A Survey on Data Mining Techniques In Business Intelligence

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Abstract— **There are assortment of procedures, methodologies and distinctive zones of the exploration which are useful and stamped as the vital field of data mining Technologies. Numerous MNC's and vast associations are worked in better places of the distinctive nations. Each one spot of operation may produce expansive volumes of data. Corporate chiefs oblige access from all such sources and take vital choices .The data distribution center is utilized within the critical business esteem by enhancing the adequacy of managerial choice making. In a dubious and very aggressive nature's turf, the estimation of vital data frameworks, for example, these are effortlessly perceived however in today the earth, effectiveness or velocity is by all account not the only key for aggressiveness. This sort of gigantic measure of data's are accessible as tera- to peta-bytes which has definitely changed in the ranges of science and building. To examine, oversee and settle on a choice of such sort of tremendous measure of data we require systems called the data mining which will changing in numerous fields. This paper confers more number of uses of the data mining furthermore centres extent of the data mining which will accommodating in the further research.**

Index Terms— **Data mining, Business Intelligence, Data mining Methods, Data mining applications, Data Mining Tools, Educational Data Mining, Knowledge Discovery.**

I. INTRODUCTION

In the 21st century the people are utilized within the diverse innovations to sufficient in the general public. Every single day the people are utilizing the unlimited data and these data are in the diverse fields. It may be in the form of documents, may be graphical formats, may be the video, may be records(differing exhibit). As the data are accessible in the distinctive arrangements so that the best possible move to be made. To examine these data as well as take a decent choice and keep up the data. As and when the client will obliged the data ought to be recovered from the database and settle on the better choice. This system is really we called as a data mining or Knowledge Hub or basically KDD (Knowledge Discovery in Database). The critical reason that pulled in a lot of consideration in data innovation the revelation of valuable data from extensive accumulations of data industry towards field of "Data mining" is because of the impression of "we are data rich however data poor". There is immense volume of data yet we barely ready to turn them into helpful data and learning for managerial choice making in business. To create data it requires enormous accumulation of data. It may be diverse arrangements like sound/feature, numbers, content, figures, hypertext groups. To exploit data, the data recovery is basically insufficient, it obliges an instrument for programmed rundown of data, extraction of the quintessence of data put away, and the finding of examples in crude data. With the huge measure of data put away in documents, databases, and different archives, it is progressively essential, to create influential device for dissection and understanding of such data and for the extraction of fascinating learning that could help in choice making. The main reply to all above is 'Data Mining'. Data mining is the extraction of concealed prescient data from vast databases; it is a compelling innovation with extraordinary potential to help associations concentrate on the most vital data in their data stockrooms. Data mining devices foresee future patterns and practices, helps associations to make proactive information driven choices.

The mechanized, prospective examines offered by data mining move past the breaks down of past occasions gave by prospective apparatuses normal of choice help supportive networks. Data mining apparatuses can address the inquiries that customarily were excessively time intensive to purpose. They get ready databases for discovering concealed examples, discovering prescient data that specialists may miss in light of the fact that it lies outside their desires.

Data mining, prominently known as Knowledge Discovery in Databases (KDD), it is then on trifling extraction of verifiable, formerly obscure and possibly helpful data from data in databases. It is really the methodology of discovering the shrouded data/example of the storehouses. The improvement and application of data mining calculations obliges the utilization of effective programming instruments. This paper[1] is composed as takes after: the first segment verifiable improvement and state-of-the-symbolization highlights the recorded advancement of data mining programming until present; the criteria to analyse data mining programming are clarified in the second area criteria for analysing data mining programming. . In this paper[2], we open these discovery DM demonstrates by utilizing a novel visualization approach that is focused around an affectability investigation (SA) technique. Specifically, we propose a worldwide SA (GSA), which develops the appropriateness of past SA routines (e.g. To characterization errands), and a few visualization Techniques (e.g. Variable impact trademark bend), for evaluating data significance and impacts on the model's reactions. A set of true research endeavours has been led to test the structures, with some of them informed in this paper[3]. They distinguish joined together examples for illuminating government obligation anticipation and enhancing taxpayer supported organization goals, which demonstrate the adaptability and instantiation proficience of consolidated mining in uncovering enlightening information in intricate data. This paper[4] presents two separate situations for gaining from methodology model adjustments and for uncovering a reference model out of which the variants could be arranged with least exertions. This paper[5] thinks about the viability of five such instruments - neural systems, choice trees, logistic relapse, memory-based thinking, and the gathering model in assessing whether an obligation is prone to be reimbursed. This study[6] applies a mixture of data mining instruments to liquidation data, with the reason for analysing precision and number of standards. This paper[8] examines how to clean preparing datasets and outsourced datasets in such a path, to the point that true blue order tenets can in any case be concentrated however separating principles focused around delicate traits. The most ordinary/regular undertakings in the instructive environment that have been determined through data mining systems lastly the absolute most guaranteeing future lines of examination are discussed[9]. This paper[10] presents a survey of — and

order plan for — the writing on the application of data mining systems for the recognition of budgetary extortion. This study[11] examines the online inquiries and visit messages consequently recorded by a Live Video Streaming (LVS) framework utilizing data mining and content mining strategies. We find that notion investigation, an accepted strategy for shopper objection identification, is lacking for discovering, ordering, and prioritizing vehicle deformities examined in online gatherings, and we portray and assess another methodology and choice help supportive network for car imperfection distinguishing proof and prioritization.

II. RELATED WORKS

Data is an indispensable crude material of the data economy, much as coal and iron mineral were in the Industrial Revolution. Anyway the business world is simply starting to figure out how to process everything. In the previous 10–15 years, data mining has turned into an engineering in it right, is settled additionally in business intelligence (BI), and keeps on exhibiting relentlessly expanding imperativeness in innovation and life sciences parts. For instance, data mining was a key component supporting methodological leaps forward in heredity. It is a guaranteeing innovation for future fields, for example, content mining and semantic hunt engines, adapting in independent frameworks as with humanoid robots and autos, chemo informatics and others[1].

A novel visualization methodology focused around a Sensitivity Analysis (SA), which is a basic strategy that measures the impacts on the yield of a given model when the inputs are shifted through their scope of values[2]. Immediate mining for discriminative examples has been highlighted, for example, in Harmony, model-based pursuit tree, and rising difference designs. Consolidated mining helps this classification as well. The postanalysis and postmining of educated examples is a generally utilized methodology, case in point, to prune tenets, lessen repetition, and compress scholarly runs the show. Not quite the same as postanalysis-based systems, the majority of the joined together examples introduced[3].

A procedure administration framework (PrMs) gives non specific methodology help works and takes into consideration differentiating methodology rationale from application code. For this reason, the procedure rationale must be unequivocally characterized focused around the demonstrating examples gave by a methodology meta model. At runtime the PrMs then coordinates the methodologies as per the characterized rationale. For every business methodology to be backed, a procedure sort spoke to by a procedure model S must be characterized. In this paper, a methodology model is spoken to as controlled chart, which contains a set of hubs – either speaking to process steps (i.e., exercises) or control connectors (e.g, And-/Xor-

Split) – and a set of control edges between them. The last point out priority and also circle retrogressive relations. Besides, we assume that process models are square structured[4]. Model transparency identifies with human capacity to comprehend what the model comprises of, heading preferably to the capability to apply it to new perceptions (which we may term transportability). On the off chance that a model is transparent, it could be transported. A few models have reliably turned out to be solid in their capability to fit data, for example, neural system models, however to have low transparency or transportability[6]. The current writing on hostile to segregation in software engineering essentially explains on data mining models and related strategies. A few recommendations are turned to the disclosure and measure of segregation. Others manage the avoidance of discrimination[8]. There are numerous applications or undertakings in instructive situations that have been determined through DM. Case in point, Baker recommends four key ranges of use for EDM: enhancing learner models, enhancing space models, contemplating the pedagogical backing gave by learning programming, experimental examination into learning and learners; and five methodologies/routines: forecast, bunching, relationship mining, refining of data for human judgment and disclosure with models[9].the writing inquiry focused around the descriptors "fiscal extortion," "data mining" and "business intelligence." We utilized Boolean articulations to apply these terms to a pursuit of online databases, which initially delivered roughly 1200 articles. The survey and order procedure was deliberately and freely confirmed by the co-writers, and just articles that were identified with data mining and FFD were included[10].

As indicated by the instructive data mining group site, instructive data mining (EDM) is characterized to be "a developing order, concerned with creating systems for investigating the interesting sorts of data that originate from instructive settings, and utilizing those strategies to better comprehend understudies, and the settings which they learn in." Furthermore, a few heading EDM specialists (Baker, 2009; Baker & Yacef, 2009; Romero & Ventura, 2010) arrange work in EDM into a couple of classifications, for example, facts and visualization, forecast (grouping, relapse, and thickness estimation), bunching, relationship mining, outlier discoveries, and content mining[12]. In the notion dissection writing, it is assumed that vigorously negative postings (protestations) will be demonstrative of item deserts. Then again, whether this assumption – that negative slant predicts imperfection presence – is valid for auto imperfections has not been tried in earlier research[13]. Temporal Abstraction(TA) is a manmade brainpower procedure, which incorporates area learning into the data dissection process. TA diagrams the evolutionary procedure of fleeting data through a qualitative presentation mode, for example, level movements, times of strength and trends[14]. A Web based business application programming model of the framework portrays different segments of the framework and how they are interfaced for mining procedures utilized for concentrating significant data. The application building design model demonstrates that, a guide of different data and practical modules[17].

TABLE I.: **Comparison of DM tools on the basis of their features.**

Tools	Ease of use	Depth of algorithms	GUI	Accuracy	Cost of tool	Scalability	Application area	Functions	Techniques
Insightful Miner	Relatively ease to use	It has rich set of Data mining algorithms	It has low Graphical interface	Good level of accuracy	Relatively Inexpensive	It has good scalability	Support strategic marketing operations	Association rules, clustering, classification, prediction, sequential patterns, time series	Decision trees(modified CART), K-means, neural networks (MLP, back-propagation , RBF), regression (linear)
Kxen	Ease to use	Good variety of DM algorithms	Moderate level of GUI	One of the most accurate tool	Moderately Expensive	It is scalable	Embedded in an application	Association rules, clustering, classification, prediction	Decision trees, K-means, Binary classification and regression (linear), rule induction

XL-Miner	Relatively ease to use	Lack of ETL capabilities	Moderate level of GUI	Good level of accuracy	Low cost	Limited in Scalability	In Financial operation based on spreadsheets	Association rules, classification, clustering, prediction, time series	Discriminant Analysis Logistic Regression with best subset selection Classification Trees Naive Bayes Classifier Neural Networks k-Nearest Neighbors
SPSS Clementine	Moderately easy to use	Good variety of DM algorithms	Poor output graphics form	One of the most accurate tool	Moderately Expensive	It is scalable	To support customer behavior modeling	Association rules, classification, clustering, factory analysis, forecasting, prediction, sequence discovery	Apriori, BIRCH, CARMA, Decision trees(C5.0,C&RT a variation of CART),K-means clustering, neural network(Kohonen, MLP,RBFN),regression(linear, logistic) rule induction(C5.0,GRI)
SAS Enterprise Miner	Ease to use	It has rich set of Data mining algorithms	Easy to use GUI	Very high level of accuracy	Moderately Expensive	It is highly scalable	Dm tools, Embedded in an application, to support management rules reporting	Association rules, classification, clustering, prediction, time series	Decision trees (CART,CHAID),K nearest neighbors, regression(linear, logistic),memory-based reasoning, neural networks(kohonen , MLP,RBF,SOM)
Statistica Data Miner	Moderate to use	It has very rich set of Data mining algorithms	It has relatively easy to use graphical user interface	High level of accuracy	Moderately Expensive	It has very high level of scalability	DM tools, in the Databases, Support of direct mail operations	Variable Filtering,Association Rules, Interactive Drill-Down Explorer, Cluster Analysis, General Classification	Regression, K- nearest neighbors technique, general neural n/w explorer, general classifier.

III. MINING APPROACH FOR BUSINESS INTELLIGENCE

An effective Building Applications is one which can enhances bits of knowledge of business intelligence by offering results among different modules currently compelling choice making by utilizing essential mining methods as a device. In many tools: decision trees, clustering, regression, data cleaning, data filtering, feature extraction, principal component analysis, factor analysis, advanced feature evaluation and selection, computation of similarities, artificial neural networks, model cross validation, and statistical relevance tests. In some tools: fuzzy classification, association learning and mining frequent item sets, independent component analysis, bootstrapping, complexity measures, model fusion, support vector machines, k-nearest-neighbour methods, Bayesian networks, and learning of crisp rules. Comparison of DM tools based on their features and approaches along with the mining techniques they can perform is represented in table 1.

Visualization: The fundamental destination of data visualization is the general thought regarding the data mining model .In data mining the majority of the times we are recovering the data from the vaults which are in the concealed structure. This is the troublesome task for a client. So this visualization of the data mining model helps us to give most extreme levels of understanding and trust. Since the client does not know beforehand what the data mining methodology has found, it is a much greater jump to take the yield of the framework and make an interpretation of it into a significant answer for a business issue. The data mining models are of two types: Predictive and Descriptive. The predictive model makes prediction about unknown data values by using the known values. Ex. Classification, Regression, Time series analysis, Prediction etc. The descriptive model identifies the patterns or relationships in data and explores the properties of the data examined. Ex. Clustering, Summarization, Association rule, Sequence discovery[20].

Association Rule Mining: In ARM a couple set of association rules are applied on elements of web site structure to identify relationships among various modules of

web engineering application. Association rule mining is finding all association rules with support and confidence values that are greater than or equal a user-specified minsup and minconf respectively. In general, the process of extracting interesting association rules consists of two major steps.

Step 1: The first step is finding all item sets that satisfy minsup (known as Frequent-Item awz generation).

Step 2: The second step, is generating all association rules that satisfy min conf using item sets generated in the first step.

After generating frequent item sets, association rules that are greater than or equal to min conf are generated. Those rules are called interesting association rules. Those rules can be invested in many different applications. One of those applications is improving the structure of the company's website that the mined database belongs to. This is done during the website's design phase by creating links between items that seem to be sold together, or highlight those links if they are already exist, and/or create index pages which are pages that have direct links to some products that may be of interest for some group of customers. All paragraphs must be indented. All paragraphs must be justified, i.e. both left-justified and right-justified[17].

Classification: Classification is dividing an existing set of events or transactions into other predefined sets or classes based on some characteristics. In web usage mining, classification is used to group users into predefined groups with respect to their navigation patterns in order to develop profiles of users belonging to a particular class or category. A web mining strategy for web personalization based on a novel pattern recognition strategy which analysis and classifies users taking into account both user provided data and navigational behaviour of the users[17].

Clustering: Clustering is the process of partitioning a given population of events or items into sets of similar elements, so that items within a cluster have high similarity in comparison to one another, but are very dissimilar to items in other clusters. In web usage mining there are two main interesting clusters to be discovered: usage clusters and pages clusters[17].

Multirelational data mining and multidatabase mining are different from combined mining. Our method is not only aimed at multirelational data, but it is also a general approach for mining complex knowledge in complex data. As the multisource combined mining shows, combined mining does not rely on joining related tables. The resulting patterns of the multisource combined mining can consist of pairs or clusters of patterns with components from multiple data sets, which is new to multirelational mining, to the best

of our knowledge. A typical difference between the combined mining and other existing methods is that new pattern types can be produced such as incremental/decremental cluster patterns[3]. In a comparative analysis of multiple prediction models, it is a common practice to split the complete data set into training and testing sub sets, and compare and contrast the prediction models based on their accuracy on the test data set. In splitting the data into training and testing dataset one can choose to make a single split (e.g., half of the data for training and other half of the data for testing) or multiple splits, which is commonly referred to as k-fold cross validation. The idea behind k-fold cross validation is to minimize the bias associated with the random sampling of the training and holdout data samples[6]. There are many applications or tasks in educational environments that have been resolved through DM. For example, Baker suggests four key areas of application for EDM: improving student models, improving domain models, studying the pedagogical support provided by learning software, scientific research into learning and learners; and five approaches/methods:prediction, clustering, relationship mining, distillation of data for human judgment and discovery with models. Castro suggests the following EDM subjects/tasks: applications dealing with the assessment of the student's learning performance, applications that provide course adaptation and learning recommendations based on the student's learning behavior, approaches dealing with the evaluation of learning material and educational web based courses, applications that involve feedback to both teacher and students in e-learning courses, and developments for detection of atypical students' learning behaviors[9]. Prediction estimates numeric and ordered future values based on the patterns of a data set. Han and Kamber note that, for prediction, the attribute for which the values are being predicted is continuous-valued (ordered) rather than categorical (discrete-valued and unordered). This attribute can be referred to simply as the predicted attribute. Neural networks and logistic model prediction are the most commonly used prediction techniques[10]. A CRM system is a repository of customer information which contains all customer profiles. In addition to the traditional database roles, it has the capability of personalising needs of individual customers by differentiating products or services for each unique customer. Popular strategies recommended to improve CRM include the use of BI for price discrimination, lock-in/high switching costs, and BI tools[16]. Business understanding consists of determining business objectives, assessing the situation, determining the data mining goals and producing the project plan. In the following, we also subsume the setting of the business model under these activities. None of these activities in themselves already violate privacy, but the choice of objectives, goals and plans may imply later business practices that are prone to do so[19]. PETs are tools and mechanisms which, when integrated or used in conjunction with online services or applications, allow users to protect their data provided to and handled by such services or applications. They provide encryption (to prevent eavesdroppers from seeing the content of transferred information), and/or anonymization/ pseudonymization(to prevent the identity of the communication partners from being released)[19].

IV. CHALLENGES IN BUSINESS INTELLIGENCE

In 1989, Howard Dresner proposed "business intelligence" as an umbrella term to portray "ideas and strategies to enhance business choice making by utilizing actuality based help supportive networks. It was not until the late 1990s that this use was far reaching. Frequently BI applications use data accumulated from a data distribution center (DW) or from a data shop, and the ideas of BI and DW now and again join together as "BI/DW" or as "BIDW". A data stockroom holds a duplicate of explanatory data that encourages choice backing. Be that as it may, not all data distribution centres serve for business intelligence, nor do all business intelligence applications oblige a data stockroom.

Starting a business intelligence (BI) method could be scary for little endeavours and departmental arrangements. BI is regularly seen as a convoluted, language filled coliseum that obliges bunches of IT mastery and assets. There is additionally a pressure between conveying quick comes about monetarily and making the best choice for long haul development and adaptability. This paper furnishes littler associations with a schema to assess and select the right BI result and approach that meets their necessities today and tomorrow.

Difficulties may confront:

A. Guaranteeing development – Gainful and maintained development is discriminating for a little venture. Without it, chance either being made unimportant by speedier contenders or being swallowed by a bigger organization. Productive development obliges pulling the right levers on a reliable premise, so there ought to be clear experiences into your business. Case in point, knowing which items, sections, and clients return higher benefits will help to dispense more assets to them. On a continuous premise, there ought to have the capacity to screen and approve if your incremental ventures are in fact conveying a normal expand in deals and benefits.

B. Accomplishing pace – Capability to quickly exploit another business open door is one of your greatest favorable circumstances. Nonetheless, more modest associations frequently have restricted assets. Need to comprehend what is working admirably, so it could be immediately promoted, and what is not living up to expectations well, so it might be quickly tended to. Know the income, costs, and use for as of late presented items. This can prompt all the more effectively recognize poor entertainers and rapidly movement use far from them. Without such experiences, it may take more time to settle on such choices and keep wagering on poor entertainers, or it may settle on wrong choices that are wrongly affected by one data point.

C. Staying Focused – Not at all like substantial organizations, little associations offer a slender arrangement of items and administrations and typically have constrained assets. Proceeded with achievement lies in getting everybody in the group on the same page by utilizing the same set of presumptions focused around the same variant of reality. Along these lines, if building, deals, fund, and showcasing associations utilize the same examination on pipeline, income, and edges, they are more inclined to have the same conclusions and be adjusted on necessary.

V. SCOPE OF DATA MINING

When now is the right time to take business intelligence (BI) to the following level by including data mining and propelled investigation. This is a level of BI brilliance that numerous associations never figure out how to develop to, however the criticalness of pushing ahead with cutting edge competencies can't be disparaged – they can give a really manageable playing point and empower your association to amplify both its productivity and viability. Data Mining is the procedure of running data through refined calculations to uncover genuine examples and connections that may overall be stowed away. These might be utilized to help you comprehend the business better furthermore misused to enhance future execution through prescient investigation. Case in point, data mining can caution you there's a high likelihood a particular client won't pay on time focused around an investigation of clients with comparative aspect. The below represented graph.1 shows the rate of data mining used in various different applications.
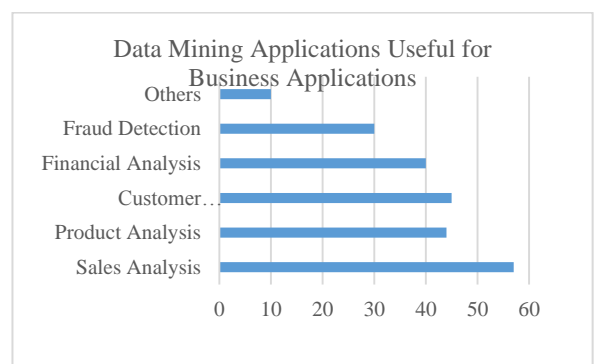

Figure 1. Data Mining Applications Useful for Business Applications

To help you completely use data mining for hierarchical playing point, the Pentaho BI Undertaking group has worked in conjunction with the advancement and business groups to coordinate standard BI capacities with cutting edge data mining. Pentaho Data Mining is separated by its open, guidelines agreeable nature, utilization of Weka data mining engineering, and tight joining with center business intelligence capacities including reporting, examination and dashboards. Other data mining offerings fail to offer this level of sophistication and integration.

In this report we blanket the business profits of integrating data mining as a component of business intelligence arrangement, together with the how's and why's of data mining to furnish you with a strong understanding of this theme. Gives knowledge into concealed examples and connections in your data. An exemplary sample of data mining is a retailer who reveals a relationship between offers of bread and screw driver on Sunday evenings – two

things you wouldn't typically consider as connected. The clarification is that individual who are conveyed to get a crisp supply of breads are additionally prone to get screw drivers while they happen to be in the store – something that hadn't been perceived as a critical deals driver before data mining uncovered it.

Empowers you to adventure these connections to enhance hierarchical execution proceeding with the sample above, all the time retailers follow up on the connections they find by utilizing strategies, for example, putting interfaced things together on end-of-isle shows as an approach to goad extra buys. All associations can profit from acting in a comparable manner – utilizing newfound examples and connections as the premise for making a move to enhance their effectiveness and viability.

"The individuals who don't gain from history are destined to rehash it" is an acclaimed quote from savant George Santayana. On account of data mining, having the capacity to foresee conclusions focused around noteworthy data can drastically enhance the quality and results of choice making in the present. As a straightforward sample, if the best marker of whether a client will pay on time ends up being a blend of their business portion and whether they have paid past bills on time, then this is data you can helpfully profit from in settling on present credit choices.

No calculation is liable to be ideal in all circumstances. Thus its paramount that you're ready to go for an extent to discover the calculation that fits a specific set of data the best. Gives a complete set of machine taking in calculations from the Weka task including bunching, division, choice trees, irregular backwoods, neural systems, and key part investigation. Pentaho has included combination with Pentaho Data Mix and computerized the procedure of converting data into the arrangement the data mining motor needs. Calculations can either be connected specifically to a dataset or called from Java code. Yield might be seen graphically, interfaced with automatically, or utilized data hotspot for reports, further dissection, and different techniques. Channels are accommodated discretization, standardization, re-testing, trait determination, and converting and joining together properties. Classifiers give models to foreseeing ostensible or numeric amounts. Learning schemes include decision trees and lists, instance-based classifiers, support vector machines, multi-layer perceptron, logistic regression, Bayes' nets, and other advanced techniques. The data mining engine is likewise appropriate for creating new machine learning plans, empowering clients to consolidate their models. Inputs and yields might be controlled automatically, empowering designers to make totally custom results utilizing the parts gave.

CRM as depicted by Strategic Customer Relationship Management System (SCRMS) which gathers, coordinates and determinations different client related data from distinctive operation frameworks in divisions inside an endeavor characterizes CRM as streamlines values as gainfulness, income and client fulfillment (what and why) by sorting out around client sections, encouraging client fulfilling practices and actualizing client driven business models.

VI. CONCLUSION

This study concludes with Data Mining is one of the utilitarian gatherings among the exhaustive undertaking class investigative functionalities offered inside of Business Intelligence. In the previous 10–15 years, data mining has turned into an innovation in it right, is settled additionally in business intelligence (BI), and keeps on exhibiting relentlessly expanding essentialness in engineering and life sciences divisions. This business gathering utilization data mining as an instrument for settling financially important business applications, for example, client relationship administration, extortion recognition, etc. This field is essentially secured by a mixture of business devices giving backing to databases with huge datasets, and profound incorporation in the organization's work process. For training at colleges, data mining apparatuses ought to be extremely natural, with an agreeable intuitive client interface, and cheap. Moreover, they ought to permit the joining of in-house strategies throughout programming classes. Numerous propelled instruments for data mining are accessible either as open-source or business programming. They blanket an extensive variety of programming items, from agreeable issue autonomous data mining suites, to business-focused data stockrooms with incorporated data mining capacities, to right on time research models for recently created techniques alongside the future degree.

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