examples of decision tree analysis

Examples of Decision Tree Analysis: Real-World Applications and Insights

Examples of decision tree analysis abound across various industries, showcasing the versatility and power of this intuitive machine learning technique. Whether you're a business owner trying to optimize marketing strategies, a healthcare professional diagnosing diseases, or a data enthusiast exploring predictive models, decision trees offer a transparent and effective way to make informed decisions based on data. In this article, we'll dive into several compelling examples of decision tree analysis, explore how they work in practice, and highlight why they continue to be a favorite tool for data-driven decision-making.

What Is Decision Tree Analysis?

Before jumping into specific examples, it’s helpful to understand what decision tree analysis entails. At its core, a decision tree is a flowchart-like structure where each internal node represents a test on an attribute, each branch denotes the outcome of that test, and each leaf node represents a class label or decision. It’s a supervised learning algorithm used for classification and regression tasks.

One of the reasons decision trees are so popular is their interpretability. Unlike some black-box models like neural networks, decision trees allow you to visualize the decision-making process, making it easier for stakeholders to understand why a particular decision or prediction was made.

Examples of Decision Tree Analysis in Business

Businesses frequently leverage decision tree analysis to improve operational efficiency and customer engagement. Here are some prominent examples:

1. Customer Churn Prediction

Customer churn—the rate at which customers stop doing business with a company—is a critical metric for many industries, especially telecommunications, subscription services, and banking. Companies use decision trees to analyze customer behavior and identify factors that lead to churn.

For example, a telecom company might build a decision tree using data such as customer tenure, monthly charges, customer service calls, and contract type. The tree might reveal patterns like customers with month-to-month contracts and frequent complaints are more likely to churn. This insight allows companies to proactively engage at-risk customers with tailored retention offers.

2. Loan Approval and Credit Scoring

Financial institutions often rely on decision trees to streamline the loan approval process. By analyzing historical data on loan applicants, including income, credit history, employment status, and debt-to-income ratio, decision trees help predict the likelihood of default.

In this context, the model might split applicants first by credit score thresholds, then by income levels, and finally by employment duration to reach a decision node indicating approval or rejection. The transparency of decision trees makes it easier for loan officers to explain decisions to applicants, enhancing trust and regulatory compliance.

3. Marketing Campaign Optimization

Marketing teams use decision tree analysis to identify the best customer segments for targeted campaigns. By feeding in data such as demographic details, purchase history, and engagement metrics, decision trees can highlight which groups are most likely to respond positively.

For instance, a retail brand might find that customers aged 25-34 who have purchased within the last 30 days and have engaged with email newsletters are prime candidates for a new product launch campaign. This targeted approach improves conversion rates and reduces marketing spend waste.

Examples of Decision Tree Analysis in Healthcare

Healthcare is another domain where decision trees have proven invaluable, particularly in diagnostic and treatment decision-making.

1. Disease Diagnosis

Imagine a doctor assessing a patient with symptoms like fever, cough, and fatigue. A decision tree model trained on patient data can help differentiate between flu, pneumonia, or COVID-19 based on symptom severity, travel history, and lab test results.

For example, the tree might first ask if the patient has a high fever, then check for respiratory distress, and finally evaluate exposure risks. This stepwise process assists physicians in making quicker, evidence-based diagnoses, especially in resource-constrained settings.

2. Treatment Effectiveness and Outcome Prediction

Decision trees also aid in predicting patient outcomes based on treatment plans. For instance, oncologists can use patient characteristics, tumor markers, and previous treatment responses to decide on chemotherapy regimens.

The model can help identify which patients are likely to respond positively to a particular therapy, thereby personalizing treatment and improving survival rates. This use of decision trees supports the broader movement towards precision medicine.

Examples of Decision Tree Analysis in Manufacturing and Supply Chain

Manufacturing companies and supply chain managers use decision trees to enhance quality control, forecasting, and inventory management.

1. Quality Control and Defect Detection

Decision trees are effective in identifying factors leading to product defects. By analyzing sensor data, machine settings, and environmental conditions, manufacturers can pinpoint which variables cause defects.

For example, a car manufacturer might discover that defects increase when a specific machine temperature exceeds a threshold during a certain shift. This insight can lead to adjustments that reduce defects and lower production costs.

2. Demand Forecasting and Inventory Management

Inventory managers can use decision trees to predict product demand based on historical sales, seasonality, and promotional activities. This helps optimize stock levels, preventing overstocking or stockouts.

A decision tree might reveal that demand spikes for certain items during holidays or weekends, allowing businesses to adjust ordering schedules accordingly. This application improves customer satisfaction and operational efficiency.

Examples of Decision Tree Analysis in Education

Educational institutions are increasingly turning to data analytics to improve student outcomes and resource allocation.

1. Student Performance Prediction

Schools and universities use decision trees to predict which students might struggle academically. By analyzing factors like attendance, previous grades, participation, and socio-economic background, educators can identify at-risk students early.

For example, a decision tree might classify students with low attendance and poor homework completion as high risk for failing a course. This enables timely interventions such as tutoring or counseling.

2. Course Recommendation Systems

Decision trees can also power personalized course recommendations. By examining student interests, academic history, and career goals, educational platforms can suggest suitable courses that align with their profiles.

This tailored approach helps improve engagement and ensures that students acquire skills relevant to their aspirations.

Tips for Implementing Decision Tree Analysis Effectively

While decision trees are intuitive, certain best practices can enhance their performance and reliability:

- **Data Quality Matters:** Ensure your dataset is clean, representative, and free from biases to build accurate trees.
- **Feature Selection:** Choose relevant features that contribute meaningfully to the decision-making process to avoid overfitting.
- **Pruning Techniques:** Use pruning methods to simplify complex trees and improve generalization to new data.
- **Combine with Other Models:** Consider ensemble methods like Random Forests or Gradient Boosted Trees for improved prediction accuracy.
- **Interpretability:** Leverage visualization tools to make decision trees understandable to non-technical stakeholders.

Why Decision Trees Stand Out

In the realm of data science, decision trees strike a balance between simplicity and power. Their ability to handle both categorical and numerical data, coupled with their clear graphical representation, makes them accessible and actionable.

Moreover, decision trees are non-parametric, meaning they don't assume any underlying data distribution. This flexibility allows them to be applied in diverse contexts, from finance and healthcare to manufacturing and education.

The transparency of decision trees fosters trust, especially in industries where decisions must be justified to regulators or customers. When combined with other machine learning techniques, decision

trees often form the backbone of robust predictive systems.

Exploring examples of decision tree analysis reveals not only the breadth of their applications but also their potential to transform raw data into meaningful insights. Whether predicting customer behavior, diagnosing diseases, or optimizing supply chains, decision trees empower professionals to navigate complex decisions with confidence.

Frequently Asked Questions

What are some common examples of decision tree analysis in business?

Common examples include customer segmentation, credit risk assessment, sales forecasting, and product recommendation systems.

How is decision tree analysis used in healthcare?

In healthcare, decision tree analysis helps in diagnosing diseases, predicting patient outcomes, and deciding treatment plans based on patient data.

Can decision tree analysis be applied to marketing strategies?

Yes, decision trees are used to identify target customer groups, optimize marketing campaigns, and predict customer responses to promotions.

What is an example of decision tree analysis in finance?

Decision trees are used for credit scoring, fraud detection, and investment decision-making by evaluating various financial indicators.

How do decision trees help in supply chain management?

They assist in demand forecasting, supplier selection, and optimizing logistics by analyzing different scenarios and outcomes.

Is decision tree analysis useful in human resources?

Yes, it can be used for employee retention analysis, recruitment decision-making, and performance evaluation by analyzing employee data.

What are examples of decision tree applications in education?

Decision trees help in student performance prediction, identifying at-risk students, and tailoring educational content based on learning styles.

How is decision tree analysis applied in environmental science?

It is used to assess environmental risks, classify land use types, and predict the impact of environmental policies.

Can decision tree analysis be used in customer service?

Yes, it helps in automating decision-making for customer queries, routing service requests, and predicting customer satisfaction.

What is an example of decision tree analysis in manufacturing?

Decision trees are used for quality control, equipment maintenance scheduling, and optimizing production processes by analyzing operational data.

Additional Resources

Examples of Decision Tree Analysis: Applications and Insights Across Industries

Examples of decision tree analysis demonstrate the versatility and effectiveness of this method in solving complex problems by breaking them down into manageable, sequential decisions. Decision trees are widely used in fields ranging from finance and healthcare to marketing and manufacturing, leveraging their intuitive structure to facilitate data-driven decision-making. This article explores various examples of decision tree analysis, illustrating how organizations deploy this technique to optimize outcomes and mitigate risks.

Understanding Decision Tree Analysis

Decision tree analysis is a graphical representation of possible solutions to a decision based on certain conditions. Each branch of the tree represents a potential decision or occurrence, making it a powerful tool for predictive analytics and classification tasks. The method's strength lies in its ability to simplify complex decisions by mapping out alternatives and their consequences, including chance event outcomes, resource costs, and utility.

The core components of decision tree analysis include nodes representing decisions or chance events, branches indicating possible actions or outcomes, and leaves that represent final results or classifications. By employing algorithms such as ID3, C4.5, or CART, decision trees can be constructed from data sets to predict categorical or continuous outcomes.

Examples of Decision Tree Analysis in Real-World

Contexts

Healthcare: Diagnosing Diseases and Treatment Planning

In healthcare, decision tree analysis plays a critical role in diagnostic processes and treatment recommendations. For example, a hospital might use a decision tree to determine whether a patient exhibiting certain symptoms should undergo further testing for diseases like diabetes or heart conditions. By analyzing patient data such as age, blood pressure, glucose levels, and family history, the decision tree helps clinicians identify high-risk cases efficiently.

Another example is treatment planning for cancer patients. Decision trees can incorporate variables such as tumor size, patient age, and genetic markers to evaluate the potential benefits and side effects of chemotherapy versus radiation therapy. This structured approach aids in personalized medicine, ensuring that treatment decisions align with patient-specific factors and expected outcomes.

Finance: Credit Risk Assessment and Loan Approval

Financial institutions frequently utilize decision tree analysis to assess credit risk and approve loans. For instance, banks develop decision trees that consider applicants' credit scores, income levels, employment status, and existing debts to predict the likelihood of loan repayment. This predictive modeling helps minimize defaults by categorizing applicants into risk segments—such as low, medium, or high risk—based on the probability of repayment.

Additionally, decision trees assist in streamlining the loan approval process by automating decisions for straightforward cases while flagging complex applications for human review. This not only accelerates processing but also enhances accuracy in risk evaluation.

Marketing: Customer Segmentation and Campaign Optimization

Marketing teams employ decision tree analysis to segment customers into distinct groups based on purchasing behavior, demographics, and interaction history. For example, an e-commerce company might use a decision tree to classify customers into categories like loyal buyers, occasional shoppers, or one-time purchasers by analyzing data points such as purchase frequency, average order value, and product preferences.

This segmentation enables targeted marketing campaigns tailored to each group's characteristics, improving engagement and conversion rates. Furthermore, decision trees can help identify which promotional offers are likely to resonate with specific segments, optimizing marketing spend and return on investment.

Manufacturing: Quality Control and Process Optimization

In manufacturing, decision tree analysis is instrumental in quality control and process optimization. For example, a production plant may use a decision tree to determine the root causes of defects in a product line. By examining factors such as raw material quality, machine settings, and operator skill levels, the decision tree can pinpoint which variables most significantly impact product quality.

This approach facilitates proactive interventions, reducing waste and enhancing efficiency. Moreover, decision trees can guide decisions on equipment maintenance schedules by predicting failure probabilities based on operating conditions and historical data.

Comparing Decision Tree Analysis to Other Predictive Models

Decision trees are often compared with other machine learning methods, such as logistic regression, random forests, and neural networks. One advantage of decision trees is their interpretability; stakeholders can easily understand the logic behind decisions, which is crucial in regulated industries like healthcare and finance. However, decision trees can be prone to overfitting, especially with noisy data, unless pruning techniques or ensemble methods (like random forests) are applied.

In contrast, logistic regression provides a probabilistic output but may not capture complex nonlinear relationships as effectively. Neural networks offer high accuracy in many contexts but operate as "black boxes," making their decisions less transparent. Thus, the choice of model depends on the specific use case, data characteristics, and the need for interpretability.

Key Features and Benefits of Decision Tree Analysis

- **Visual Simplicity:** The tree structure makes it easy to visualize decisions and outcomes.
- **Flexibility:** Applicable to both classification and regression problems.
- **Non-parametric Nature:** Does not require assumptions about data distribution.
- **Handles Both Numerical and Categorical Data:** Useful in diverse datasets.
- **Facilitates Feature Selection:** Identifies the most significant variables influencing decisions.

Despite these advantages, decision trees also have limitations such as sensitivity to data variations and the potential for creating biased trees if some classes dominate the dataset. Addressing these issues often involves combining multiple trees into an ensemble, which improves robustness and predictive performance.

Future Trends in Decision Tree Analysis

With the growing availability of big data and advancements in artificial intelligence, decision tree analysis continues to evolve. Integration with ensemble techniques like gradient boosting and random forests enhances predictive accuracy, while hybrid models combining decision trees with neural networks are emerging in complex domains.

Moreover, explainable AI initiatives emphasize the importance of transparent decision-making models, positioning decision trees as a valuable tool in ensuring accountability and trustworthiness in automated systems. As industries increasingly rely on data-driven strategies, decision tree analysis remains a foundational method for translating raw data into actionable insights.

The diverse examples of decision tree analysis across sectors underscore its adaptability and practical value. Whether guiding medical diagnoses, assessing financial risks, targeting marketing efforts, or streamlining manufacturing processes, decision trees provide a structured framework that transforms uncertainty into informed choices.

Examples Of Decision Tree Analysis

examples of decision tree analysis: Project Valuation Using Real Options Prasad Kodukula, Chandra Papudesu, 2006-07-15 Business leaders are frequently faced with investment decisions on new and ongoing projects. The challenge lies in deciding what projects to choose, expand, contract, defer, or abandon, and which method of valuation to use is the key tool in the process. This title presents a step-by-step, practical approach to real options valuation to make it easily understandable by practitioners as well as senior management. This systematic approach to project valuation helps you minimize upfront investment risks, exercise flexibility in decision making, and maximize the returns. Whereas the traditional decision tools such as discounted cash flow/net present value (DCF/NPV) analysis assume a “fixed” path ahead, real options analysis offers more flexible strategies. Considered one of the greatest innovations of modern finance, the real options approach is based on Nobel-prize winning work by three MIT economists, Fischer Black, Robert Merton, and Myron Scholes.

examples of decision tree analysis: *Northern Nevada Geothermal Exploration Strategy Analysis* N. E. Goldstein, Lawrence Berkeley Laboratory, 1977

examples of decision tree analysis: Comparative Analysis of Deterministic and Nondeterministic Decision Trees Mikhail Moshkov, 2020-03-14 This book compares four parameters of problems in arbitrary information systems: complexity of problem representation and complexity of deterministic, nondeterministic, and strongly nondeterministic decision trees for problem solving. Deterministic decision trees are widely used as classifiers, as a means of knowledge representation, and as algorithms. Nondeterministic (strongly nondeterministic) decision trees can be interpreted as systems of true decision rules that cover all objects (objects from one decision class). This book develops tools for the study of decision trees, including bounds on complexity and algorithms for construction of decision trees for decision tables with many-valued decisions. It considers two approaches to the investigation of decision trees for problems in information systems: local, when decision trees can use only attributes from the problem representation; and global, when decision trees can use arbitrary attributes from the information system. For both approaches, it describes all possible types of relationships among the four parameters considered and discusses the algorithmic problems related to decision tree optimization. The results presented are useful for researchers who

apply decision trees and rules to algorithm design and to data analysis, especially those working in rough set theory, test theory and logical analysis of data. This book can also be used as the basis for graduate courses.

examples of decision tree analysis: Quantitative Analysis Roy M Chiulli, 1999-02-22 Written in a lecture format with solved problems at the end of each chapter, this book surveys quantitative modeling and decision analysis techniques. It serves to familiarize the reader with quantitative techniques utilized in planning and optimizing complex systems, as well as students experiencing the subject for the first time. It can be used by students of business and public administration without a background in calculus as well as engineers with significant scientific training. It allows the reader to comprehend the material through examples and problems and also demonstrates the value and shortcomings of many methods. Quantitative Analysis: An introduction developed out of the author's experience teaching the material to students at the University of California Los Angeles, California State University, Northridge, and the University of Southern California, Los Angeles.

examples of decision tree analysis: Management and Leadership for Nurse Administrators Linda Roussel, Richard J. Swansburg, Russell C. Swansburg, 2006 Designed for the management and development of professional nurses, this text provides management concepts and theories, giving professional administrators theoretical and practical knowledge, enabling them to maintain morale, motivation, and productivity. Organized around the four management functions of Planning, Organizing, Leadership, and Evaluation, it includes new chapters on total quality management, the theory of human resource development, and collective bargaining. Additionally, content has been added to include recommendations from the work of the Institute of Medicine and the Magnet Appraisal process.

examples of decision tree analysis: 5 FIVE DATA SCIENCE PROJECTS FOR ANALYSIS, CLASSIFICATION, PREDICTION, AND SENTIMENT ANALYSIS WITH PYTHON GUI Vivian Siahaan, Rismon Hasiholan Sianipar, 2022-04-29 PROJECT 1: SUPERMARKET SALES ANALYSIS AND PREDICTION USING MACHINE LEARNING WITH PYTHON GUI The dataset used in this project consists of the growth of supermarkets with high market competitions in most populated cities. The dataset is one of the historical sales of supermarket company which has recorded in 3 different branches for 3 months data. Predictive data analytics methods are easy to apply with this dataset. Attribute information in the dataset are as follows: Invoice id: Computer generated sales slip invoice identification number; Branch: Branch of supercenter (3 branches are available identified by A, B and C); City: Location of supercenters; Customer type: Type of customers, recorded by Members for customers using member card and Normal for without member card; Gender: Gender type of customer; Product line: General item categorization groups - Electronic accessories, Fashion accessories, Food and beverages, Health and beauty, Home and lifestyle, Sports and travel; Unit price: Price of each product in $; Quantity: Number of products purchased by customer; Tax: 5% tax fee for customer buying; Total: Total price including tax; Date: Date of purchase (Record available from January 2019 to March 2019); Time: Purchase time (10am to 9pm); Payment: Payment used by customer for purchase (3 methods are available – Cash, Credit card and Ewallet); COGS: Cost of goods sold; Gross margin percentage: Gross margin percentage; Gross income: Gross income; and Rating: Customer stratification rating on their overall shopping experience (On a scale of 1 to 10). In this project, you will perform predicting rating using machine learning. The machine learning models used in this project to predict clusters as target variable are K-Nearest Neighbor, Random Forest, Naive Bayes, Logistic Regression, Decision Tree, Support Vector Machine, LGBM, Gradient Boosting, XGB, and MLP. Finally, you will plot boundary decision, distribution of features, feature importance, cross validation score, and predicted values versus true values, confusion matrix, learning curve, performance of the model, scalability of the model, training loss, and training accuracy. PROJECT 2: DETECTING CYBERBULLYING TWEETS USING MACHINE LEARNING AND DEEP LEARNING WITH PYTHON GUI As social media usage becomes increasingly prevalent in every age group, a vast majority of citizens rely on this essential medium for day-to-day

communication. Social media’s ubiquity means that cyberbullying can effectively impact anyone at any time or anywhere, and the relative anonymity of the internet makes such personal attacks more difficult to stop than traditional bullying. On April 15th, 2020, UNICEF issued a warning in response to the increased risk of cyberbullying during the COVID-19 pandemic due to widespread school closures, increased screen time, and decreased face-to-face social interaction. The statistics of cyberbullying are outright alarming: 36.5% of middle and high school students have felt cyberbullied and 87% have observed cyberbullying, with effects ranging from decreased academic performance to depression to suicidal thoughts. In light of all of this, this dataset contains more than 47000 tweets labelled according to the class of cyberbullying: Age; Ethnicity; Gender; Religion; Other type of cyberbullying; and Not cyberbullying. The data has been balanced in order to contain ~8000 of each class. 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, XGB classifier, LSTM, and CNN. 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. PROJECT 3: HIGHER EDUCATION STUDENT ACADEMIC PERFORMANCE ANALYSIS AND PREDICTION USING MACHINE LEARNING WITH PYTHON GUI The dataset used in this project was collected from the Faculty of Engineering and Faculty of Educational Sciences students in 2019. The purpose is to predict students' end-of-term performances using ML techniques. Attribute information in the dataset are as follows: Student ID; Student Age (1: 18-21, 2: 22-25, 3: above 26); Sex (1: female, 2: male); Graduated high-school type: (1: private, 2: state, 3: other); Scholarship type: (1: None, 2: 25%, 3: 50%, 4: 75%, 5: Full); Additional work: (1: Yes, 2: No); Regular artistic or sports activity: (1: Yes, 2: No); Do you have a partner: (1: Yes, 2: No); Total salary if available (1: USD 135-200, 2: USD 201-270, 3: USD 271-340, 4: USD 341-410, 5: above 410); Transportation to the university: (1: Bus, 2: Private car/taxi, 3: bicycle, 4: Other); Accommodation type in Cyprus: (1: rental, 2: dormitory, 3: with family, 4: Other); Mother's education: (1: primary school, 2: secondary school, 3: high school, 4: university, 5: MSc., 6: Ph.D.); Father's education: (1: primary school, 2: secondary school, 3: high school, 4: university, 5: MSc., 6: Ph.D.); Number of sisters/brothers (if available): (1: 1, 2:, 2, 3: 3, 4: 4, 5: 5 or above); Parental status: (1: married, 2: divorced, 3: died - one of them or both); Mother's occupation: (1: retired, 2: housewife, 3: government officer, 4: private sector employee, 5: self-employment, 6: other); Father's occupation: (1: retired, 2: government officer, 3: private sector employee, 4: self-employment, 5: other); Weekly study hours: (1: None, 2: <5 hours, 3: 6-10 hours, 4: 11-20 hours, 5: more than 20 hours); Reading frequency (non-scientific books/journals): (1: None, 2: Sometimes, 3: Often); Reading frequency (scientific books/journals): (1: None, 2: Sometimes, 3: Often); Attendance to the seminars/conferences related to the department: (1: Yes, 2: No); Impact of your projects/activities on your success: (1: positive, 2: negative, 3: neutral); Attendance to classes (1: always, 2: sometimes, 3: never); Preparation to midterm exams 1: (1: alone, 2: with friends, 3: not applicable); Preparation to midterm exams 2: (1: closest date to the exam, 2: regularly during the semester, 3: never); Taking notes in classes: (1: never, 2: sometimes, 3: always); Listening in classes: (1: never, 2: sometimes, 3: always); Discussion improves my interest and success in the course: (1: never, 2: sometimes, 3: always); Flip-classroom: (1: not useful, 2: useful, 3: not applicable); Cumulative grade point average in the last semester (/4.00): (1: <2.00, 2: 2.00-2.49, 3: 2.50-2.99, 4: 3.00-3.49, 5: above 3.49); Expected Cumulative grade point average in the graduation (/4.00): (1: <2.00, 2: 2.00-2.49, 3: 2.50-2.99, 4: 3.00-3.49, 5: above 3.49); Course ID; and OUTPUT: Grade (0: Fail, 1: DD, 2: DC, 3: CC, 4: CB, 5: BB, 6: BA, 7: AA). 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. PROJECT 4: COMPANY BANKRUPTCY ANALYSIS AND PREDICTION USING MACHINE LEARNING WITH PYTHON GUI 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; X48 - Inventory Turnover Rate (times); X49 - Fixed Assets Turnover Frequency; X50 - Net Worth Turnover Rate (times): Equity Turnover; X51 - Revenue per person: Sales Per Employee; X52 - Operating profit per person: Operation Income Per Employee; X53 - Allocation rate per person: Fixed Assets Per Employee; X54 - Working Capital to Total Assets; X55 - Quick Assets/Total Assets; X56 - Current Assets/Total Assets; X57 - Cash/Total Assets; X58 - Quick Assets/Current Liability; X59 - Cash/Current Liability; X60 - Current Liability to Assets; X61 - Operating Funds to Liability; X62 - Inventory/Working Capital; X63 - Inventory/Current Liability X64 - Current Liabilities/Liability; X65 - Working Capital/Equity; X66 - Current Liabilities/Equity; X67 - Long-term Liability to Current Assets; X68 - Retained Earnings to Total Assets; X69 - Total income/Total expense; X70 - Total expense/Assets; X71 - Current Asset Turnover Rate: Current Assets to Sales; X72 - Quick Asset Turnover Rate: Quick Assets to Sales; X73 - Working capitcal Turnover Rate: Working Capital to Sales; X74 - Cash Turnover Rate: Cash to Sales; X75 - Cash Flow to Sales; X76 - Fixed Assets to Assets; X77 - Current Liability to Liability; X78 - Current Liability to Equity; X79 - Equity to Long-term Liability; X80 - Cash Flow to Total Assets; X81 - Cash Flow to Liability; X82 - CFO to Assets; X83 - Cash Flow to Equity; X84 - Current Liability to Current Assets; X85 - Liability-Assets Flag: 1 if Total Liability exceeds Total Assets, 0 otherwise; X86 - Net Income to Total Assets; X87 - Total assets to GNP price; X88 - No-credit Interval; X89 -

Gross Profit to Sales; X90 - Net Income to Stockholder's Equity; X91 - Liability to Equity; X92 - Degree of Financial Leverage (DFL); X93 - Interest Coverage Ratio (Interest expense to EBIT); X94 - Net Income Flag: 1 if Net Income is Negative for the last two years, 0 otherwise; and X95 - Equity to Liabilitys. 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. PROJECT 5: DATA SCIENCE FOR RAIN CLASSIFICATION AND PREDICTION WITH PYTHON GUI This dataset contains about 10 years of daily weather observations from many locations across Australia. RainTomorrow is the target variable to predict. You will determine rain or not in the next day. This column is Yes if the rain for that day was 1mm or more. Observations were drawn from numerous weather stations. The daily observations are available from http://www.bom.gov.au/climate/data. The dataset contains 23 attributes. Some of them are as follows: About some of them are: DATE - The date of observation; LOCATION - The common name of the location of the weather station; MINTEMP - The minimum temperature in degrees celsius; MAXTEMP - The maximum temperature in degrees celsius; RAINFALL - The amount of rainfall recorded for the day in mm; EVAPORATION - The so-called Class A pan evaporation (mm) in the 24 hours to 9am; SUNSHINE - The number of hours of bright sunshine in the day; WINDGUESTDIR - The direction of the strongest wind gust in the 24 hours to midnight; WINDGUESTSPEED- The speed (km/h) of the strongest wind gust in the 24 hours to midnight; and WINDDIR9AM - Direction of the wind at 9am. 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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