ISSN: 2424-8460(O)
2251-2608(P)

Original Research Article

Predictive analysis in computer information management driven by artificial intelligence

Yihan Wang [1], Juan Cao [2]

1 College of Weihai International Education, Beijing Jiaotong University, Weihai City, Shandong Province, 264207, China

2 Fuxin Dingsheng Construction Project Management Co., Ltd., Fuxin City, Liaoning Province, 123000, China

Abstract: In the era of information explosion, traditional computer information management methods are difficult to extract effective information from massive data to support forward-looking decision-making. Artificial Intelligence (AI) technology provides a scientific basis for organisational decision-making by predictive analysis and mining the potential patterns and trends of data. This paper systematically discusses the application of AI in predictive analysis for computer information management, covering key technologies such as machine learning and deep learning, and combining cases such as system performance prediction, user behaviour analysis and market trend prediction to demonstrate the practical effects of AI in improving reliability, conversion rate and return on investment. At the same time, the article points out the challenges of data quality, model interpretability and privacy security, and looks forward to the future development direction of the integration with IoT, big data and other technologies.

Keywords: Artificial intelligence; Predictive analytics; Computer information management; Machine learning

1. Introduction

In the current age of information overload, computer information management systems churn out a huge volume of data daily. This data encompasses a wide range of information, from user actions to system performance. However, traditional information management approaches usually have a hard time extracting useful information from this vast amount of data to support far - sighted decision - making.

The advancement of Artificial Intelligence (AI) technology offers a novel solution to this issue. By leveraging AI algorithms for predictive analysis, computer information management systems can uncover the hidden patterns and trends within the data and predict the probability of future events. This, in turn, offers a scientific basis for an organization's decision - making and boosts its competitiveness in the market[1].

2. Basic concepts of artificial intelligence and predictive analytics

2.1. Overview of artificial intelligence

Artificial Intelligence is a discipline that simulates human intelligence and aims to equip computer systems with the ability to perceive, learn, reason and make decisions. Commonly used AI techniques in computer information management include machine learning, deep learning, and natural language processing. Machine learning is an important branch of artificial intelligence that allows computers to learn patterns from data and make predictions and decisions based on those patterns. Deep learning, on the other hand, is a subset of machine learning that automatically extracts features from data by constructing multi-layer neural networks, and is

particularly suited to processing complex unstructured data.

2.2. Definition and role of predictive analytics

Predictive analytics uses historical data, stats, and AI to forecast future events. In computer info management, it helps predict system performance, user demand, etc. For instance, admins can adjust server resources, and firms can make targeted marketing plans[2].

3. Key technologies for artificial intelligence in predictive analytics for computer information management

3.1. Machine learning algorithms

Machine learning algorithms are one of the core techniques in predictive analytics. Common machine learning algorithms include linear regression, logistic regression, decision trees, random forests and support vector machines. Linear regression is suitable for predicting continuous variables, such as predicting the response time of a server, while logistic regression is used for classification problems, such as predicting whether users will churn. Decision trees and random forests are algorithms based on tree structures; they can handle non-linear relationships and have good interpretability. Support Vector Machines, on the other hand, excel in dealing with high-dimensional data and non-linear classification problems.

3.2. Deep learning models

Deep learning models are uniquely suited to handle complex unstructured data. For example, Convolutional Neural Networks (CNNs) have achieved great success in image and video analysis by automatically extracting features from images for tasks such as image classification, target detection, and so on. Recurrent Neural Networks (RNNs) and their variants, such as Long Short-Term Memory Networks (LSTMs) and Gated Recurrent Units (GRUs), on the other hand, are suitable for processing sequential data, such as time-series data and text data. In computer information management, deep learning models can be used to predict user behavioural sequences, system performance trends, etc[3].

3.3. Application process of artificial intelligence techniques in predictive analytics

Artificial intelligence-driven predictive analytics usually includes the following steps: data collection, data preprocessing, model selection and training, model evaluation, and predictive application. Data collection refers to the collection of data related to the prediction goal from various data sources. Data preprocessing includes steps such as data cleaning, feature extraction, and feature selection, aiming to improve the quality and usability of data. Model selection and training refers to selecting an appropriate AI model based on the characteristics of the prediction problem and training the model using historical data. Model evaluation refers to the evaluation of the trained model using test data to determine the performance of the model. Finally, the trained model is applied to real data for prediction and decision making.

Table 1. Model analysis.

Technical Category	Algorithm/Model	Application Scenarios
Machine Learning	Linear Regression	Predicting continuous variables, e.g., server response time
Machine Learning	Logistic Regression	Classification problems, e.g., user churn prediction
Machine Learning	Decision Trees, Random Forests	Handling non-linear relationships with good interpretability

Technical Category	Algorithm/Model	Application Scenarios
Machine Learning	Support Vector Machines (SVM)	High-dimensional data and non-linear classification problems
Deep Learning	Convolutional Neural Networks (CNNs)	Image and video analysis

Table 1. *(continued)*

4. Application cases of artificial intelligence driven predictive analytics in computer information management

4.1. System performance prediction

System performance prediction is an important application area in computer information management. A performance prediction model is constructed using machine learning algorithms by collecting historical server performance data, such as CPU usage, memory usage, and disk I/O. For example, an Internet company used a linear regression model to predict the CPU usage of servers, discovering potential performance bottlenecks in advance and adjusting resource allocation in time to avoid system crashes and improve system reliability and availability.

4.2. User behaviour prediction

User behaviour prediction can help enterprises understand users' needs and preferences and develop personalised marketing strategies. For example, e-commerce platforms use deep learning models to predict users' purchasing behaviour by analysing their browsing records, purchase history, search keywords and other data. An e-commerce platform uses an LSTM model to predict the user's next purchase time and the category of goods to be purchased, and pushes personalised product recommendations to the user based on the prediction results, which improves the user's purchase conversion rate and customer satisfaction[4].

4.3. Forecast of market trends

Market trend forecasting is crucial for strategic decision making in business. AI algorithms are used to predict market trends by collecting market data, industry data and competitor data. For example, a financial institution uses the Random Forest model to predict stock price trends, providing investors with decision-making advice that improves return on investment.

Table 2. Prediction comparison.

Application Area	Prediction Target	Technology Used	Application Outcome
System Performance Prediction	Server CPU Usage	Linear Regression	Prevents system crashes and improves reliability/availability
User Behavior Prediction	User Purchase Behavior	Long Short-Term Memory (LSTM) Model	Improves purchase conversion rate and customer satisfaction
Market Trend Prediction	Stock Price Trends	Random Forest Model	Enhances investment return rate (ROI)

5. Challenges and future directions

5.1. Challenges faced

AI in computer info - management predictive analyses has made progress but faces challenges. Data quality needs pre - processing, model interpretability is poor, and privacy & security measures are required.

5.2. Future directions

To tackle challenges, future AI in computer info - management pred. analytics will focus on data quality, model interpretability, and privacy. Integration with IoT, big data, and cloud will bring more opportunities and challenges.

6. Conclusion

AI-driven predictive analytics provides efficient decision support for computer information management by improving the accuracy of system performance optimisation, user behaviour prediction and market trend analysis, but its application still faces core challenges such as data noise, model 'black box' issues and privacy risks. In the future, we need to focus on the development of efficient data preprocessing technology to improve data quality, build interpretable models to balance complexity and transparency, and strengthen privacy protection mechanisms to ensure that the technology is safe and reliable. Meanwhile, with the deep convergence of the Internet of Things and cloud computing, AI will further expand its prediction capabilities in complex scenarios, and promote the creation of higher value in the field of information management.

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