The USA can be said to be the center of globalization, especially in New York and Los Angeles, where there are many tourists and the phenomenon of immigration is very common. At this time, we will find that there are many languages, and poor communication is a very real problem. Therefore, they set up a targeted organization, mainly responsible for multilingual translation, to provide better services. In accordance with the translation standard of official characters, the service department provides multilingual translation and interpretation services, which will involve many translation languages. In many Chinese cities and regions, Chinese translation service is divided into “Putonghua” and “Cantonese.” The aim is to give all citizens the opportunity to use their mother tongue to enjoy the social welfare of the USA (Aminu et al. 2017).

In the USA, many nonprofit organizations (such as DMV) and popular tourist attractions with large numbers of passengers (e.g., Universal Studios and Disneyland) produce multilingual pamphlets and maps. At the same time of convenience, it increases people’s popularity and promotes intangible cultural and economic development (Banerjee et al. 2018).

In addition to providing free multilingual translation services, the government also provides a special feedback form for the general public to discover translation errors in time. This table can be written at that time or transmitted through the network, which is very convenient and easy to understand. The responsible management department also has an appropriate mechanism for processing and responding to feedback.

Translators of public signs must be certified by the government. Certification covers basic personal information, educational information, language skills, translation skills, etc. This measure greatly standardizes the quality and professional skills of public sign translators and fundamentally ensures the quality of public sign translators.

**Conclusion**

Based on the long-term observation data of groundwater level in the plain area, this study analyzes the characteristics of groundwater level fluctuation in this area. Since 1985, there have been three factors for the annual rainfall in the flat area of city S: groundwater exploitation, rainfall, and the influence of all the state-owned GDP on the change of urban average water level. Using multiple linear regression analysis and BP genetic algorithm for the neural network, a model city for shallow groundwater depth prediction is established and compared. After review and analysis, we selected a genetic model to predict the BP neural network, from 2016 to 2021 for comprehensive treatment of groundwater overuse in S city. In the case of implemented but not comprehensive conditions, we should deal with the problem of groundwater overuse in cities and predict and analyze the average depth of groundwater on the horizontal surface.

**Declarations**

Conflict of interest The author declares no competing interests.
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