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Research Article

Design and Optimization of Hotel Management Information System Based on Artificial Intelligence

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With the improvement of people's living standards, the traditional hotel management model has been unable to meet the needs of customers. The traditional hotel management model also has the defects of low efficiency. The hotel management model is also gradually developing towards the direction of intelligence. The combination of artificial intelligence technology and hotel management can not only improve the operation efficiency of the hotel but also solve the operation cost of the hotel. For customers, artificial intelligence technology can bring smarter and more comfortable accommodation conditions to customers. This study uses the convolutional neural network (CNN) and long short-term memory (LSTM) technology in artificial intelligence technology to conduct related research on the in-store mode, entertainment mode, sleep mode, and out-of-store mode in hotel management. CNN is used to extract the spatial features of hotel management, and LSTM is used to extract the temporal features of hotel management. The research results show that CNN and LSTM technology can help hotel management achieve intelligent management and optimization. CNN and LSTM techniques can better predict related factors in-store entry mode, entertainment mode, and sleep mode. For the correlated predictions of these four modes, the maximum prediction error is only 2.81%. The linear correlation coefficient also reached above 0.96. The relevant parameters of artificial intelligence technology are also suitable for the optimization and design of hotel information systems.

1. Introduction

With the rapid development of computer performance, information systems have been widely used in hotel management. Compared with traditional manual methods, information systems can have better efficiency in hotel management. In today's society, people begin to pursue a higher level of quality of life [1, 2]. Whether it is in the process of business trip or tourism, they not only need the level of accommodation, but they are also constantly pursuing a higher level of hotel service. This puts forward higher requirements for the management level of the hotel. Hotel management is not only limited to the management of the hotel front desk, but it also needs to achieve a higher level of management of the hotel rooms. The management of the hotel front desk needs to achieve higher efficiency and more accurate management, which will save many manpower and material resources of the hotel front desk [3]. At the same time, efficient hotel front desk management will save more time for the occupants, and it will also provide more convenience for the occupants. The provision of hotel management level will provide occupants with a more comfortable and warmer accommodation environment, and it will also provide more convenience for hotel managers [4, 5]. With the wide application of intelligence in various fields, the intelligent management of hotels is also a popular direction. The intelligent management of hotels will not only improve the efficiency and service level of hotel front desk management but also bring certain convenience to the intelligent management of guest rooms [6, 7]. The intelligent management of guest rooms will bring more convenience, comfort, and safety to the occupants, and it will also save human and material resources for hotel operators. The intelligent development of the hotel needs to have a solution suitable for the hotel style. It cannot ignore the feelings of the occupants just to achieve intelligence. The intelligent development of hotel management needs to make the occupants feel more technological elements, and it cannot bring more troubles to the occupants.

Artificial intelligence technology is the product of the rapid development of computer computing power and the improvement of hardware technology [8]. Artificial intelligence technology has been applied in many people's lives, and it can liberate more labor. It can also replace people to perform more dangerous and complex tasks, which has brought great convenience to people's lives [9, 10]. The core of artificial intelligence technology being able to perform these tasks is that it can process these complex data very well. For hotel management, in order to realize the intelligence of hotel management, artificial intelligence is required to process the relevant data of hotel management [11]. The advantage of artificial intelligence technology is that it can better handle nonlinear and high-dimensional data. It uses nonlinear functions to find correlations in complex data. Artificial intelligence technology mainly includes three algorithms: supervised learning, unsupervised learning, and reinforcement learning, which are the three most common learning algorithms. Among these three algorithms, supervised learning is a more common method, whether in the field of image recognition or speech recognition. Artificial intelligence technology includes CNN and LSTM algorithms, which are relatively common feature extraction methods in the field of artificial intelligence. The convolutional neural network (CNN) method can better extract the spatial features of the data [12], and it has been widely used in the fields of transportation and medical care. Long short-term memory (LSTM) recurrent neural network can better process data related to temporal features [13], and it has been widely used in speech recognition and other fields. Reinforcement learning is an algorithm with a relatively large correlation with the environment, and it is mainly used in research objects with strong environmental interference [14]. For the intelligence of hotel management, it mainly involves the spatial characteristics of data and the temporal characteristics of data.

The combination of artificial intelligence technology and hotel management is an important direction for the intelligent development of hotel management. Artificial intelligence technology can optimize the management plan of the hotel management front desk, and it can also intelligently optimize the management of guest rooms. In the process of hotel's intelligent management, these data mainly involve spatial and temporal characteristics. CNN and LSTM methods are used to study the intelligent management of hotels. The combination of artificial intelligence technology and hotel management can reduce the operating cost of hotel management, and it can also improve the operational level of hotel management. The traditional manual management mode has a large error rate. At the same time, intelligent hotel management will also meet the personalized accommodation consumption needs of the occupants, which will also improve the hotel's satisfaction rate and occupancy rate. The intelligent management of the hotel can realize the intelligent management of check-in mode, entertainment mode, sleep mode, and check-out mode. This will not only save the hotel operator's time and human resources but also provide greater convenience to the occupants. The CNN method is used to extract the features of in-store patterns and out-of-store patterns for hotel management. The LSTM method is mainly used to extract the temporal and spatial features of entertainment patterns and sleep patterns of hotel management.

This study mainly uses CNN and LSTM algorithms to predict and study the check-in mode, entertainment mode, sleep mode, and check-out mode of hotel management. The CNN method is mainly used to map the relationship between the needs of the occupants and these four modes, and the LSTM method is mainly used to study the temporal feature analysis of hotel intelligent management. This study will be introduced from five aspects: the first section introduces the necessity of the intelligent development of hotel management and the background of artificial intelligence technology. The related research status of hotel management is analyzed in the second section. The third section mainly analyzes and introduces the system design of intelligent hotel management and the principles of CNN and LSTM algorithms. Section 4 analyzes the accuracy and feasibility of CNN and LSTM algorithms in predicting hotel management check-in patterns, entertainment patterns, check-out patterns, and sleep patterns. In Section 4, the predicted linear correlation coefficient, average error, and error hotspot distribution map of hotel rooms are used to analyze the feasibility of CNN and LSTM methods in predicting hotel management. Section 5 summarizes the research.

2. Related Work

With the continuous development of business travel and tourism boom, the hotel is a fast-growing industry. The intelligent development of hotels is also one of the research hotspots, and many researchers have done a lot of research on hotel management. Li [15] already believes that hotel management needs to meet the needs of market development in tourist cities, which is also an important part of market development. The innovative management and the provision of management level of coastal resort hotel are beneficial to improve the core competitiveness of the hotel. This study takes the management of coastal hotels as the research object, and it uses the SWOT method to analyze the relationship between the coastal hotels and the tourism supply chain. In order to realize the stable management of coastal resort hotel and improve the popularity of tourists, he proposed a platform management and construction model for coastal resort hotel. Maté-Sánchez-Val and Teruel-Gutierrez [16] have noticed that hotel location has a greater relationship with company performance and the environmental strategy of hotel management. They proposed a theoretical model to analyze the important role of hotel location in hotel management. They collected data on hotels in Barcelona as a research object, and it used peer effects to analyze the impact of hotel location on hotel performance. The results show that the variable of hotel location has an important relationship with the hotel's explanatory coefficient characteristics. This study has important implications for the location selection of hotel managers. Zhang et al. [17] have studied the online hotel management model, which mainly focuses on the effect of online reviews on hotel management. The dataset for this study was derived from online data on hotels in New York City on Expedia. It combines data such as online comments and online replies of online data into one dataset. It also fully mines these textual information using textual similarity. It also correlatively validates text mining functions using fixed-effects panel data. The results of the study show that consumers' online reviews do not significantly affect hotel bookings. However, highly similar responses significantly reduce hotel bookings. This research has a certain reference value for the evaluation of hotel management and online booking. Obonyo et al. [18] found that the development of ICT has provided more convenience and efficiency for hotel management. More hotels are starting to invest more in ICT to improve performance. However, this situation is weaker for economically developing countries. This study mainly analyzes the actual situation of ICT application in hotel management in Kenya. He collected and quantified data on 194 hotels. The research results show that ICT has a strong correlation with human resource management and operational management of hotels, which will also affect the application of ICT in hotel management. Wang and Zhang [19] believe that the hotel industry has become a pillar industry of the tertiary industry. The hotel industry has developed rapidly under the rapid economic development, but it is also facing huge pressure. Based on the background of rapid development of information, this research uses the fuzzy analytic hierarchy process FAHP method to study the user decision-making process in hotel management. Based on the common data of the hotel management system, he established the customer model of the hotel business data by using the method of data mining. This method improves the service level of the hotel and enhances the core competitiveness of the hotel enterprise. Brahami and Adjaine [20] believe that only after the company or enterprise really understands the motivation management of knowledge and customer relationship management (CRM), the competitiveness of the enterprise can be improved. He also found that the two indicators of KM and CRM are less used in hotel management. He collected sample data of large hotels in the Algeria region, and it discussed the application effect of KM and CRM in hotel performance management. The research results show that KM and CRM methods can effectively improve hotel performance, which in turn can enhance the competitiveness of hotel management. This has certain guiding significance for the further improvement of the hotel. With the development of intelligent technology and big data technology, there are also a few researchers here who have adopted artificial intelligence technology to study the related factors of hotel management and intelligent hotel management system. Ma [21] has found that the traditional concept of hotel management can no longer keep up with the pace of the times, and this method cannot provide timely training for hotel financial personnel, which leads to the relative lag of the hotel management model, which in turn affects the hotel benefit. To solve these problems, he designed an intelligent hotel financial management system. The results show that the support vector machine method and logistic regression method can reduce the risk of financial crisis in hotels. The response time of this intelligent hotel management system is significantly shortened, and the success rate has been improved to a certain extent. From the above literature review, it can be seen that artificial intelligence methods are rarely used in hotel management, and it rarely studies the entire process of hotel management systems. The current research is mainly to optimize and design the front desk management system of the hotel management system. This research uses CNN and LSTM methods to intelligently manage and study the hotel's in-store mode and out-of-store models.

3. The Application of Artificial Intelligence Methods in Hotel Management

3.1. The Importance of CNN and LSTM for Hotel Management. This research mainly uses CNN and LSTM algorithms to predict the in-store mode, entertainment mode, sleep mode, and out-of-store mode in the hotel management mode. The CNN algorithm can map the relationship between the relevant factors of the in-store management system and the needs of the occupants. This data information is often more complex, but there is a relatively large correlation between these data. Relying on hotel managers alone to find correlations in these data is more difficult. CNN can process these data well, and the CNN algorithm has strong advantages in processing these nonlinear data. The LSTM algorithm has obvious advantages in dealing with temporal features, which can deal with time-related temporal features in hotel management. For example, in the process of predicting the entertainment mode, it can automatically adjust the air conditioning system, video system, lighting system, etc. according to the change of time. Because these factors are not only strongly related to space, but also it had strongly related to time.

3.2. The Hotel Management Intelligent System and CNN Algorithm. This research will use the CNN and LSTM methods to realize the intelligent management mode of the hotel. At the same time, the in-store mode, entertainment mode, sleep mode, and out-of-store mode of hotel management will be unified as a whole for system design. These patterns are not a single pattern, because there are some correlations in the data between these patterns. Figure 1 shows the hotel's intelligent management system design scheme utilizing CNN and LSTM methods. First of all, it needs to collect more relevant data of the hotel's in-store mode, entertainment mode, sleep mode, and out-of-store mode as an obvious training set and test set. These data first go through the CNN algorithm, and the CNN algorithm will use the convolution layer, pooling layer, and activation function to extract the spatial features of hotel management. The LSTM will receive the output data from the CNN, which will be input to the network layers of the LSTM in the form of time

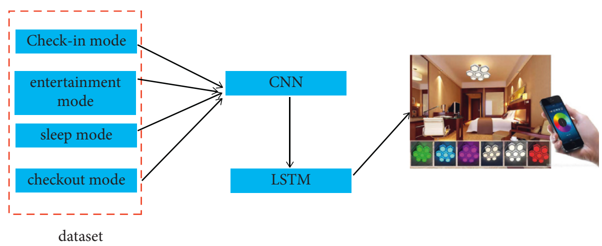

Figure 1: The design of hotel intelligent management system.

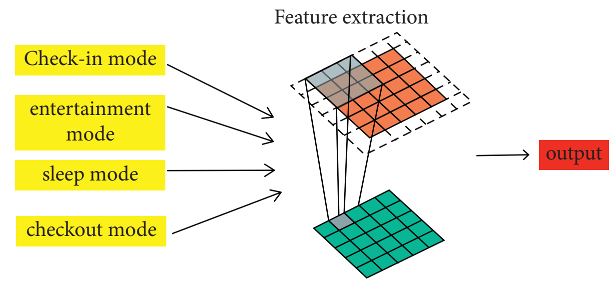

Figure 2: The workflow of CNN algorithm.

series. There is a backpropagation mechanism for these two networks. After the hotel management data are processed by the LSTM algorithm, it will become the control signal of the hotel room. It will automatically control the lighting system, air conditioning system, and influence system of hotel rooms. Once the model is trained, the optimal weights and biases are determined. In the actual application process, it can rely on these weights and biases to realize the prediction and analysis of the relevant data of the four modes of the hotel management information system. First, the hotel management data will be processed through data cleaning and data normalization methods. Then, these data will be processed into a matrix and input into the network layer of CNN.

CNN is a relatively common feature extraction neural network. Compared with the fully connected neural network, it has less parameters. Therefore, it allows more network layers, which guarantees the task of extracting features from hotel management system data. Figure 2 shows the workflow of CNN. A matrix operation is performed between each weight of the fully connected neural network. However, the weights of CNN will selectively perform matrix operations, which is the advantage of weight sharing. CNN is mainly composed of convolution layer, pooling layer, activation function, and fully connected layer. The convolutional layer will extract the features of hotel management data through parameters such as filter and stride. The pooling layer will further extract features by upsampling or downsampling. The parameters of the CNN will be trained and tested on the Tensorflow platform, and the weights and biases will be saved in the .h5 file. The learning rate chosen in this study is 0.001, which will speed up the training, but it will not easily get stuck in a local minimum.

CNN and fully connected neural network are similar computational methods, and it also has a backpropagation mechanism. The CNN dataset also contains actual numerical values, which is required by the backpropagation algorithm. Equation (1) shows how the backpropagation error is calculated. This study will calculate the error in the form of mean square error, which is also a commonly used error calculation method. Equation (2) is also a form of mean square error calculation, which is a form of the summation of equation 1:

$$E = \frac{1}{2}\left\| d - y^L \right\|_2^2, \tag{1}$$

$$E = \frac{1}{2}\left(d_{\text{out}} - O_{\text{real}}\right)^2 = \frac{1}{2}\sum_{\kappa=1}^{t}\left(d_\kappa - O_\kappa\right)^2. \tag{2}$$

Many hyperparameters will be involved in the iterative calculation process of CNN, and hyperparameters will also affect the accuracy and convergence of CNN iteration. There is a certain relationship between these hyperparameters of CNN. Equation (3) shows the calculation relationship of CNN hyperparameters. Equation (4) shows the computation process of the input layer of the CNN:

$$w' = \frac{(w + 2p - k)}{s} + 1, \tag{3}$$

$$V = conv2\left(W, X, \text{"valid"}\right) + b. \tag{4}$$

This will involve many derivative operations during the CNN computation, either forward or backward. Equation (5) shows how the weight derivative is calculated:

$$\Delta\omega_{ji} = -\eta \frac{\partial E}{\partial \omega_{ji}}. \tag{5}$$

3.3. The Introduction to LSTM Algorithm. The entertainment mode and sleep mode in the hotel management mode have a strong time relationship with the lighting system, air conditioning system, and film and television system of the guest room. The advantage of the LSTM method is that it deals with time-dependent data. For the in-store mode and the out-of-store mode, these data also have a relatively strong time relationship. Therefore, this study chooses the LSTM algorithm to process these temporally correlated data. Figure 3 shows the computational process of the LSTM algorithm. It differs from CNN in that it can memorize historical information because of its obvious gate structure. This is also the reason why it can memorize historical state information. The data input form of LSTM is time series. In this study, it will accept the output data of CNN. CNN and LSTM algorithms are a continuous process. CNN first extracts the spatial features of hotel management, and LSTM extracts the temporal features of hotel management. The gate structure of LSTM algorithm mainly includes input gate, forget gate, and output gate structure. After the hotel management data are output in the output layer of the CNN, the data will be transformed by a reshape layer. These data will be transformed into labeled data by sliding windows and sliding steps. This is because LSTM is also a supervised learning algorithm.

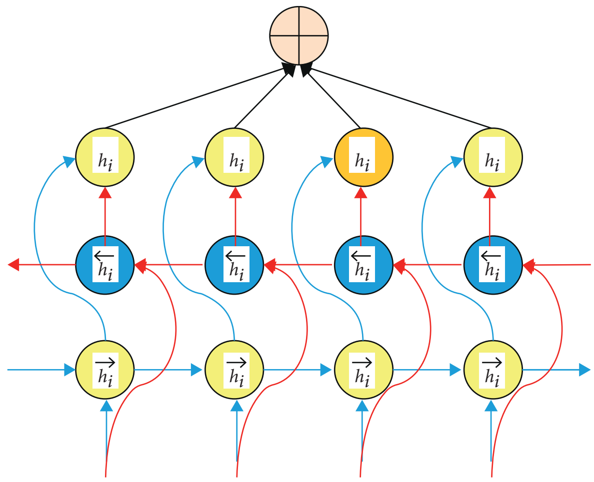

Figure 3: The workflow of LSTM algorithm.

The LSTM algorithm is inherited from the RNN algorithm. RNN is also an important algorithm for dealing with speech recognition. Equation (6) shows the basic principle of the LSTM method to memorize historical state information. The historical state information realizes the memory of historical state information by affecting the information of the current state. Both historical state information and current state information will be given a certain weight, which can realize the memory of historical information according to the weight. Equation (7) is the abstract structure of Equation 6. Equation 8 shows the temporal feature information that the LSTM structure needs to load. Through Equation 8, LSTM is given certain time information:

$$y(t) = f(X(t)\bullet W + y(t-1)\bullet V + b), \quad (6)$$

$$\tilde{c}(t) = f(W\bullet x(t) + V\bullet y(t-1)), \quad (7)$$

$$C(t) = C(t-1) + \tilde{C}(t). \quad (8)$$

The input gate can control the input amount of information, and it can control the input characteristics of historical state information and current state information. If all the historical state information and current state information are input into the network, it will not only cause too many parameters. It also causes poor feature extraction. Equations (9) and (10) show the calculation process of the input gate. It can selectively pass historical state information and current state information according to the size of the weight:

$$C(t) = C(t-1) + g_{\text{in}}\bullet\tilde{C}(t), \quad (9)$$

$$C(t) = C(t-1) + g_{\text{in}}\otimes\tilde{C}(t). \quad (10)$$

Equation (11) shows the calculation process of the LSTM forget gate. If the forget gates are all open, this will cause a lot of information to flow into the LSTM. The forgetting gate will assign a certain weight according to the importance of the feature, and the forgetting gate will selectively input some historical state information features according to the size of the weight:

$$C(t) = g_{\text{forget}}C(t-1) + g_{\text{in}}\otimes\tilde{C}(t). \quad (11)$$

Equation (11) shows how the output gate of the LSTM method is calculated. The output gate will output features related to the current state information. This requires a gate structure for effective control. It can not only ensure the output of effective historical information but also ensure that the information parameters will not be too large:

$$y(t) = g_{\text{out}}\otimes f(C(t)). \quad (12)$$

4. Result Analysis and Discussion

In this study, it mainly uses CNN and LSTM algorithms to analyze the intelligent management information system of in-store mode, entertainment mode, sleep mode, and out-of-store mode in hotel management. The data used in this study come from the operation data of 40 hotels in Beijing. It uses CNN and LSTM algorithms to study the accuracy and feasibility of these four hotel intelligent management modes. Figure 4 shows the linear correlation coefficients predicted by hotel management's in-store patterns. The linear correlation coefficient can compare the degree of agreement between the predicted value and the actual value of the intuitive response. The closer the linear correlation coefficient is to the linear function $y = x$, the more accurate it is for the predicted value. From Figure 4, it can be seen that the corresponding values of the in-store patterns of the 40 hotels have a high linear correlation, and all the linear correlation coefficients exceed 0.96. Moreover, the corresponding values of the in-store patterns of these 40 hotels are distributed on both sides of the $y = x$ function, and the predicted data of the in-store patterns of these 40 hotels are relatively close to the $y = x$ function. This further illustrates the high feasibility and accuracy of CNN and LSTM algorithms in predicting the in-store patterns of hotel management. Only a few data points deviate from the $y = x$ line, but the deviation is within the requirements of hotel management.

In the information system of hotel management, the entertainment system is a key part. The prediction accuracy of this part is directly related to the accuracy of CNN and LSTM. This is because the entertainment system varies greatly, and it has a greater relationship with time and the preferences of different people. Predictions for entertainment systems are more complex. Figure 5 shows the distribution of predicted and actual values of entertainment patterns managed by the hotel information system. In Figure 5, both A and B are representative of the entertainment mode group managed by the hotel. A represents the group of predicted values of entertainment pattern data. B represents the group of actual values of the entertainment mode data. The blue curve represents the predicted value of the entertainment mode, and the red curve represents the actual value of the entertainment mode. In general, the predicted value of hotel management is larger than the actual value of entertainment mode, which is mainly because the

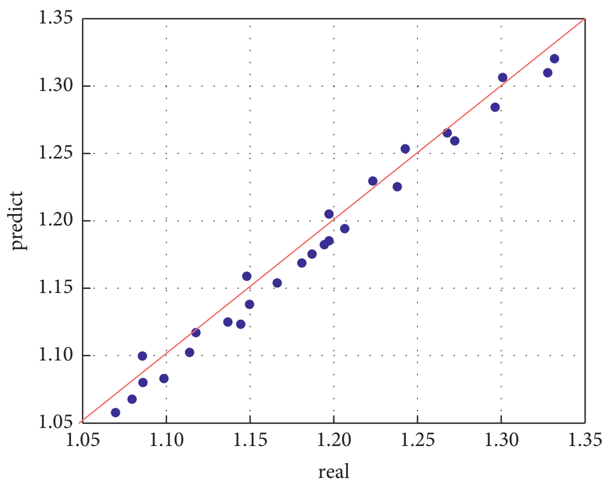

FIGURE 4: The linear correlation coefficient of in-store patterns of hotel management.

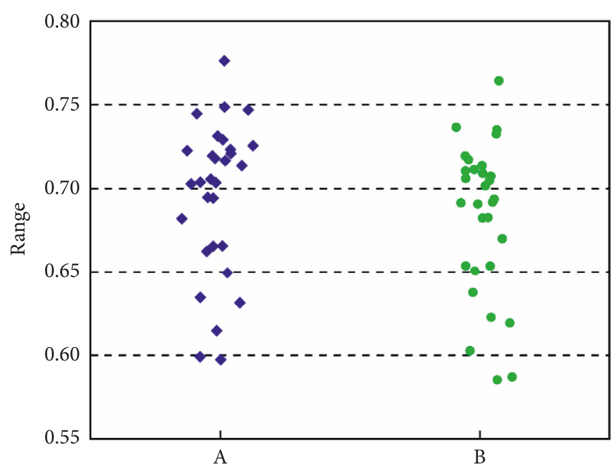

FIGURE 5: The predicted value distribution of entertainment patterns in hotel management.

predicted value of entertainment mode is in a relatively ideal environment. In general, the corresponding predicted value of the entertainment mode of hotel management has the same distribution as the actual value, and the numerical value is also well maintained. Between intervals 0.6 and 0.75, the predicted values of the hotel management entertainment mode have a good degree of agreement, and most of the corresponding values of the entertainment mode are also distributed in this interval. Only in the interval greater than 0.75 and less than 0.6, the prediction error of the data is large. Overall, CNN and LSTM methods can also better predict the corresponding values of entertainment patterns in hotel management.

Compared with the prediction of entertainment mode, the check-out mode of hotel management is easier to predict. The check-out model of hotel management has minor changes, and the check-out model of hotel management involves relatively few features. Figure 6 shows the distribution of the predicted and actual values of the hotel management system's check-out patterns. It can also be easily seen from Figure 6 that the check-out pattern of hotel management has relatively small fluctuations. CNN and LSTM algorithms also easily predict the corresponding data and characteristics of hotel management check-out patterns. Although the hotel values between 0 and 30 have large fluctuations, the CNN and LSTM methods can also better reflect the peak and trough values of the check-out pattern. The prediction error value for the hotel management check-out mode is completely acceptable to the hotel management. Larger errors mainly appear in the data of hotels in the range of 20 to 25. The CNN and LSTM methods only predict the numerical value of the data well, but it is poor in predicting the fluctuation trend between the data.

For hotel managers and occupants, sleep patterns are an important system. Its prediction error is mainly related to the air-conditioning system, curtain control system, and so on. The sleep system has more obvious time characteristics. Figure 7 reflects the change trend between the predicted value and the actual value of the sleep pattern of hotel management. The red curve represents the predicted data of sleep patterns, and the black part represents the actual data value of the hotel management. The green area is the error area between the two. In general, the data of sleep patterns have relatively large fluctuations, and they also have relatively large fluctuations over time. However, CNN and LSTM algorithms are better at predicting data related to sleep patterns in hotel management. It can also be seen from the green area in Figure 7 that the prediction error of the sleep mode is also relatively small. It has a relatively obvious cumulative error over time. The larger error mainly exists in the interval 18 to 30, which is also one of the defects of the LSTM algorithm. In order to improve the accuracy of data prediction of this part of the sleep pattern, it is necessary to increase the data sample size of this part of the region.

The prediction errors of entertainment mode and sleep mode are mainly related to the operation of electronic equipment in the guest room. It is a critical part that the impact system, air conditioning system, and lighting system in the guest room can be adjusted in real time according to the real-time needs of the occupants. To further demonstrate the prediction error of in-room device operation, Figure 8 shows the prediction error of indoor facilities in entertainment and sleep modes. The squares represent the hotel rooms. This study will illustrate the distribution error of each area of the hotel room in the form of an error heat map. In general, CNN and LSTM have small errors in predicting the operation of indoor equipment, and the prediction error distribution is relatively uniform. Larger prediction errors are mainly distributed in the edge regions of the room. This part of the area may correspond to the video system and air conditioning system. But all the errors meet the requirements of the hotel management information system. This further illustrates that the CNN and LSTM methods can better predict the entertainment and sleep patterns of hotel management. Figure 9 shows the average errors of CNN and LSTM under four modes for predicting hotel management information systems. The largest average prediction error is only 2.81%, and this part of the error comes from the hotel management's prediction of sleep patterns. The prediction

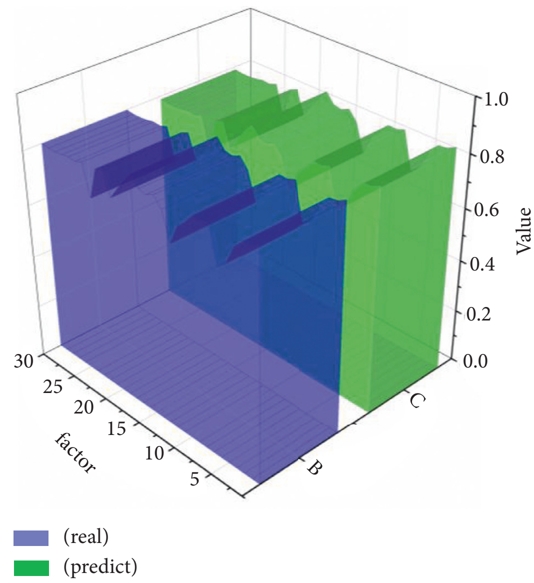

Figure 6: The predicted value distribution of check-out patterns for hotel management.

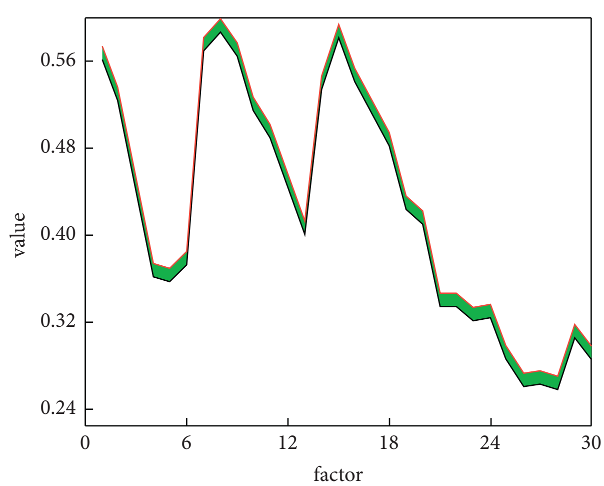

Figure 7: The distribution of predicted values for sleep patterns in hotel management.

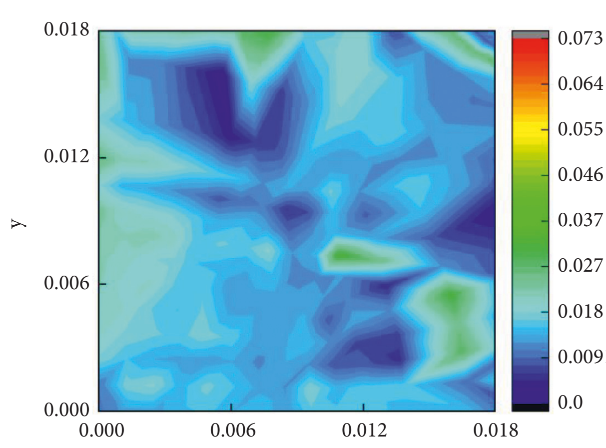

Figure 8: Prediction errors for indoor facilities in recreation mode.

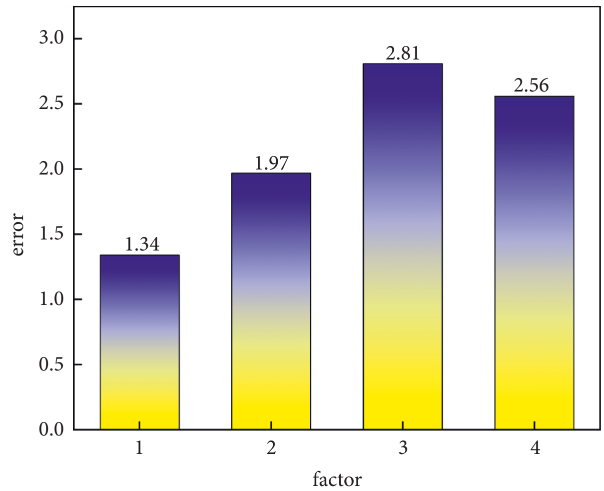

Figure 9: The average forecast error of four modes of hotel management.

errors of the in-store mode and the out-of-store mode are only 1.34% and 1.97%, respectively. This prediction error can not only satisfy the requirements of hotel managers, but it can also satisfy the requirements of lodging guests. In conclusion, the CNN and LSTM methods have certain feasibility and accuracy in realizing the intelligence of the hotel management information system.

5. Conclusions

The traditional manual hotel management model can no longer meet the needs of today's people's accommodation. Now, the flow of people in the hotel and the needs of the occupants have a relatively large change and a relatively large amount of information. This requires computer technology to assist hotel managers to manage. More and more hotels have begun to introduce computer information management system, but it can only assist hotel managers to realize the management of in-store mode and out-of-store mode. As for the individual requirements of the occupants, the current computer information management system cannot help the occupants to realize them very well.

This research uses CNN and LSTM methods in artificial intelligence technology to design a hotel information management system, which can realize intelligent management of in-store mode, entertainment mode, sleep mode, and out-of-store mode. It can not only improve the work efficiency of hotel managers, but it can also meet the individual needs of the occupants. In general, CNN and LSTM methods can better predict the four modes of hotel information management system. The largest prediction error is only 2.81%, and this part of the error comes from the prediction of the sleep pattern of the hotel information system. For the prediction of the in-store and out-of-store patterns of the hotel management system, the average error is only 1.34% and 1.97%. For the prediction of the entertainment mode and sleep mode of the hotel management system, the prediction error distribution of the operation of indoor equipment is relatively uniform, and most of the errors are distributed within 2%. This shows that CNN and LSTM methods have high credibility in realizing hotel management intelligence.

Data Availability

The dataset can be accessed upon request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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