Application and Optimization of Machine Learning in Intelligent Financial Cost Prediction

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Abstract: Against the backdrop of financial digital transformation, machine learning technology provides an efficient solution for intelligent financial cost prediction. Its core advantage lies in improving prediction accuracy and timeliness through data mining and model training. Current applications of machine learning in financial cost prediction suffer from uneven data quality, lack of targeted model selection, insufficient feature engineering design, and poor adaptability in practical implementation, which restrict the full release of prediction performance. Based on the technical characteristics of machine learning and business requirements for financial cost prediction, this paper systematically analyzes the application status and existing dilemmas. It proposes optimization strategies from four dimensions: data governance, model optimization, feature engineering, and implementation support, providing theoretical references and practical paths for enterprises to enhance financial cost prediction capabilities and strengthen cost control.

***Keywords*:** machine learning; intelligent finance; cost prediction; data governance; model optimization

1. Introduction

As a core link in corporate cost control and strategic decision-making, financial cost prediction directly affects the efficiency of enterprise resource allocation and market competitiveness with its accuracy [1]. Traditional cost prediction relies on manual accounting and empirical judgment, featuring low efficiency, large errors, and limited capacity to cope with complex variables. With the rapid development of big data and machine learning technologies, intelligent finance has become the core direction of financial transformation. Through in-depth analysis of massive financial and business data, machine learning can explore potential correlations among cost influencing factors, realize independent learning and iterative optimization of prediction models, and greatly improve the accuracy and timeliness of cost prediction. In this context, exploring the application and optimization paths of machine learning in intelligent financial cost prediction is not only a practical necessity to break the bottlenecks of traditional prediction models, but also a key measure to promote financial digital transformation [2].

2. Application Status and Existing Problems of Machine Learning in Intelligent Financial Cost Prediction

2.1 Uneven Data Quality and Weak Basic Support

Financial cost prediction involves multi-dimensional information such as financial data, business data and market data. However, current corporate data management has many shortcomings: data collection lacks unified standards, data formats between financial systems and business systems are incompatible, leading to data duplication, omission and errors; data cleaning and preprocessing procedures are imperfect, with outliers and noisy data not fully eliminated, making data quality unable to meet the training needs of machine learning models; data security and privacy protection mechanisms are inadequate, and some sensitive financial data face leakage risks, affecting data sharing and application [3].

2.2 Lack of Targeted Model Selection and Poor Adaptability

When applying machine learning for cost prediction, enterprises tend to prioritize technology over actual needs, blindly pursuing complex models while ignoring business scenario adaptability. Common regression models (such as linear regression and random forest) and neural network models (such as LSTM and CNN) lack targeted selection criteria, without matching model characteristics with cost types (such as production costs, operating costs and marketing costs) and prediction cycles (short-term, medium-term and long-term). Personal factors such as industry differences, enterprise scale and business models are not fully considered during model training, resulting in weak model generalization ability and large deviations between predicted results and actual costs [4].

2.3 Insufficient Feature Engineering Design and Restricted Prediction Accuracy

Feature engineering is a core part of machine learning modeling, which directly affects model prediction performance. Current enterprises face problems such as incomplete feature extraction and unreasonable feature screening in cost prediction: potential deep correlations among cost influencing factors are not fully explored, focusing only on financial indicators while ignoring business indicators (such as output, sales volume, raw material price fluctuations and changes in market demand); feature screening lacks scientific methods, with redundant features not eliminated through correlation analysis and principal component analysis, leading to low model training efficiency and increased overfitting risks; feature update mechanisms are imperfect, failing to dynamically adjust feature variables according to business changes, making it difficult to adapt to changes in the market environment and enterprise operation models [5].

2.4 Poor Adaptability in Practical Implementation and Insufficient Collaborative Efficiency

Machine learning models have low integration with existing financial systems and business processes of enterprises. Isolated data islands and system barriers make it difficult to connect model prediction results with practical business scenarios such as financial control and budget preparation. Financial personnel lack sufficient understanding of machine learning technology and capabilities in data interpretation and model application, making it hard to convert prediction results into cost control decisions. There is no continuous iteration mechanism after model implementation, with no optimization and adjustment based on actual prediction effects and business changes, resulting in declining long-term application performance of models.

3. Optimization Strategies for Machine Learning in Intelligent Financial Cost Prediction

3.1 Strengthen Data Governance and Consolidate Basic Support

Establish a standardized data management system. Formulate unified standards for financial and business data collection, standardize data formats, statistical criteria and collection procedures to realize data interconnection between financial systems and business systems; build data cleaning and preprocessing mechanisms, and adopt technologies such as missing value filling, outlier elimination and data standardization to improve data quality; construct an integrated data middle platform to integrate multi-dimensional data including finance, business and market, realizing centralized data management and sharing.

Improve data security guarantee mechanisms. Adopt technologies such as data encryption, access permission control and desensitization processing to protect sensitive financial data; establish a data security audit system to regularly investigate data security risks and ensure compliance in data application; formulate data privacy protection specifications to balance the needs of data sharing and privacy protection.

3.2 Optimize Model Selection and Enhance Adaptability

Build a scenario-based model matching system. Select applicable models according to the characteristics of cost prediction scenarios: random forest and gradient boosting tree models can be adopted for short-term production cost prediction to balance accuracy and computing efficiency; LSTM and Prophet models are suitable for long-term strategic cost prediction to adapt to multi-variable and long-cycle data features; hybrid models (such as neural network combined with regression models) can be used for complex cost structures (such as multi-product and multi-region costs) to improve prediction performance.

Strengthen model training and iteration. Establish training and test datasets, and optimize model parameters through cross-validation; conduct personalized model adjustments combining corporate industry characteristics and operation modes to enhance model generalization ability; regularly iterate and optimize models according to deviations between actual cost data and predicted results to ensure adaptation to business changes.

3.3 Improve Feature Engineering and Enhance Prediction Accuracy

Fully extract multi-dimensional features. Construct a three-dimensional feature system integrating financial indicators, business indicators and external environmental indicators: financial indicators include historical costs and expense ratios; business indicators cover output, sales volume and production efficiency; external environmental indicators involve raw material prices, market demand and policy changes, ensuring full coverage of all cost influencing factors.

3.4 Strengthen Implementation Support and Release Collaborative Efficiency

Promote in-depth integration of models and business systems. Embed machine learning prediction models into enterprise

ERP systems and financial control platforms to realize seamless connection between prediction results and business processes such as cost accounting, budget preparation and expense control; develop visual prediction result display modules through data dashboards and chart analysis to improve financial personnel' s efficiency in interpreting prediction results.

Improve technical application capabilities of financial personnel. Carry out training on machine learning and intelligent finance to enhance financial personnel' s capabilities in data processing, model application and result interpretation; establish cross-departmental teams composed of financial personnel, data analysts and technical staff to strengthen collaboration between business and technology and promote practical application of prediction results.

4. Conclusion

Machine learning technology provides efficient and accurate solutions for intelligent financial cost prediction. However, releasing its full application performance requires breaking multi-dimensional bottlenecks in data, models, features and practical implementation. By strengthening data governance to consolidate foundations, optimizing model selection to enhance adaptability, improving feature engineering to raise accuracy, and reinforcing implementation support to release efficiency, enterprises can build a full-chain optimization system covering data, models and applications and promote in-depth application of machine learning in financial cost prediction. This optimization path conforms to the trend of financial digital transformation, helps enterprises improve cost prediction capabilities and cost control levels, and provides strong support for corporate strategic decision-making. In the future, it is necessary to further deepen the integrated innovation of machine learning and financial business, continuously optimize solutions combining industry characteristics and actual corporate needs, and advance intelligent financial cost prediction toward greater accuracy, efficiency and intelligence.

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