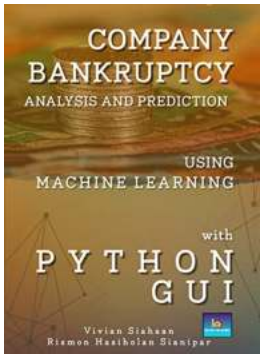
# Discover How Machine Learning Predicts Company Bankruptcy in Python

If you have an interest in finance or business, understanding bankruptcy analysis and prediction can be a valuable skill to possess. In today's volatile economic climate, being able to forecast the finances of a business accurately can give you a competitive edge.

Thanks to advancements in technology, machine learning has emerged as a powerful tool in predicting bankruptcy. In this article, we will delve into the world of company bankruptcy analysis and prediction using machine learning with Python, a popular programming language for data science and machine learning tasks.

## Understanding Company Bankruptcy Analysis

Bankruptcy refers to a legal process that allows individuals or companies to eliminate or repay their debt under the protection of the court. It typically occurs when a business fails to pay its debts, resulting in financial insolvency. Analyzing a company's financial statements and identifying key indicators can help predict the likelihood of bankruptcy.




**COMPANY BANKRUPTCY ANALYSIS AND PREDICTION USING MACHINE LEARNING WITH PYTHON GUI** by Vivian Siahaan (Kindle Edition)

4.4 out of 5

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Traditionally, bankruptcy analysis involved manual examination of financial records, which was time-consuming and prone to human errors. Machine learning has revolutionized this process by automating the analysis using algorithms that can quickly process vast amounts of data.

## Predicting Bankruptcy with Machine Learning

Machine learning algorithms can learn from historical data to identify patterns and make predictions about future outcomes. When it comes to bankruptcy, these algorithms analyze various financial ratios, trends, and other relevant factors to determine the financial health of a company.

Python, with its extensive libraries such as Pandas, NumPy, and Scikit-learn, provides a robust and flexible platform for implementing machine learning algorithms. These libraries offer a wide range of tools for data preprocessing, feature selection, model training, and evaluation.

One popular machine learning technique used in bankruptcy prediction is logistic regression. This algorithm is suitable for binary classification tasks, where the outcome can be either bankrupt or non-bankrupt. By training the algorithm with labeled historical data, it can learn to generalize patterns and predict the bankruptcy likelihood of new companies.

## Steps for Bankruptcy Analysis and Prediction in Python

1. Data Collection: The first step involves gathering relevant financial data of companies, including profit and loss statements, balance sheets, and cash flow statements. This data will serve as the input for the machine learning algorithm.

2. Data Preprocessing: Raw financial data often contains missing values, outliers, and inconsistencies. Data preprocessing techniques, such as imputation, scaling, and outlier handling, are essential to ensure accurate analysis and predictions.

3. Feature Selection: Not all financial variables are equally important in determining bankruptcy likelihood. Feature selection techniques help identify the most relevant variables that contribute to accurate predictions.

4. Model Training: Split the data into training and testing sets. The training set is used to train the machine learning model on labeled data, enabling it to learn from patterns and make predictions. Various algorithms can be employed for training, including logistic regression, decision trees, random forests, and support vector machines.

5. Model Evaluation: Assess the performance of the trained model using evaluation metrics such as accuracy, precision, recall, and F1-score. This step helps determine the reliability and accuracy of the bankruptcy predictions.

6. Predicting New Cases: Once the model is trained and evaluated, it can be used to predict the likelihood of bankruptcy for new, unseen companies.

## Benefits of Bankruptcy Prediction

Accurate bankruptcy prediction through machine learning offers several benefits for various stakeholders, including:

**1. Financial Institutions:** Banks and lending institutions can use this prediction to determine creditworthiness, assess risks, and make informed lending decisions.

**2. Investors:** Investors can evaluate the financial stability and growth potential of companies before investing their money. Predicting bankruptcy helps them avoid potential loss and make better investment choices.

**3. Suppliers:** Suppliers can assess the risks associated with offering credit to a company. They can adjust their pricing and payment terms appropriately, ensuring their financial stability.

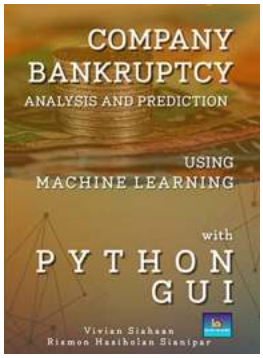
**4. Regulators:** Government agencies can use bankruptcy prediction to monitor the financial health of companies and take necessary actions to prevent economic instability. It helps in maintaining a stable market and protecting consumers.

**5. Researchers:** Academics and researchers can analyze bankruptcy data to understand the factors contributing to a company's financial distress. This information can further help in developing preventive measures and policies.

Bankruptcy analysis and prediction are crucial aspects of finance and business. Using machine learning with Python, businesses, financial institutions, investors, suppliers, and regulators can harness the power of predictive analytics to mitigate risks and make informed decisions.

Python's comprehensive libraries and machine learning algorithms provide a powerful framework for analyzing financial data and predicting bankruptcy. By implementing these techniques, one can gain insights into the financial health of companies and respond proactively to prevent financial crises.

As technology continues to advance, machine learning-driven bankruptcy prediction will become an indispensable tool in the financial industry, ensuring a stable and resilient economy.

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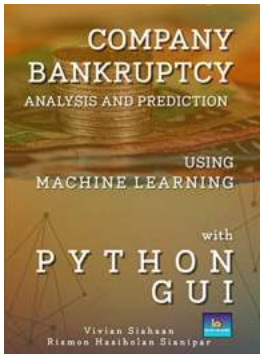
The dataset was collected from the Taiwan Economic Journal for the years 1999 to 2009. Company bankruptcy was defined based on the business regulations of the Taiwan Stock Exchange.

Attribute information in the dataset are as follows: Y - Bankrupt?: Class label; X1 - ROA(C) before interest and depreciation before interest: Return On Total Assets(C); X2 - ROA(A) before interest and % after tax: Return On Total Assets(A); X3 - ROA(B) before interest and depreciation after tax: Return On Total Assets(B); X4 - Operating Gross Margin: Gross Profit/Net Sales; X5 - Realized Sales Gross Margin: Realized Gross Profit/Net Sales; X6 - Operating

Profit Rate: Operating Income/Net Sales; X7 - Pre-tax net Interest Rate: Pre-Tax Income/Net Sales; X8 - After-tax net Interest Rate: Net Income/Net Sales; X9 - Non-industry income and expenditure/revenue: Net Non-operating Income Ratio; X10 - Continuous interest rate (after tax): Net Income-Exclude Disposal Gain or Loss/Net Sales; X11 - Operating Expense Rate: Operating Expenses/Net Sales; X12 - Research and development expense rate: (Research and Development Expenses)/Net Sales; X13 - Cash flow rate: Cash Flow from Operating/Current Liabilities; X14 - Interest-bearing debt interest rate: Interest-bearing Debt/Equity; X15 - Tax rate (A): Effective Tax Rate; X16 - Net Value Per Share (B): Book Value Per Share(B); X17 - Net Value Per Share (A): Book Value Per Share(A); X18 - Net Value Per Share (C): Book Value Per Share(C); X19 - Persistent EPS in the Last Four Seasons: EPS-Net Income; X20 - Cash Flow Per Share; X21 - Revenue Per Share (Yuan ¥): Sales Per Share; X22 - Operating Profit Per Share (Yuan ¥): Operating Income Per Share; X23 - Per Share Net profit before tax (Yuan ¥): Pretax Income Per Share; X24 - Realized Sales Gross Profit Growth Rate; X25 - Operating Profit Growth Rate: Operating Income Growth; X26 - After-tax Net Profit Growth Rate: Net Income Growth; X27 - Regular Net Profit Growth Rate: Continuing Operating Income after Tax Growth; X28 - Continuous Net Profit Growth Rate: Net Income-Excluding Disposal Gain or Loss Growth; X29 - Total Asset Growth Rate: Total Asset Growth; X30 - Net Value Growth Rate: Total Equity Growth; X31 - Total Asset Return Growth Rate Ratio: Return on Total Asset Growth; X32 - Cash Reinvestment %: Cash Reinvestment Ratio; X33 - Current Ratio; X34 - Quick Ratio: Acid Test; X35 - Interest Expense Ratio: Interest Expenses/Total Revenue; X36 - Total debt/Total net worth: Total Liability/Equity Ratio; X37 - Debt ratio %: Liability/Total Assets; X38 - Net worth/Assets: Equity/Total Assets; X39 - Long-term fund suitability ratio (A): (Long-term Liability+Equity)/Fixed Assets; X40 - Borrowing dependency: Cost of Interest-bearing Debt; X41 - Contingent liabilities/Net worth: Contingent Liability/Equity; X42 - Operating profit/Paid-in capital: Operating Income/Capital; X43 - Net profit

before tax/Paid-in capital: Pretax Income/Capital; X44 - Inventory and accounts receivable/Net value: (Inventory+Accounts Receivables)/Equity; X45 - Total Asset Turnover; X46 - Accounts Receivable Turnover; X47 - Average Collection Days: Days Receivable Outstanding; and so on.

The models used in this project are K-Nearest Neighbor, Random Forest, Naive Bayes, Logistic Regression, Decision Tree, Support Vector Machine, Adaboost, LGBM classifier, Gradient Boosting, and XGB classifier. Three feature scaling used in machine learning are raw, minmax scaler, and standard scaler. Finally, you will develop a GUI using PyQt5 to plot cross validation score, predicted values versus true values, confusion matrix, learning curve, decision boundaries, performance of the model, scalability of the model, training loss, and training accuracy.

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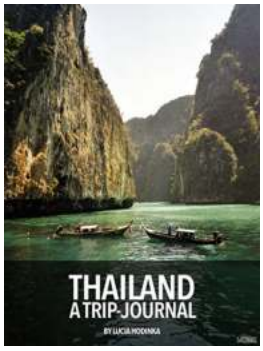


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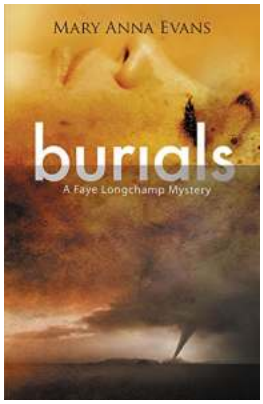


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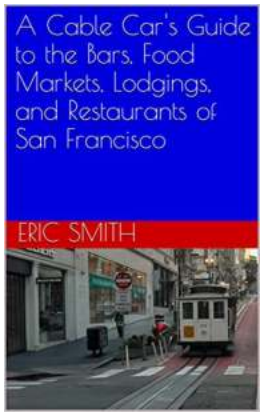


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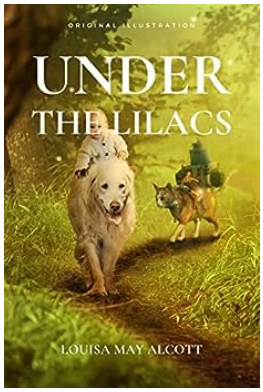


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