Retraction

Retraction: Research on Intelligent Management of Campus Water Supply System under the Background of Big Data (J. Phys.: Conf. Ser. 1744 022005)

Published 16 September 2022

This article has been retracted by IOP Publishing following an allegation that raises concerns this article may have been created, manipulated, and/or sold by a commercial entity. In addition, IOP Publishing has seen no evidence that reliable peer review was conducted on this article, despite the clear standards expected of and communicated to conference organisers.

The authors of the article have been given opportunity to present evidence that they were the original and genuine creators of the work, however at the time of publication of this notice, IOP Publishing has not received any response. IOP Publishing has analysed the article and agrees there are enough indicators to cause serious doubts over the legitimacy of the work and agree this article should be retracted. The authors are encouraged to contact IOP Publishing Limited if they have any comments on this retraction.

Retraction published: 16 September 2022
Research on Intelligent Management of Campus Water Supply System under the Background of Big Data

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Abstract. This article uses Excel to preprocess the readings of smart water meters in the four quarters of a university, filter and delete invalid data, and divide 91 water meters by quarter, month and different functional areas into 6 major functional areas. Then get the characteristics of water use in different functional areas. Next, horizontal analysis and vertical analysis are carried out for the relationship between water surface levels. Descriptive longitudinal statistical analysis of big data is carried out through spss software, and then based on correlation analysis and regression analysis, the horizontal relationship model of water surface level is established, the multiple linear statistical regression prediction model is obtained, and the error analysis model between the predicted value and the actual data is established. Finally, the three steps of discovering leakage, determining the location, and repairing the leakage point are used to solve the problems in the campus water supply system, reduce the leakage of the campus, determine a reasonable water use rule, and solve the problems in the intelligent management of the campus water supply system. The purpose of improving campus services and management.

Keywords: Big data, spss software, Correlation analysis, Multiple linear regression model

1. Introduction
The campus water supply system is an important part of campus public facilities. In order to ensure the normal operation of the campus water supply system, the school needs to invest a lot of manpower, material resources and financial resources[1]. With the development of science and technology, smart water meters have been widely used on campuses, so that a large amount of real-time water supply system operating data can be obtained. The logistics department hopes to use these data to discover and solve problems in the water supply system in a timely manner through mathematical modeling and data mining, and to improve campus services and management.

It is known that the water meter hierarchy of a school district and the readings of all water meters in four quarters (at a certain time interval, such as 15 minutes) and the corresponding water consumption data are known. Please use this information and data to build a mathematical model and discuss the following issues: (1) Statistic and analyze the changing law of each water meter data, and give the water use characteristics of different functional areas (dormitories, teaching buildings, office
buildings, canteens, etc.) on the campus. (2) Establish a relationship model between water meter data based on the relationship between the water meter levels in the campus, and use existing data to analyze model errors. (3) Leakage of the water pipeline network is a serious problem. Statistics show that in a well-maintained public water supply network, the average water loss is about 5%; while in the older pipe network, there will be more water loss. Please use the data provided in the attachment to establish a mathematical model to analyze the leakage of the campus’s water supply network. (4) It is not easy to detect the hidden leakage of underground water pipes. It takes a lot of manpower to detect and locate the leakage of water supply pipes. It will be extremely beneficial if the real-time data of the water meter can find and determine the location of the leakage in time. Please help the school solve this problem.

2. Method

2.1 Preprocessing the big data of campus water supply system

Before analyzing the data, first preprocess the data. There are a total of 93 sets of data in the water meter data, and a total of 91 sets of valid data. The data marked "no record" is invalid, and the success rate accounts for 99.8%. Observing the data in four quarters, we find that there are more than 700,000 data in each quarter. Among them, the fire department only has data in the second, third, and fourth quarters, while the education supermarket only has data in the first quarter. Correct or eliminate abnormal data. For example, the water consumption of the swimming pool at 12 noon on April 25th in the second quarter soared. Observing the water consumption data for several hours before and after, it is not ruled out that the data is abnormal due to the worker's record error. Finally, use Excel to establish a pivot table to obtain the summation value of each water meter in the four quarters, observe and analyze the change law of each water meter. Draw charts and compare the characteristics of water use in each functional area.

2.2 Establish model relationships between water meter data and analyze errors

There are 91 water meters remaining through data preprocessing. There are 11 first-level tables, 51 second-level tables, 25 third-level tables, and 4 fourth-level tables. Use SPSS software to perform Pearson correlation linear analysis on the levels[2]. Next, the specific operation steps in spss are as follows: "Analysis-Correlation-Bivariate", perform correlation linear regression analysis, and obtain a multiple statistical regression mathematical model.

3. Results

3.1 Descriptive statistical analysis of water surface level

Descriptive statistical analysis through SPSS software. The details are as follows:

| Level      | N  | Minimum | Maximum  | Sum      | Mean     | Std. Deviation |
|------------|----|---------|----------|----------|----------|----------------|
| first-level| 11 | 25.17   | 121416.71| 266494.58| 24226.780| 37421.25215    |
| second-level| 51 | 11.20   | 186025.00| 566969.22| 11117.0435| 30403.72304    |
| third-level| 25 | 27.20   | 18745.84 | 102758.63| 4110.3452| 5401.03976     |
| fourth-level| 4  | 58.63   | 5983.49  | 14751.35 | 3687.8375 | 2780.82896     |

Valid N (listwise) | 0  |

Through Table 1, we can clearly find that the number of water meters at different levels, as well as the average, standard deviation, sum, maximum, and minimum values between each level.
Table 2. Top 5 and bottom 5 of total water consumption in each functional area

| water meter name            | number           | Total water consumption |
|-----------------------------|------------------|-------------------------|
| 64397 secondary table       | 3620300300       | 121416.71               |
| Area 4+                     | 3620301400       | 109700.91               |
| Area 3+                     | 3620300400       | 57152.87                |
| Breeding team 6721 +        | 3620300200       | 50620.96                |
| XXX flower nursery+         | 3620300100       | 47339.14                |
| ...                         | ...              | ...                     |
| XXX botanical garden        | 3160300300       | 74.4                    |
| Tea garden+                 | 3620301500       | 58.63                   |
| XXX central pool            | 3170200100       | 27.2                    |
| Gymnasium tennis court      | 3030100101       | 25.17                   |
| Dangerous goods warehouse+  | 3620302400       | 11.2                    |

It can be seen from Table 2 that there is an intermediate relationship between the water meter name, water meter number and the top 5 of each water meter. There are more people in swimming pools, dormitories etc, and the water consumption is larger. The last one is the dangerous goods warehouse, which is rarely approached by people, so the water consumption is the least. Therefore, the change in water consumption is related to the number of people in various places.

3.2 Analyze different functional areas

It can be found from Figure 1 that there are 26 teaching building functional areas, accounting for 28% of the total; the largest proportion, 23 office building functional areas, accounting for 25% second; canteen and sanitary functional areas both have 9, accounting for the least 10%. There are 91 valid water meter data in this article, which can be divided 6 major functional areas, and the characteristics of water use in each major functional area are introduced below.

Figure 1. The major functional areas account for the proportion of the total functional areas
Figure 2. 12-month water consumption in dormitory functional area

It can be found from Figure 2 that the dormitories consume the least water in February compared to other months. It is not ruled out that the winter vacation students go home for the New Year; the highest water consumption occurs in August. At this stage, students return to school one after another, and water consumption gradually increases.

Table 3. Total water consumption in the fourth quarter and the year in health functional areas

| Public health | First quarter | Second quarter | Third quarter | Fourth quarter | Total water consumption |
|---------------|---------------|----------------|---------------|----------------|-------------------------|
| East toilet   | 169.07        | 297.25         | 336.01        | 316.06         | 1118.39                 |
| West toilet   | 1093.03       | 1559.69        | 902.15        | 1629.6         | 5184.47                 |
| Athletic field toilet | 400.19    | 425            | 407.53        | 371.34         | 1604.06                 |
| Nano building toilet | 37.84      | 47.24          | 32.94         | 57.21          | 175.23                  |
| Fish group toilet+ | 177.26    | 257.25         | 169.2         | 134.32         | 738.03                  |
| Breeding toilet2+ | 37         | 45.53          | 66.86         | 36.86          | 186.25                  |
| Breeding toilet1+ | 14.33      | 41.58          | 53.76         | 25.02          | 134.69                  |
| Public restroom | 23.64       | 34.82          | 58.88         | 28.73          | 146.07                  |
| bathroom      | 91.78         | 1048.3         | 1331.3        | 668.69         | 3140.07                 |

Figure 3. Water consumption in four quarters in the sanitation function area
It can be found from Figure 3 and Table 3, water consumption in the third quarter is generally higher than in other quarters, and water consumption in the first quarter is generally lower than that in other quarters; the annual total water consumption in the toilet west is the highest, followed by the bathroom; the toilet on the first floor of the breeding hall The total annual water consumption is the lowest. It can be seen that in the campus, the water consumption in the third quarter is usually more than that in the first quarter, and the water consumption is related to the quarter time.

![Figure 4. Water consumption in four quarters in the sanitation function area](image)

It can be found from Figure 4 that the different seasons and climates, the water consumption of the campus in a year fluctuates greatly. It is observed that the water consumption in April and July-August is relatively large. In January and February, when the winter arrives, the school water consumption is less than in other months. Then June enters the summer, the weather gradually warms, and the use of water for bathing and laundry increases. Lead to an increase in water consumption. As October enters winter, the boiler water and heating water increase will also lead to an increase in water consumption.

3.3 Establish model relationships between water meter data and analyze errors

Through the school district water surface level relationship, use SPSS software to conduct longitudinal and horizontal statistical analysis respectively, establish the relationship model between water meter data, and use the existing data to analyze the model error[3]. The following is a linear regression analysis of the relationship between the first two water surface levels in the campus.

![Figure 5. The first water surface level division](image)

According to the hierarchical relationship in Figure 5, the specific operation steps in SPSS are as follows: "Analysis-Correlation-Bivariate". The result is $a=1219.023$, $b=4.678$.

Then the unary linear regression equation is

$$y = 1219.023 + 4.678x$$

(1)
Figure 6. The second water surface level division.

According to the hierarchical relationship in Figure 6, the specific operation steps in SPSS are as follows: "Analysis-Correlation-Bivariate", Finally, the multiple linear regression model can be obtained.

4. Conclusions

Through the statistical comparison of the overall functional area, the average water loss rate of the fleet + in the first quarter was filtered out. It is found that the average water loss rate of the fleet is above 15%, which is beyond the range of the normal average water loss rate. After the step-by-step screening, it is found that the fleet + the third level mark code is located. It is inferred that the campus water supply network is in the fleet + this The leakage in a water meter is too serious. The quarterly average water loss rate of the fleet + and breeding hall + water meter exceeded the normal average water loss rate (about 5%). Looking up the level of the water meter, the fleet+ is the third-level water meter, and the breeding hall is the second-level water meter. And because there is no water meter with more water loss in the process of searching for the first-level water meter, the leakage of the first-level water meter is excluded. Through the investigation of the data during the three months of the first quarter, it was found that the average water loss rate in the first week of March was the highest, and then the first week was screened and analyzed, and the average daily water loss rate was the highest on March 1, which can be determined The location of the water leak was in the third-level water meter fleet and the time was March 1.

For this kind of serious leakage problem, special personnel are arranged for regular inspection and maintenance to avoid large-scale waste of water. The serious leakage problem is solved in accordance with the three steps of "discovering the leakage-determining the location-repairing the leakage point". Reducing campus water leakage, determining reasonable water usage rules, and solving the problems of intelligent management of the water supply system on campus have achieved the goal of improving campus services and management.

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