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Optimizing Test Data Management Strategies in Banking Domain Projects

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Abstract

The steady rise in processing power over the past 20 years has resulted in an enormous volume of data. Furthermore, anybody may now easily create and consume material in any format thanks to recent advancements in Web technology. Large volumes of data are regularly gathered by banking systems, including trade finance data, SWIFT and telex communications, client information, details about transactions, risk profiles, credit card details, limit and collateral details, the compliance or Anti Money Laundering (AML)-related data, and limit and collateral details. Every day, thousands of choices are made at banks. These choices pertain to credit, default, beginning a relationship, investments, AML, and illicit funding, among other things. To make these crucial choices, one must rely on a variety of data and drill down capabilities offered by the banking systems. We created a set of specifications for the kinds of data that should be included in a product catalogue. We ascertained what data the departments need by using a survey and questionnaire of the retailer's staff. We ensured that there was no one standard for the information organisation and then put out our own plan. This enormous amount of data may be mined for information and intriguing patterns, which can then be used to the decision-making process. This article examines and summarises a number of data mining methods that have applications in the banking industry. An overview of data mining methods and procedures is given. It also sheds light on how these methods may be applied in the banking industry to facilitate and enhance decision-making.

Keywords: Banking Systems, Continuous Increase, Data Mining, Anti Money Laundering (AML), Bank, Employees, Finance Data, SWIFT, Decision Making, Illegal Financing, Mining Techniques.

I. INTRODUCTION

The usefulness of research data is becoming more widely acknowledged these days. The International Council for research (ISCU), the Committee on Data for Science and Technology (CODATA), and the Open Data Institute all assert that open research has enormous potential and that it advances social and economic development by encouraging findings auditability, reuse, and transparency. In addition, the 17 Sustainable Development Goals (SDGs), which the United Nations Member States endorsed in 2015 with the aim of eradicating poverty, safeguarding the environment, and promoting peace and prosperity by 2030, call for extensive cooperation among the scientific community at large, the global data community in particular, and the development of information infrastructures. The Research Data Alliance (RDA), one of the RDM projects for the Open Science paradigm, offers best practices, guidelines, and activities related to Research Data Management (RDM) that are in line with achieving the SDGs [1, 2].

These days, technology is greatly influencing financial services, which are distinguished by extremely dispersed and heterogeneous offerings. However, because there are so many different data storage systems, it can be difficult to efficiently retrieve and query pertinent data to respond to business requests

[1, 2]. Furthermore, the absence of established data standards exacerbates this issue. In order to create semantic web services that can analyse heterogeneous financial data, ontologies are essential components [2, 3].

The digitisation of the banking sector has significantly changed the way financial services are offered, as it has in other industries as well [3]. Nowadays, millions of people who have bank accounts rely on mobile banking apps as their constant companions, using them for a wide range of services [2, 3].

However, testing scenarios for banking apps need to be carefully thought out because they manage the most sensitive human data, which includes financial information [3]. Nothing should be left up to chance, and there may be risks and vulnerabilities as a result of insufficient test coverage.

Put simply, the bank domain is a single system that includes external services intended for end users and internal procedures created for staff members [4]. A financial system normally consists of the following components:

- **Market segments –** The bank's main business segments are investment banking, retail banking, consumer banking, and others [4, 5].
- **Target customers –** Individuals and businesses utilising banking products.
- **Banking products –** Every activity that brings in money for the bank, such as deposits, loans, investments, and more.
- **Sales campaigns –** The techniques used to provide customers with banking goods both offline and online [5].
- **Business processes –** Processes both internal and external to the bank's operations.
- **Technologies –** Any technology employed to support banking services.

1.1 Banking Domain Activities

Financial institutions offer both consumers and companies a wide range of services and operations within the banking sector [4, 5]. The financial realm has two primary purposes:

1.1.1 Traditional Banking as the Main Purpose

Facilitating transactions between depositors and borrowers is the primary function. Savings and lending are two subcategories of this fundamental role that keep the economy and market's cash flow intact [5].

- Core Banking
- Retail Banking
- Corporate Banking

1.1.2 Service-oriented Banking's Secondary Responsibilities

The banking industry's non-banking operations, often known as supplementary functions, comprise other services that aid in making money [5]. These duties include portfolio management, cheque collection, and payables supervision [5].

- Loan
- Trade and Stacks
- Private Banking
- Front End Delivery

The banking sector has profited greatly from the developments in digital technology. Centralised databases have replaced the idea of data being kept at branches [4, 5]. There are now more ways than ever to access bank accounts. With online transactions, electronic wire transfers, cash machines, cash and cheque deposit machines and electronic wire transfers, banking systems have evolved into robust, customer-focused technology platforms. The quantity of transactions and the associated data saved have grown along with the number of channels. As a result, banks' computer storage systems presently house enormous electronic data archives [5]. The amount and dimensions of data have increased. This data

mountain is becoming the organization's most valuable asset thanks to developments in data mining tools and expertise [5, 6].

This data contains intriguing patterns and important information that is buried. Data mining offers banks enormous potential for use in their decision-making processes in marketing, credit risk management, and money laundering detection, management of liquidity, investment banking, and timely fraud transaction detection. Failures in these areas may result in unfavourable consequences for the bank, including financial loss, reputational damage, lost business to competitors, and significant fines from the authorities [6, 7].

Conventional contexts for decision making are depicted in Figure 1 [7]. They are primarily carried out by hand. Users review the reports produced by the financial information system and utilise them to guide their choices. They could also utilise the system's drill down features to analyse data and make important choices. Due to the restricted amounts of data that can be manually evaluated, manual analysis has limits and may not produce as accurate of results as planned. For instance, [7, 8] suggest that even while there is a concerning downward trend in customer turnover and the account could be on the verge of default, it is still feasible that loan instalments are being paid on time. It is difficult to find these correlations using manual methods. This volume of operational and historical data is thought to include important information that, if found and processed by qualified tools, may be used for crucial decision-making processes [8]. For instance, a data mining-based decision support system may be used to raise the standard of a bank's lending procedure. Figure 2 illustrates how data mining may enhance the process of making decisions [8, 9].

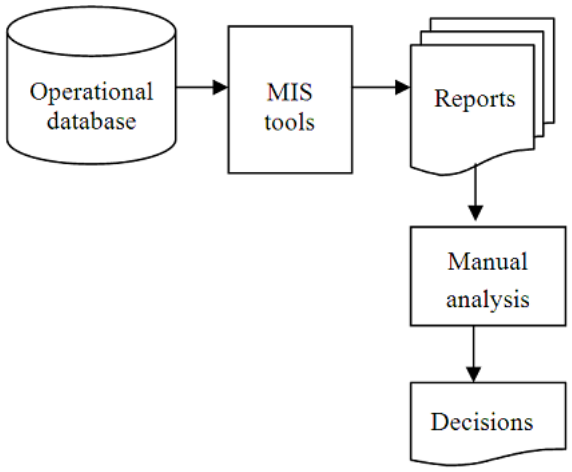
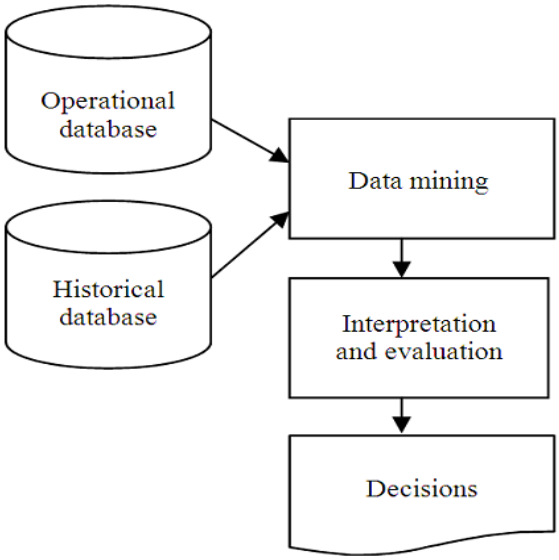


Fig. 1 Traditional Methods of Making Decisions. [9]

Fig. 2 Using Data Mining to Make Decisions.



[10]

II. DATA MINING AND SKILLS

One of the most recent advancements in data management technology is discovery. Information science, database administration, machine learning, statistics, and visualisation are all combined. The field is still in its infancy. In spite of this, the industry is using it more frequently [10, 11] as a tool to research their clients and make informed choices. The process of finding valid, [11], unique, possibly helpful, and eventually intelligible patterns of data is known as knowledge discovery from databases. Data mining is one of the most important phases of knowledge discovery, and the terms are frequently used interchangeably [12].

The technique of extracting useful information from massive data repositories in order to provide answers to important business queries is known as data mining. It reveals connections that are implicit,

patterns, trends, exceptions, and oddities that are concealed from human study. [12. Customers have an abundance of options in the fiercely competitive market climate of today. In order to maintain their client base, banks must take the initiative to analyse the preferences and characteristics of their customers and modify their offerings appropriately. Through client segmentation into good and bad customers, the bank may reduce losses before they become too big to ignore. A bank can detect fraudulent transactions before they have an impact on its profitability by studying transaction patterns [12, 13]. Data mining may be able to assist with these very desirable qualities.

The e-commerce sector, which is a priority, is lagging behind due to inadequate optimisation of storage and data interchange. Performance management is an ongoing, adaptable method of managing the organisation that requires the greatest amount of communication between its members. E-commerce and e-marketing require establishing a strong relationship, learning more about, and communicating with customers [13]. It follows that implementing automatic information storage and sharing across participants is necessary. Studies on enhancing organisation management systems have been conducted in the context of competitiveness and market interactions. Without a doubt, big data and the associated information technologies and methodologies will play a major role in future socioeconomic changes [13].

The implementation of informatics techniques in the applied sector is the primary focus of system analysis in management (Management Information Systems, Business Information Systems). It is advised that each business employ specialised hardware and software systems for data collection, storage, and transmission. These systems offer convenient data input, output, and processing, as well as reliable data storage [14]. Internal logic and a complicated structure define modern information systems. Numerous techniques and strategies have been established to date for high-quality and ideal information systems projects, allowing for the growth of modularity, splitting it into parallel processes, and reducing the amount of mistakes. The most popular paradigm is object-oriented programming [14].

The practice of extracting knowledge from massive amounts of unprocessed data is known as data mining. The information must be novel, obscure, pertinent, and applicable to the field in which it was acquired. Figure 3 illustrates the logical process flow that goes into data mining and knowledge discovery [14, 15]. The steps in the data mining process may be split down into the iterative list that follows [15].

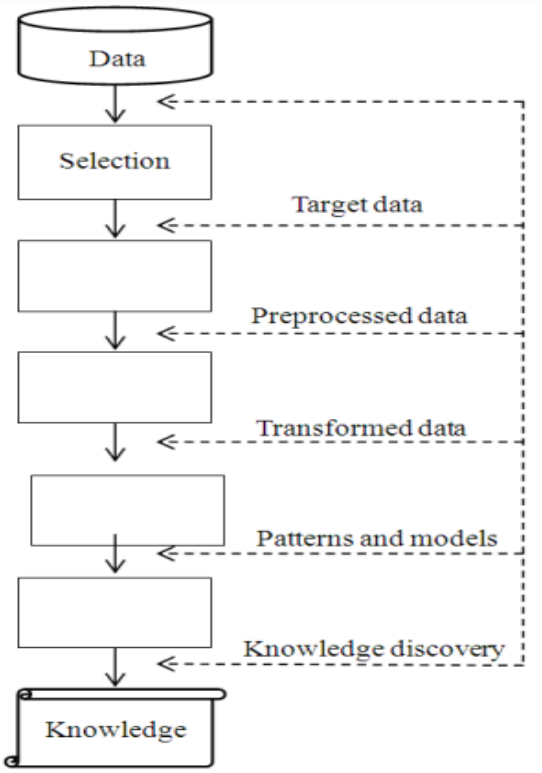


Fig. 3 Knowledge Discovery Process. [14, 15]

2.1 Data Mining Methods

Depending on the type of knowledge the system is uncovering, techniques used for knowledge mining may be categorised into several types [15]. Now, let's examine these crucial methods.

2.1.1 Association

This method is applied to reveal data dependencies that are not anticipated. Put another way, it looks for data points that were previously hidden but are interconnected, connected, or correlated with one another. For instance, this method can identify a pattern where clients who are questioning about a banking product also frequently enquire about another unrelated product [15, 16]. The marketing team can subsequently be informed of this information. Formally speaking, the goal is to find hidden correlations in a sizable database [16].

If an associated connection meets predetermined standards for confidence and support, it is deemed valuable [16]. Therefore, if a rule doesn't meet both of these minimal support and minimum confidence thresholds, it is eliminated. It's possible that none of these strong connection rules found are noteworthy enough to share [17]. To find intriguing statistical connections between related attribute-value pairings, more research must be done. Different kinds of associations consist:

- Multilevel association rule
- Multidimensional association rule
- Quantitative association rule
- Direct association rule
- Indirect association rule

2.1.2 Categorisation and Forecasting

This is the data mining approach that is used the most frequently. When the population's data classes are known, it is used. For instance, there can only be two classes—fraudulent and non-fraudulent—when identifying fraudulent financial transactions from a bank's transactions database [17, 18]. In order to forecast the class of objects in the population whose classes are unknown, it builds a model from sample data items with known class labels [18]. Every tuple in the database has one or more predictive features that, when combined with the built model, predict the tuple's class label. Classification techniques are used in the banking industry to detect fraud, including credit and corporate fraud [18, 19]. Typically, decision tree or neural network models are used to build these models [19].

2.1.3 Concept Development and Cluster Analysis

Classification is comparable to clustering. The little distinction is that classes were unknown beforehand. Class labels are produced using clustering [19, 20]. Based on the observed pattern, the items are categorised or sorted according to the concept of maximising similarity within a class. The K-means technique is the most popular and straightforward clustering algorithm. When the K-Means

method generates a lot of outliers in cluster data, heuristics based on domain information might be used [20].

III. DATA MINING APPLICATION AREAS IN BANKING

Massive operational and historical data volumes are included in banking information systems. Important decision-making procedures in banks can benefit from data mining [20, 21]. Banks that use data mining techniques in their decision-making process stand to gain a great deal and an advantage over those who do not. Marketing, risk management, default detection, fraud detection, customer relationship management, and money laundering detection are some of the domains where these judgements are made. Below is a description of these uses [20].

3.1 Managing Risk and Identifying Defaults

Every loan choice a bank makes carries some degree of risk. By putting this risk into numbers, the bank can reduce the chance of suffering a financial loss and streamline the risk management procedure. Credit managers can make far better selections if they are aware of their clients' capacity to repay [20, 21]. Additionally, data mining can assist in determining whether customers are likely to miss or default on a loan payment. With this increased information, the bank can avert losses by taking remedial action. Turnover trends, balance sheet numbers, limit utilisation, behavioural patterns, and cheque return patterns are among the characteristics to take into account for this kind of forecasting [20, 21]. When similar trends in the past are found, they may also be used to anticipate defaults in the future [21].

3.2 Marketing

3.2.1 One of the most popular uses of data is marketing

Mining done by the sector as a whole. The banking industry is hardly an exception. Because of the fierce rivalry that exists in the market these days, it is becoming harder and harder to retain clients and acquire new ones [21, 22]. Being proactive, anticipating the needs of the consumer, and providing for his demands are the only ways to keep existing customers and attract new ones. Here, data mining can be quite helpful [22, 23].

3.2.2 Measuring Fraud

Frauds of all kinds cost banks millions of dollars every year. The banks can take early action and minimise losses by detecting fraudulent transactions. The process of distinguishing fraudulent transactions from legal ones, or dividing a list of transactions into two classes—fraudulent and lawful—is known as fraud detection [24, 25].

3.2.3 Detection of Money Laundering

The act of disguising the illicit source of "black" money in order to give it legitimacy is known as money laundering. Money laundering frequently occurs through banks [26]. As a result, banks are required by governments and financial authorities to put in place systems, processes, and procedures to identify and stop money laundering [27, 28]. The bank may face severe operational and financial penalties for failing to identify and stop these illicit activities, which might potentially threaten the bank's existence [29, 30]. To identify increasingly complex transaction patterns like smurfing and networked transactions, traditional rule-based transaction analysis based on reports and tools will not be enough [30].

3.2.4 Investment Banking

Investing money in a product or asset in order to generate income or profit is known as investment. Customers of banks are frequently provided with investing services. The market is filled with a huge variety of financial products. Based on a customer's profile, data mining techniques like K-means clustering may be used to determine the optimum investments [26, 30]. The capacity to forecast asset values, such as stock prices, based on past prices can significantly boost investment returns. Stock price predictions may be made using data mining techniques such as neural networks and linear regression.

IV. CONCLUSION

The practice of extracting information from pre-existing data is called data mining. It is a technology used in banking and finance generally to extract meaningful information from operational and historical data so that decisions may be made more effectively. It is an interdisciplinary area that combines information science, machine learning, visualisation, database technology, and statistics. Data selection, integration, transformation, mining, pattern analysis, and knowledge display are some of the stages that are involved. Data mining is used by banks for a number of purposes, including marketing, risk management, fraud detection, money laundering detection, and investment banking. The bank can use the patterns it has found to foresee future occurrences to aid in its decision-making. To stay competitive, an increasing number of institutions are investing in data mining tools.

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