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“A Survey On Bankruptcy Prediction Model Using Deep Learning Techniques”

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ABSTRACT

Bankruptcy prediction is a critical task in financial risk management, aiding businesses and investors in making informed decisions. This survey explores recent advancements in bankruptcy prediction models using deep learning techniques. Traditional financial models often struggle with high-dimensional, nonlinear financial data, whereas deep learning methods, including artificial neural networks (ANNs), convolutional neural networks (CNNs), recurrent neural networks (RNNs), and transformer-based architectures, offer improved accuracy and robustness. We analyze various datasets, feature selection methods, and performance metrics used in bankruptcy prediction studies. The survey highlights key challenges such as data imbalance, feature interpretability, and model generalization. Additionally, we discuss the effectiveness of hybrid approaches that combine deep learning with traditional statistical models for enhanced predictive capabilities. Our findings suggest that deep learning significantly improves bankruptcy prediction accuracy, making it a valuable tool for financial forecasting. Future research directions

include explainable AI, transfer learning, and real-time bankruptcy risk assessment.

Keywords: Bankruptcy, Bankruptcy prediction system

Classification, machine learning techniques, Credit Card Fraud Detection

1. INTRODUCTION

Techniques for predicting bankruptcy of companies and financial organization became an important issue in the days. Recently in India bankruptcy become a very hot topic in banking, social and political area. The high individual, economic, and social costs inherent in corporate failures or bankruptcies have prompted efforts to provide better insight into and prediction of bankruptcy events [1]. Given the radical change of globalization, more accurate forecasting of corporate financial distress would provide useful information for decision-makers, such as stockholders, creditors, governmental officials, and even the general public. In fact, corporate bankruptcies can be caused by many factors such as wrong investment decisions, a poor investment environment, low cash flow and so on [1]. Therefore, the many current methods for

predicting corporate failure must be continuously improved.

The bankruptcy is a typical binary classification problem: there are only two results of prediction, bankruptcy and non-bankruptcy. Up to now, many researchers have proposed some classical bankruptcy prediction models based on statistical methods [2] However, the validity of these traditional statistical methods mainly depends on the

Subjective judgments of the human financial experts when

Applied in the selection of some parameters which, in turn,

Inevitably makes feature selection bias. With the development of data mining techniques, machine learning methods have been exploited by many researchers for the bankruptcy prediction problem since these methods can provide an unbiased feature selection and decision-making mechanism. In this paper, different machine learning techniques are employed to predict bankruptcy. The support system can be utilized by stockholders and investors to predict the performance of a company based on the nature of risk associated.

2. LITERATURE REVIEW

The literature review explores existing research on bankruptcy prediction models, comparing traditional statistical methods with advanced deep learning techniques. It highlights key findings, challenges, and emerging trends, emphasizing the growing role of AI in financial risk assessment.

This research [1] aims to compare the predictive performance of five models namely the Linear Discriminant Analysis (LDA), Logistic Regression (LR), Decision Trees (DT), Support Vector Machine (SVM) and Random Forest (RF) to forecast the bankruptcy of Tunisian companies. A Deep Neural Network (DNN) model is also applied to conduct a prediction performance comparison with other statistical and machine learning algorithms.

This review [2] examines the discriminatory power of an MLP in the context of bankruptcy prediction. The model was developed using a data set of Taiwanese firms composed of 95 financial ratios for the years 1999 to 2009. We compared different setups of four main parameters of MLPs: optimization algorithm, activation function, number of neurons, and number of layers. The goal was to find the

parameter setup that achieves the best results in four evaluation metrics that we used: average accuracy, specificity, sensitivity, and precision.

In [3] author compare some traditional statistical methods for predicting financial distress to some more “unconventional” methods, such as decision tree classification, neural networks, and evolutionary computation techniques, using data collected from 200 Taiwan Stock Exchange Corporation (TSEC) listed companies. Empirical experiments were conducted using a total of 42 ratios including 33 financial, 8 non-financial and 1 combined macroeconomic index, using principle component analysis (PCA) to extract suitable variables.

Author [4] proposed a semi-parametric Cox survival analysis model and non-parametric CART decision trees have been applied to financial distress prediction and compared with each other as well as the most popular approaches. This analysis is done over a variety of cost ratios (Type I Error cost: Type II Error cost) and prediction

Intervals as these differ depending on the situation. The results show that decision trees and survival analysis models have good prediction accuracy that justifies their use and supports further investigation.

The proposed [5] algorithm is successfully applied in the bankruptcy prediction problem, where experiment data sets are originally from the UCI Machine Learning Repository. The simulation results show the superiority of proposed algorithm over the traditional SVM-based methods combined with genetic algorithm (GA) or the particle swarm optimization (PSO) algorithm alone.

In [6] researchers investigate the effect of sampling methods on the performance of quantitative bankruptcy prediction models on real highly imbalanced dataset. Seven sampling methods and five quantitative models are tested on two real highly imbalanced datasets. A comparison of model performance tested on random paired sample set and real imbalanced sample set is also conducted. The experimental results suggest that the proper sampling method in developing prediction models is mainly dependent on the number of bankruptcies in the training sample set. In this research, authors [7] propose the implementation of Jordan Recurrent Neural Networks (JRNN) to classify and predict corporate bankruptcy based on financial ratios. Feedback interconnection in JRNN enables to make the network keep important information well allowing

the network to work more effectively. The result analysis showed that JRNN works very well in bankruptcy prediction with average success rate of 81.3785%. Neural Networks can process a tremendous amount of attribute factors; it results in over fitting frequently when more statistics is taken in. By using K-Nearest Neighbor and Random Forest, authors [9] obtain better results from different perspectives.

3. FINDING OF THE SURVEY

Deep Learning Enhances Predictive Accuracy:

Deep learning techniques, including ANNs, CNNs, RNNs, and transformer-based models, outperform traditional financial models by effectively handling high-dimensional and nonlinear financial data.

Challenges in Traditional Models: Conventional bankruptcy prediction models struggle with capturing complex patterns in financial data, leading to lower accuracy compared to deep learning-based approaches.

Impact of Data Imbalance: The survey identifies data imbalance as a significant challenge in bankruptcy prediction, requiring techniques like oversampling, cost-sensitive learning, or synthetic data generation to improve model performance.

Hybrid Approaches Improve Performance:

Combining deep learning with traditional statistical models enhances predictive power, providing better generalization and interpretability.

Importance of Feature Selection: Effective feature engineering and selection methods significantly influence model performance, highlighting the need for robust preprocessing techniques.

Model Interpretability Remains a Concern:

While deep learning models provide superior accuracy, their black-box nature makes them less interpretable, necessitating the use of Explainable AI (XAI) techniques.

Future Research Directions: Advancements in explainable AI, transfer learning, and real-time bankruptcy risk assessment can further enhance prediction models, making them more transparent and reliable.

4. CONCLUSION

Bankruptcy prediction plays a crucial role in financial risk assessment, helping businesses, investors, and policymakers mitigate potential financial crises. This survey explored the advancements in bankruptcy prediction models using deep learning techniques, highlighting their ability to analyze complex financial data with high accuracy. Traditional machine learning models, while effective, often struggle with handling high-dimensional, imbalanced, and nonlinear financial data. Deep learning methods such as artificial neural networks (ANNs), convolutional neural networks (CNNs), recurrent neural networks (RNNs), and transformer-based models have demonstrated superior performance in capturing intricate patterns in financial data. Despite the success of deep learning models, several challenges remain, including data availability, model interpretability, and overfitting. Addressing these challenges requires further research in explainable AI, hybrid modeling, and transfer learning. Additionally, incorporating alternative data sources, such as social media sentiment analysis and macroeconomic indicators, can enhance prediction reliability. Overall, deep learning has significantly improved bankruptcy prediction accuracy, making it a valuable tool for financial forecasting. Future research should focus on developing interpretable, robust, and real-time bankruptcy prediction systems to aid decision-making and risk management in an ever-evolving financial landscape.

5. REFERENCES

- [1] Manel Hamdi et al “Artificial Intelligence Techniques for Bankruptcy Prediction of Tunisian Companies: An Application of Machine Learning and Deep Learning-Based Models” 2024, 17, 132. <https://doi.org/10.3390/jrfm17040132>
<https://www.mdpi.com/journal/jrfm>
- [2] Raffael F"orch Brenes et al “An intelligent bankruptcy prediction model using a multilayer perceptron” <https://doi.org/10.1016/j.iswa.2022.200136> Elsevier 2022

- [3] Mu-Yen Chen “Bankruptcy prediction in firms with statistical and intelligent techniques and a comparison of evolutionary computation approaches” Elsevier 2011
- [4] Adrian Gepp and Kuldeep Kumar* “Predicting Financial Distress: A Comparison of Survival Analysis and Decision Tree Techniques” Elsevier 2015
- [5] Yang Lu,¹ Nianyin Zeng,² Xiaohui Liu,^{3,4} and Shujuan Yi¹ “A New Hybrid Algorithm for Bankruptcy Prediction Using Switching Particle Swarm Optimization and Support Vector Machines” Hindawi 2015
- [6] Ligang Zhou “Performance of corporate bankruptcy prediction models on imbalanced dataset: The effect of sampling methods” Elsevier 2012
- [7] Lingga Hardinata¹ , Budi Warsito¹ , Suparti¹ Bankruptcy prediction based on financial ratios using Jordan Recurrent Neural Networks: a case study in Polish companies IOP Conf. Series: Journal of Physics: Conf. Series 1025 (2018) 012098 doi :10.1088/1742-6596/1025/1/012098
- [8] Wenhao Zhang Machine Learning Approaches to Predicting Company Bankruptcy Journal of Financial Risk Management, 2017, 6, 364-
<http://www.scirp.org/journal/jfrm> ISSN Online: 2167-9541 ISSN Print: 2167-9533
- [9] Björn mattsson & olof steinert corporate bankruptcy prediction using machine learning techniques department of economics university of gothenburg school of business economics and law, 2017
- [10] Duaa Alrasheed¹ , Dongsheng Che¹ Improving Bankruptcy Prediction Using Oversampling and Feature Selection Techniques Int'l Conf. Artificial Intelligence | ICAI'18 |
- [11] Jacky C. K. Chow “analysis of financial credit risk using machine learning” Aston University Birmingham, United Kingdom April 2017
- [12] Kalyan Nagaraj and Amulyashree Sridhar “a predictive system for detection of bankruptcy using machine learning techniques” International Journal of Data Mining & Knowledge Management Process (IJDKP) Vol.5, No.1, January 2015
- [13] M. Krivko, “A hybrid model for plastic card fraud detection systems,” Expert Systems with Applications, vol. 37, no. 8, pp. 6070–6076, Aug. 2010.
- [14] Benson Edwin Raj, A. Annie Portia, “Analysis on Credit Card Fraud Detection Methods”, IEEE International Conference on Computer, Communication and Electrical Technology – ICC CET2011, 978-1-4244-9394-4/11, 2011 IEEE.
- [15] David Opitz and Richard Maclin, “Popular Ensemble Methods: An Empirical Study”, Journal of artificial intelligence research 169-198, 1999.
- [16] L. Breiman, “Bagging predictors,” Machine Learning, vol. 24, no. 2, pp. 123–140, 1996.
- [17] Freund, Y., & Schapire, R. (1996). Experiments with a new boosting algorithm. In Proceedings of the thirteenth international conference on machine learning, Bari, Italy (pp. 148–156).
- [18] Wolpert, D. H. (1992). Stacked generalization. Neural Networks, 5(2), 241–259.
- [19] Masoumeh Zareapoor, Pourya Shamsolmolli, “Application of Credit Card Fraud Detection: Based on Bagging Ensemble Classifier”, International Conference on Intelligent Computing, Communication & Convergence, (ICCC 2015), Elsevier, Procedia Computer Science 48 (2015) 679 – 685.