Research on roof waterproof construction of agricultural construction engineering based on big data technology

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ABSTRACT

To improve the roof waterproof construction effect of agricultural construction projects, this paper applies big data technology to construction management and construction decision-making of construction projects. Moreover, this paper improves the traditional big data technology, and from the perspective of the roof waterproof construction requirements of agricultural construction projects, this paper improves data mining to make it a core intelligent algorithm that can be used for data recognition and analysis of construction projects. In addition, this paper simulates the construction process according to the roof waterproof construction process of agricultural construction projects, builds the corresponding intelligent construction simulation model and builds the agricultural construction engineering roof waterproof construction simulation through simulation research. Finally, after obtaining the data, this paper conducts experimental research and applies the data mining system of this paper to the analysis of agricultural construction engineering. From the experimental research, it can be known that the method proposed in this paper has a certain effect.

Introduction

The roof of an agricultural construction project is a covering and load-bearing structure located on the uppermost layer of an agricultural construction project. It is a very important part of the construction project, and one of its most important functions is to ‘shield from wind and rain’. Waterproofing and heat preservation are very important components of the building function, and whether it is handled well or badly directly affects the quality, use, and energy-saving aspects of the building (Mou et al. 2017). Therefore, it has been valued by mankind since ancient times. As early as in primitive society, humans knew that they would set up haylofts in caves to avoid wind and rain. In the era of ‘Qin brick and Han tile’, a sloping roof waterproof structure with tiles as the main waterproof material was formed. ‘Qin brick and Han tile’ describes the construction material’s achievements in the dynasties of Qin and Han. The brick of the Qin is known as the brick of the lead. Qin brick features basic decorations such as plaid checking, sunshine patterns and intricate photos portraying hunting and feasting. The Han tile end is more complex with decorations basic decorations such as plaid checking, sunshine patterns and intricate photos portraying hunting and feasting. The Han tile end is more complex with decorations. Moreover, this paper improves the traditional big data technology and applies big data technology to construction management and construction decision-making of construction projects. However, through on-site investigations on the leakage of reinforced concrete roofs of two buildings that adopted coating waterproofing practices, as well as retrieval and analysis of published literature on the damage of coating waterproofing roofs, we can find that the design and construction of the coated...
waterproof structure layer have always been a weak link in the roof engineering design. Moreover, the accumulation of work environment which is extremely unfavourable to the waterproof layer of the coating film will eventually lead to the rupture of the coating film layer and the waterproof failure (Guerra-Santin and Silvester 2017). Data visualisation is the graphical representation of information and data. Using visual components like charts, graphs and maps, data visualisation tools make it simple to see and understand trends, outliers and patterns in data.

Based on the above analysis, this paper uses big data technology to research and analyse the house waterproof construction of agricultural construction projects, and conduct research on its effectiveness, which makes a small contribution to the subsequent ecological agriculture and urbanisation process.

**Related work**

Roofing waterproofing materials in Europe mainly include modified asphalt coils, single-layer polymer sheets and oxidised asphalt linoleum. Among them, modified asphalt coils dominate and account for about 65%, single-layer polymer sheets have continued to grow and account for about 24%, while oxidised modified asphalt linoleum has rapidly decreased (Dodd et al. 2020). European polymer modified asphalt coils are very developed, and there are a variety of different products. Among them, France, Italy, Spain, Eastern Europe and Balkan countries mainly use asphalt coils. Other countries use a large number of single-layer polymer waterproof sheets, such as Austria accounting for about 45%, Ireland and Switzerland each accounting for about 42%, and Germany accounting for about 40%. Among the single-layer polymer sheets used in Europe, PVC waterproof sheet occupies a dominant position (Abuimara et al. 2019). Plasma polymerisation is a process for molecular deposit of thin conformable polymer layers on surfaces to indicate the development of an interphase between the plasma polymer and the epoxy resin, inter-laminal shear strength may be enhanced from the matrix. The main features of Single-layer polymer is cold construction, energy saving, environmental protection, low carbon, economy and no need of open flame. Single-layer polymer modified asphalt roofing coils have been used in some countries. Germany has standards, Sweden and other countries have used them in large quantities, and they have promoted their application technology to our country (Gao et al. 2020). German building waterproofing is still dominated by asphalt linoleum, of which modified asphalt linoleum accounts for more than 60%, and oxidised asphalt linoleum accounts for less than 40%. Among the modified asphalt felts, SBS modified asphalt felts accounted for about 92%, while APP modified asphalt felts accounted for only about 8% (Remmen et al. 2018). SBS modified asphalt linoleum accounts for more than 80% of the entire waterproof material in France, while APP modified asphalt linoleum is used less, accounting for about 4%, and rubber sheets are hardly used, and PVC only accounts for 1%–3%. The use of modified asphalt felt in Italy accounts for 95% of roofing materials. Among them, most of them are APP modified asphalt linoleum, polymer waterproof sheet is not used much, PVC waterproof sheet only accounts for 3%, and elastomer waterproof sheet only accounts for 1% (Endo et al. 2019). Switzerland uses two kinds of waterproof materials, especially PVC waterproof sheets, the annual consumption is as high as 65%, and the use of modified asphalt linoleum is also 35% (Beausoleil-Morrison 2019).

SBS, APP, PVC, EPDM waterproofing membranes, polymer cement-based and polyurethane waterproof coatings that the country has vigorously promoted have been widely used. However, the application of asphalt composite tire flexible waterproofing membranes and polyethylene polypropylene fibre double-sided composite membranes that have been restricted from development and use is on a downward trend (Xiong et al. 2020). Among the waterproof materials, SBS modified bitumen membrane is the undisputed leading variety in my country’s building waterproof material industry. Coiled materials are mainly used in roofing works. In addition, there is a certain disorder in the selection of materials for planted roofing waterproofing projects, which is related to the fact that domestic planting roofing technology has just started. In wall waterproofing projects, polymer cement-based waterproof coatings and waterproof dry mortar have become the first choice materials (Black 2018). Although the actual output of my country’s polymer waterproofing membranes has increased, the overall quality is low. Among them, there are many inferior products, and they do not account for a high proportion of the total building waterproofing materials. The product variety is small, such as EPDM only includes 1.2 m wide homogeneous type, no wide, reinforced and backing type. The ethylene-propylene rubber-polyethylene blend (TPO) is only in the development stage and has not yet entered the market in large numbers. Ethylene propylene rubber is a kind of synthetic elastomer that is closely linked to EPDM rubber and is sometimes referred to as EPM referring to an ASTM standard. EPR is utilised for electrical isolation of the cables and various flexible rubber items such as sleeves or
weather. The use of modified bitumen single layer is limited to foreign products, and there is neither use nor standard for domestic products (Zhuang et al. 2020). The long-term quality of polyvinyl chloride (PVC) is worrying, and the problem of plasticiser migration has not been fundamentally solved. Moreover, the coil stability is not high, and although the application technology has progressed, there is still a big gap between the requirements of complete supporting materials. There is a shortage of construction equipment, and neither mechanical fixings nor construction equipment is on the market (Hanson et al. 2018).

Building sealing materials are divided into unshaped sealing materials (such as caulking putty, ointment, elastic sealant, etc.) and shaped sealing materials (such as sealing tape, gasket, etc.). Generally speaking, the construction sealing material mainly refers to the unshaped sealing material (Wati and Widiansyah 2020). These sealing materials are used to seal the joints between building components and building materials, protect buildings and materials, and play a role in waterproofing, anti-corrosion, sound insulation, heat preservation, and structural bonding (Dutta et al. 2018; Nguyen et al. 2020; Lee and Cho 2017). Building sealing materials are also called building sealants. According to its chemical composition, it is divided into silicone, modified silicone, polyurethane, silicone modified polyurethane, polysulfide, polyacrylate, silicone modified acrylic, butyl, polybutene, modified asphalt sealant, polyvinyl chloride tar grease, putty, etc. According to use and applicability, it can be divided into curtain wall structure sealant, curtain wall joint weather-resistant sealant, concrete building joint sealant, insulating glass sealant, door and window sealant, stone sealant, anti-mold sealant, fireproof sealant, road and bridge joint sealant, color steel plate joint sealant, aluminium plate sealant, plastic door and window sealant, etc. According to the reaction form, it is divided into single-component and multi-component. According to the reaction curing type and solvent volatilisation type (Miller et al. 2018).

According to the basic structure of house construction and the role played by each component, according to the fortification of buildings and structures, it can be divided into above-ground waterproofing works and underground waterproofing works (Xie and Gou 2017). Above-ground waterproofing works include roofing waterproofing works, wall waterproofing works and ground waterproofing works (El-Latif et al. 2020; Nguyen et al. 2019; Yan et al. 2014). Underground waterproofing refers to the waterproofing of underground buildings and structures such as basements, underground pipe trenches, subways, tunnels, etc. (Adilkhodjayev et al. 2019). Roof waterproofing refers to the waterproofing of the roofs of various buildings and structures. Wall waterproofing refers to the waterproofing of wall elevations, slopes, plate seams, doors and windows, frame beam bottoms, column sides, etc. Floor waterproofing refers to the waterproofing of floors, floors, toilets, bathrooms, bottle washrooms, kitchens, boiling water rooms and other floors and pipes. Waterproofing of special buildings and structures refers to the waterproofing of pools, water towers, indoor swimming pools, fountains, four seasons halls, indoor gardens, oil storage tanks, oil storage pools, etc. (Imam et al. 2017).

**Visualised data system**

For the roof waterproof construction process management of agricultural buildings and engineering, due to the huge amount of data, it is impossible to directly read all the data into the memory for drawing. Therefore, it is necessary to selectively draw based on the viewpoint and first generate appropriate multi-resolution data. The multi-resolution data generation of CAE data mainly includes two parts: grid data segmentation and grid data simplification. A data grid is an architecture or collection of services that allows people or groups of users to access, alter, and transmit extraordinarily large volumes of geographically scattered data. In term, grid data segmentation is the process of separating data grids without losing any data samples, likewise data simplification is used to process the data in a simple form. In the process of generating multi-resolution data, this paper does not involve the geometric topological relationship between the grid unit and the grid vertices, and only uses the grid vertices as objects for processing operations. First of all, this paper performs adaptive spatial segmentation on the original precision grid vertex data, and divides the data into the lowest block data. The three-dimensional space corresponding to the block data varies in size, which serves as the basis for data simplification. Then, this paper uses the block data as the object to simplify the bottom-up hierarchical simplification. In the simplification process, the grid vertices in the block data are sampled, and the geometric data of the grid vertex set and the corresponding physical attribute data are saved as the previous low-precision block data, and finally multi-resolution data containing a complete level is generated. At this time, the memory binary tree index is completely established. A binary tree is a non-linear data structure that ensures binary links between items. Binary trees are special trees where a node can contain no more than two
children’s nodes. A tree-type data structure with no more than two children per parent. Every node in a binary tree is linked to the right and the data element. The parent nodes are the nodes that hold other sub-nodes. Each level of the binary tree corresponds to the block data of the corresponding precision level and the corresponding spatial bounding box, and the set of spatial bounding boxes at each level is a complete data scene space. Data processing refers to the manipulation of data by a computer. It consists of converting raw data to machine-readable form, transferring data from the CPU and memory to output devices, and formatting or transforming output. Data processing can involve any use of computers to execute specific operations on data. In the above data preprocessing process, the CAE (Computer-aided engineering) data flow is shown in Figure 1 (Pei et al. 2020).

The flow chart of data pre-processing is represented in Figure 1, in which first the raw data is taken as an input, then the input data is processed in multiresolution data. In the multiresolution process, the data segmentation and data simplification is processed. The data segmentation is the act of recording and separating data into comparable data based on the specified parameters so that the marketing and operations may be more efficient and data simplification is the process by which large and complex data may be used. Complex data must be simplified before it can be examined, but the process is far from easy, necessitating a specific set of skills and tools. To facilitate data block reading into memory for data simplification, CAE data needs to be segmented. The segmentation process takes finite element mesh data as the object. First, the data space is divided into bounding boxes. Data crosses the ownership of federal data amongst domain data proprietors that provide their data as goods while permitting numerous communications between scattered data is called mesh data. The mesh data in each bounding box and its dependencies The various physical data of the grid data is regarded as block data. The segmentation method is similar to the data segmentation method based on vertex clustering proposed by Shaffer et al., but has the following differences: using adaptive binary tree segmentation, the size of the segmented data space after segmentation is unequal, and the grid vertices are dense, that is, For spatial areas with high data density, the bounding box is divided more finely; the corresponding physical data is processed at the same time in the process of dividing the grid data. The AB-tree is a tree data structure that maintains data ordered and allows for logarithmic depreciation of searches, insertions and deletions. In contrast to binary search trees self-balancing, it has been tuned for systems that read and write big data blocks. It is used most often in database and file systems. In the data segmentation, each block space is an AABB bounding box (Axis-Aligned Bounding Box), and each surface of the bounding box is parallel to the corresponding coordinate axis. Axis-aligned bounding boxes (AABB) are created by enveloping game elements in a non-rotated (therefore axis-aligned) box and comparing their locations in 3D coordinate space to determine if they overlap. The axis-aligned requirement exists for performance reasons.

The spatial non-uniform binary tree segmentation algorithm is a spatial non-uniform network segmentation algorithm. The uniform spatial binary tree algorithm is a non-uniform spatial network segmentation algorithm, because the algorithm segments the data into spatial cube based on the direction of the field. The algorithm divides the smallest spatial cube containing the entire data field into two sub-cube spaces according to the longest vertical centre section of the three directions in turn and organises them into one A binary tree. If the total number of grid vertices contained in a sub-cube bounding box is greater than a given threshold and not greater than the depth of a given binary tree, then the sub-cube bounding box will be further divided according to the above division method. The above-mentioned segmentation process is performed sequentially and recursively according to the binary tree level, until the number of grid vertices contained in the subspace bounding box of each leaf node in the binary tree is less than a given threshold.
When dividing a space bounding box, first find out the coordinate axis corresponding to the longest side of the bounding box, and then divide the bounding box into two symmetrical sub-bounding boxes along the vertical direction of this coordinate axis through the centre of the bounding box, and the specific algorithm is as follows (Brunelli et al. 2021):

Step 1. Determine the longest axis $S$ of the bounding box $B$.

Step 2. Along the vertical direction of the longest axis $S$ of the bounding box $B$, divide it symmetrically to generate two sub-bounding boxes.

After the data is completely divided, the leaf nodes that meet the threshold need to be specially processed. To ensure the integrity of the binary tree hierarchy and the continuity of the relationship between the upper and lower levels of the leaf nodes, when the data space segmentation process proceeds to a leaf node that meets the threshold requirements, the leaf node itself is directly passed down as the only child node until the end of the data segmentation. Reach the bottom of the binary tree, as shown in Figure 2.

The data segmentation method used in this paper first divides the space into key layers according to a complete binary tree. The number of key layers is the minimum depth of the binary tree that meets the threshold requirements under ideal conditions, and then uses the spatial position index value method to assign all grid vertices to the key. Layer nodes, and finally perform a non-uniform binary tree segmentation downward according to the number of vertices contained in the key layer nodes, until the number of vertices contained in the lowest layer node all meet the threshold requirements. All divisions are horizontally extended in units of levels. When a node's bounding box is divided, it does not continue to divide down its sub-bounding box, but to the same layer of nodes to continue the bounding box division, until all nodes in the level are divided. After finishing, go to the next level of node just generated (Andrio et al. 2019).

The detailed process of data segmentation is as follows:

1. **Generate scene bounding box**

   The algorithm traverses the original grid data completely, and records the total number $\text{Num}$ of grid vertices and the extreme value of the three coordinates in the vertex coordinates. According to the extreme value of the data control coordinate, the root bounding box of the data space is initialised, and this bounding box is the root node bounding box of the binary tree.

2. **Set the threshold $T_{\text{max}}$ for the number of grid vertices in the spatial bounding box and the binary tree depth limit $N_{\text{max}}$.**

   As the number of grid vertices in the block data increases, the time and space requirements for data processing increase rapidly. To ensure the efficiency of simplification of block data, each block of data should not contain too many sample vertices. If the number is too large, the processing capacity of the computer will be exceeded and performance will be affected. However, if the number of vertices is too small, it may cause frequent data scheduling between internal and external memory as the viewpoint moves during visualisation, thereby affecting the real-time nature of the interaction. The specific settings should depend on the performance parameters of the currently running platform. The threshold is set to an appropriate value to improve the efficiency of data processing to a certain extent, and the data scheduling will not be too frequent (Petrou et al. 2019).

   The depth of the binary tree is set to control the number of subcubes for data division. That is, if the
calculation is based on a full tree, the number of nodes of a binary tree with a depth of \( n \) is 
\[
\sum_{i=0}^{n} 2^i = \sum_{i=0}^{n} 2^i 
\]

(3) Calculate the number \( L_{key} \) of key layers of the binary tree.

In the ideal case of data segmentation, the data distribution density in the entire scene is the same, the binary tree is a full tree, and the number of grid vertices in the spatial bounding box of each level is the same. Moreover, at this time, the number of grid vertices in each bounding box at the bottom layer is exactly the threshold \( T_{\text{max}} \), then the number of spatial division layers, that is, the depth of the binary tree reaches the minimum value at this time. We set this minimum number of layers as \( L_m \). Since the binary tree is full at this time, the number of nodes at the bottom is \( 2^{L_m} \). Then, the total number of all grid vertices is equal to the sum of the number of grid vertices in the bottom layer, that is, the \( L_m \)-th layer space bounding box:
\[
2^{L_m} \cdot T_{\text{max}} = \text{Num} 
\]

Thus, \( L_m \) can be obtained as
\[
L_m = \log_2 \left( \frac{\text{Num}}{T_{\text{max}}} \right) \tag{2} 
\]

However, when the actual data is split, the number of splitting levels of the binary tree must be greater than \( L_m \). It is affected by the following factors: the data distribution density in all parts of the scene must not be the same; the spatial bounding box at the data boundary will not be completely filled by the grid vertices; in addition, the binary tree may not be a full tree, and the number of bounding boxes in the \( L_m \)-th level is less than or equal to \( 2^{L_m} \). It can be seen that when the data segmentation reaches layer \( L_m \), there must be some bounding boxes in this layer where the number of vertices is greater than the threshold \( T_{\text{max}} \) of the number of vertices. Therefore, the number of binary tree division levels must be greater than \( L_m \) during data division, and \( L_m + 1 \) layers must exist in the spatial bounding box. Therefore, the layer number \( L_{key} \) of key layers \( n \) is (Gibeaux et al. 2018):
\[
L_{key} = (L_m + 1) \tag{3} 
\]

(4) Completely divide the bounding box of space to reach \( L_{key} \) layers

Starting from the root node of the binary tree, the space bounding box is completely divided layer by layer until it reaches the \( L_{key} \)-th layer. At this time, the \( L_{key} \)-th layer of the binary tree has a node. During the segmentation process, only the spatial bounding box corresponding to the binary tree node is operated, and the processing of the corresponding data is not involved.

Since it is a complete segmentation, the binary tree above the \( 2^{L_{key}} \) layer after segmentation is a full tree structure. The size and shape of the bounding box of each level node are the same, but the position is different. Therefore, the partitioning directions of the bounding boxes of the nodes of the same level are the same, and there are a total of \( L_{key} \) segmentation direction records when the segmentation reaches the \( L_{key} \) layer. During the segmentation process, the segmentation direction of the bounding box of each level node is recorded, and the recording times \( D_x, D_y, D_z \) of the three coordinate axis directions are obtained respectively.

(5) Calculate the one-dimensional spatial position feature value of the key layer node bounding box

In this paper, the spatial location feature value matching method is used to assign the grid vertices to the key layer nodes to which they belong, and the one-dimensional spatial location feature values of the key layer nodes need to be calculated, as shown in Figure 3. Unless otherwise specified in the following calculation process, all the bounding boxes mentioned referring to the spatial bounding box of the node of the key layer \( L_{key} \) layer.

The smallest vertex of the bounding box of the data space root is used as the relative base point of the calculation, and the centre point of the bounding box is used to represent the bounding box for spatial location feature calculation. We set the minimum vertex coordinate of the space root bounding box as \( (X_{d-\text{min}}, Y_{d-\text{min}}, Z_{d-\text{min}}) \), and the calculation process is as follows:

Step 1. The one-dimensional spatial location feature calculates the coordinate value \( X_{\text{mid}}, Y_{\text{mid}}, Z_{\text{mid}} \) of the

\[X_{\text{mid}}, Y_{\text{mid}}, Z_{\text{mid}} \]

Figure 3. Bounding box space position index.
The algorithm traverses the original data file and calculates the spatial position feature value of the grid vertex using the same method as above. For any mesh vertex, there must be and only a bounding box of \( L_{key} \)-th layer matching the spatial feature value, and the mesh vertex is assigned to the corresponding node of \( L_{key} \) layer. Due to the huge amount of data, it is unrealistic to store all grid vertex coordinate data in memory, so only the position index of the grid vertex in the original data file is recorded in the node. At this time, the mesh vertex index list in the node of the \( L_{key} \)-th layer of the binary tree contains all the mesh vertices in its own bounding box.

(7) Complete data space segmentation to obtain a complete non-uniform binary tree.

The algorithm continues to divide the space bounding box layer by layer from the \( L_{key} \) layer of the binary tree downward. The difference lies in step (5). The segmentation here is adaptive segmentation, and the branches of the binary tree after segmentation are asymmetrical, as shown in Figure 4.

The data segmentation process of the above binary tree node is as follows:

(1) The algorithm judges whether the number of vertices in the vertex index list of the node mesh exceeds the preset threshold \( T_{max} \). If it exceeds, the divide_flag of the node is set to 1, otherwise flag is set to 0.

(2) The algorithm judges the divide_flag of the node. If it is 1, cut the bounding box to get 2 symmetric sub-boundings and generate the corresponding binary tree child nodes. If it is 0, the segmentation will not proceed, and the node will be regarded as its own child node, and the segmentation process will be ended directly.

(3) According to the vertex position index, the vertex coordinates are read from the original data file, and the vertices contained in the node are allocated to the two generated child nodes based on the mutual position relationship.

The data segmentation process of the above binary tree node is repeated until the number of vertices of all nodes meets the threshold requirement, then the data space segmentation is completed. According to

Figure 4. Non-uniform binary tree segmentation.
the grid vertex index list in the bottom node, the geometric data and physical data of the vertices are read from the original data file to form the block data corresponding to the node. The flow chart of data segmentation is shown in Figure 5.

After the data-adaptive segmentation is completed, different block data may have different bounding box sizes and the number of mesh vertices, and the number of mesh vertices in the block data will not exceed the preset maximum threshold \( T_{\text{max}} \). This property has many advantages, if the size of the node and the number of nodes required for each processing are limited. Then, when the data is simplified, only a limited memory size is needed, and the overall data can be processed separately according to different parts of the division.

**Research on roof waterproof construction**

The actual roof structure of agricultural construction projects bears the combined effects of various natural weather conditions and loads during use, and the actual force situation is very complicated. The main purpose of this experiment is to comprehensively consider the combined effects of various factors in the simulation experiment, and abstract, simplify, and refine the factors that play a major role in the deformation of the waterproof coating film from the many influencing factors. The factors which plays a major role in the deformation of waterproof coating film are flexibility, impermeable, heat resistance and solid content. At the same time, the interaction between the waterproof base layer and the coating film layer in different roof structure forms and the improvement effect of different material isolation layers on the force and deformation of the coating film waterproof layer are reproduced as realistically in the experiment. The paint surface is physically separated from the removable varnish by a non-removable, transparent isolation coat. The isolation coat has two purposes: first, it protects you from the elements. By isolating the pigmented zone from the solvents used in removal, the painting is preserved if/when the varnish is removed.

The self-made experimental device (Figure 6) can be used to simulate the tensile force (the weight of the weight applied during the stretching process) of the waterproof base layer from closing to cracking to a certain width. Tensile force is a sort of external physical force that is applied to a material to draw it away from its surface. Tensile strength or tensile stress are two terms that are often used interchangeably.

The entire experimental device is composed of two parts: support and experiment (Figure 7). After constructing the test system (Figure 7), this paper uses the big data analysis system constructed in this paper to analyse the roof waterproof construction data of agricultural construction engineering, and give reasonable suggestions. On this basis, an experimental study is carried out on the system constructed in this paper. The major advantages of big data analysis in waterproof construction is improved customer satisfaction, health and safety, high profits and enhanced operational efficiencies. First of all, this paper counts 81 sets of data to determine the effect of big data technology in agricultural

**Figure 5.** Data segmentation process.

**Figure 6.** The expected state of the coating film under tension during direct coating.
construction engineering roof waterproofing construction data. The results obtained are shown in Table 1 and Figure 8.

Figure 7. The structure diagram of the tensile test bench.

| Dataset number | Data mining | Data mining | Data mining | Data mining |
|----------------|-------------|-------------|-------------|-------------|
| 1              | 93.7        | 28          | 93.9        | 55          |
| 2              | 92.9        | 29          | 93.3        | 56          |
| 3              | 95.7        | 30          | 95.8        | 57          |
| 4              | 96.1        | 31          | 97.0        | 58          |
| 5              | 96.0        | 32          | 95.5        | 59          |
| 6              | 94.1        | 33          | 96.0        | 60          |
| 7              | 96.7        | 34          | 96.1        | 61          |
| 8              | 94.7        | 35          | 94.1        | 62          |
| 9              | 92.3        | 36          | 92.3        | 63          |
| 10             | 93.2        | 37          | 92.7        | 64          |
| 11             | 95.7        | 38          | 95.3        | 65          |
| 12             | 92.0        | 39          | 93.2        | 66          |
| 13             | 94.1        | 40          | 93.3        | 67          |
| 14             | 92.5        | 41          | 95.6        | 68          |
| 15             | 94.9        | 42          | 93.6        | 69          |
| 16             | 95.9        | 43          | 94.7        | 70          |
| 17             | 93.4        | 44          | 94.5        | 71          |
| 18             | 93.8        | 45          | 96.4        | 72          |
| 19             | 96.6        | 46          | 93.7        | 73          |
| 20             | 94.1        | 47          | 94.4        | 74          |
| 21             | 96.2        | 48          | 92.1        | 75          |
| 22             | 95.9        | 49          | 92.9        | 76          |
| 23             | 93.0        | 50          | 92.3        | 77          |
| 24             | 94.6        | 51          | 96.3        | 78          |
| 25             | 94.5        | 52          | 94.4        | 79          |
| 26             | 93.7        | 53          | 93.0        | 80          |
| 27             | 92.7        | 54          | 94.0        | 81          |

Table 1. Effect of big data technology in the analysis.

Figure 8. Effect of big data technology in the analysis.

Table 2. Construction decision-making effect.

| Dataset number | Strategic analysis | Dataset number | Strategic analysis | Dataset number | Strategic analysis |
|----------------|--------------------|----------------|--------------------|----------------|--------------------|
| 1              | 80.8               | 28             | 83.5               | 55             | 86.8               |
| 2              | 91.1               | 29             | 84.1               | 56             | 84.1               |
| 3              | 84.9               | 30             | 85.3               | 57             | 80.5               |
| 4              | 89.9               | 31             | 86.9               | 58             | 83.1               |
| 5              | 86.5               | 32             | 82.5               | 59             | 90.8               |
| 6              | 80.6               | 33             | 87.8               | 60             | 91.0               |
| 7              | 90.0               | 34             | 88.3               | 61             | 85.3               |
| 8              | 83.7               | 35             | 91.7               | 62             | 88.5               |
| 9              | 90.5               | 36             | 87.3               | 63             | 81.5               |
| 10             | 82.1               | 37             | 79.3               | 64             | 80.6               |
| 11             | 81.6               | 38             | 88.3               | 65             | 91.2               |
| 12             | 89.8               | 39             | 79.9               | 66             | 86.1               |
| 13             | 90.9               | 40             | 80.9               | 67             | 85.8               |
| 14             | 87.6               | 41             | 86.6               | 68             | 87.6               |
| 15             | 82.7               | 42             | 82.2               | 69             | 84.9               |
| 16             | 86.8               | 43             | 84.9               | 70             | 87.1               |
| 17             | 82.9               | 44             | 87.6               | 71             | 92.0               |
| 18             | 87.9               | 45             | 83.7               | 72             | 89.0               |
| 19             | 87.8               | 46             | 85.6               | 73             | 86.2               |
| 20             | 85.9               | 47             | 85.9               | 74             | 82.1               |
| 21             | 89.5               | 48             | 82.5               | 75             | 84.0               |
| 22             | 79.2               | 49             | 88.8               | 76             | 84.7               |
| 23             | 89.3               | 50             | 89.3               | 77             | 84.3               |
| 24             | 90.3               | 51             | 84.8               | 78             | 90.4               |
| 25             | 91.4               | 52             | 82.2               | 79             | 80.9               |
| 26             | 85.4               | 53             | 90.6               | 80             | 80.8               |
| 27             | 88.7               | 54             | 90.1               | 81             | 86.9               |

From the above research, the roof waterproof construction system of agricultural construction engineering based on big data technology constructed in this paper can play a good effect in the analysis of roof construction data. Big data provides a means for construction businesses to collect, analyses, and use massive volumes of information to assist solve business challenges and provide crucial, educated insight for future actions. It assists businesses in completing projects on schedule, bidding more precisely, and building more effectively. On this basis, the effect of roof waterproof construction decision-making is evaluated, and the results are shown in Table 2 and Figure 9.

Figure 9. Construction decision-making effect.
From the above figure, it is clear that the roof waterproof construction system of agricultural construction engineering based on big data technology constructed in this paper can make effective construction decisions.

Conclusion

This paper uses big data technology to research and analyse the waterproof construction of agricultural construction engineering, and analyse the current situation of agricultural construction roofing. For the roof waterproof construction process management of agricultural buildings and engineering, due to the huge amount of data, it is impossible to directly read all the data into the memory for drawing. Therefore, it is necessary to selectively draw based on the viewpoint to generate appropriate multi-resolution data. Moreover, this paper analyses the roof construction data of industrial construction projects through data mining, and makes effective construction decisions with the support of decision support mechanisms. The actual roof structure of agricultural construction projects bears the combined effects of various natural weather conditions and loads during use, and the actual force situation is very complicated. Therefore, this paper constructs the roof waterproof construction simulation of agricultural construction engineering through simulation research and conducts experimental research after obtaining the data. From the experimental research results, it can be seen that the method proposed in this paper has a certain effect. The waterproof construction of agricultural construction engineering and current situation of agricultural construction roofing is analysed to obtain certain construction decision-making effect. So in the future the roof construction data of industrial construction projects is analysed with advanced technology to achieve better decision-making effect.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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