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Highlights

- Matrix Data Structure
- Indian Retail Banking Sector
- Improved Apriori Algorithm
- Service Identification in SOA

Discovering Thoughts, Inventing Future

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Development of Ann Based Efficient Fruit Recognition Technique

By Bhanu Pratap, Navneet Agarwal, Sunil Joshi & Suriti Gupta

Maharana Pratap University of Agriculture and Technology, India

Abstract- Use of Image processing technique is increasing day by day in all fields and including the agriculture to classify fruits. Shape, color and texture are the image features which help in classification of fruits.

This paper proposes an algorithm for fruits classification based on the shape, color and texture. For shape based classification of fruit area, perimeter, major axis length and minor axis length is calculated. Shape features are calculated by segmenting the object with the background using edge detection techniques. Mean and standard deviation is calculated for the color space like HSI, HSV which can be used for color base classification. Texture features is also calculated to enhance the classification process. Gray Level Co-occurrence Matrix (GLCM) is used to calculate texture features. Artificial neural network is used for classification of fruits. Artificial neural network classifies the fruits by comparing shape, color and texture feature provided at the time of training. MATLAB/ SIMULINK software is used to obtain result. Results obtained are better over the previous techniques and gives the accuracy upto 96%.

Keywords: fruit classification, gray level co-occurrence matrix, color, texture, artificial neural network.

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Development of ANN based Efficient Fruit Recognition Technique

Bhanu Pratap [α], Navneet Agarwal [σ], Sunil Joshi [ρ] & Suriti Gupta [ω]

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Keywords: fruit classification, gray level co-occurrence matrix, color, texture, artificial neural network.

I. Introduction

In Earlier time's fruits were sorted manually and it was very time consuming and laborious task. Human sorted the fruits on the basis of shape, size and color. Time taken by human to sort the fruits is very large therefore to reduce the time and to increase the accuracy, an automatic classification of fruits comes into existence. The automatic technique incorporate processing of images captured from the test fruits.

The features that can be extracted from an image of any fruit are its size, shape, color and texture. These features help the user to classify the fruits in different categories. There are several techniques which can be used to extract the morphological features from an image. For size/ shape, five edge detection techniques are used (Kyaw, Ahmed, & Sharrif, 2009).

Intensity (HSI)(Feng & Qixin, 2004) and L*a*b (Gejima, Zhang, & Nagata, 2003) techniques using suitable For color detection in fruits we have to calculate RGB parameters and then convert it into Hue Saturation and algorithms. These techniques are also available with MATLAB toolbox for conversion from RGB into HSI, HSV and L*a*b. Texture is an important feature for characterizing images (Osman & Hitam, 2013). It refers to a change of pixel gray level and color. There are two ways for texture analysis. One is statistical texture analysis the other is structure of texture analysis. The former is the most conventional. Statistical texture analysis methods include spatial autocorrelation method, Fourier power spectrum method, co-occurrence matrix method (Partio, Cramariuc, Gabbouj, & Visa, 2002), gray level difference statistics method and trip length statistics method.

a) Fruit classification based on shape

Shape modeling is the foundation for object recognition under change of pose, deformation, and varying lighting conditions (Rao & Renganathan, 2002. Shape based classification of fruits takes care of various features like area, perimeter, major axis length and minor axis length. The image generally consists of pixels which includes RGB (Red, Green and blue) components. For calculating these shape features RGB image is converted into gray scale image. (Riyadi, Rahni, Mustafa, & Hussain, 2007) When the image is converted into gray scale image then it represents a different intensity value. There is a difference in intensity value of an object to be classified and the background. A threshold value is decided to separate an object from its background. With the help of this threshold value a gray scale image is converted into binary image in which the value greater than the threshold is 1 and the value lower than the threshold is 0. With the help of this binary image different shape features are calculate. The most common shape features calculated from the image are area, perimeter, major axis length and minor axis length.

b) Fruit classification based on color

An image generally consist of RGB components (red, green and blue) which(Buzera, Groza, Prostean, & Prostean, 2008) represents three planes M*N*3. Fruits classified on color bases consist of these three color space RGB.

RGB color space is converted into another color space such as HIS, HSV etc(Gonzalez et al., 2004) and for all these converted color space mean and standard deviation is calculated. Each fruit image gives different

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value of mean and standard deviation which helps in its classification.

i. *HSV-Color Space*

HSI stand for hue, saturation and intensity. Pure color attribute of image is described by hue and the amount by which pure color image is diluted by white color is described by saturation. The RGB components are separated from the original image, and the Hue (H), Saturation (S) and Intensity (I) components are extracted from RGB components (Feng & Qixin, 2004). Equations (1), (2) and (3) are used to evaluate Hue, Saturation and Intensity of the image samples. The mean and variance for all these 6 components(Kay & de Jager, 1992) are calculated and color features are stored suitably for later usage in training ANN.

$$H = \begin{cases} \theta & B \le G \\ 360 - \theta & B \ge G \end{cases} \qquad (1)$$

$$\theta = \cos^{-1}\left\{\frac{1}{2}\left(\frac{\lfloor (R-G)+(R-B)\rfloor}{\lfloor (R-G)^2+(R-B)\sqrt{G-B}\rfloor}\right)\right\}$$

The saturation component is given by

$$S = 1 - \left(\frac{3}{R+G+B}\right)[\min(R,G,B)] \qquad (2)$$

Intensity component is given by

$$I = \frac{1}{3}(R+G+B) \qquad (3)$$

c) Fruit classification based on texture

Texture is calculated by the outer part of an object which measures the roughness, coarseness and smoothness. Texture is classified by the spatial distribution of gray levels in a neighborhood. It also helps in surface determination and shape determination. Gray level co-occurrence matrix is used to calculate different texture features.(Keller, Chen, & Crownover, 1989) There are two method that can be used to calculate the texture feature of image. One is statistical texture analysis; the other is structure of texture analysis. The former is the most conventional. Statistical texture analysis methods include spatial autocorrelation method, Fourier power spectrum method, co-occurrence matrix method, gray level difference statistics method and trip length statistics method. Texture is using various fields such as in rock. This paper proposes a new technique for region-based skin color classification using texture information. (Clausi, 2002). Color mapping co-occurrence matrix (CMCM) is used to extract the texture information from skin image.

Gray level co-occurrence matrix (GLCM) is used to extract texture features in an image. The Grey Level Co-occurrence Matrix, GLCM is also called as Grey Tone Spatial Dependency Matrix (Clausi, 2002). It represents the form of tabulation which contains different combinations of pixel brightness value (gray levels) that occurs in an image. To calculate different texture feature like entropy, energy, homogeneity and dissimilarity a gray level co-occurrence matrix is created. It represents the relation between the two pixels at a time, called the reference and the neighboring pixel. The Grey Level Co-occurrence Matrix, GLCM can be analyzed in four different directions which are Horizontal (00), Vertical (900) and Diagonal: Bottom left to top right (-450) Top left to bottom right (-1350) Denoted as P0, P45, P90, & P135 Respectively as shown in Fig 1.

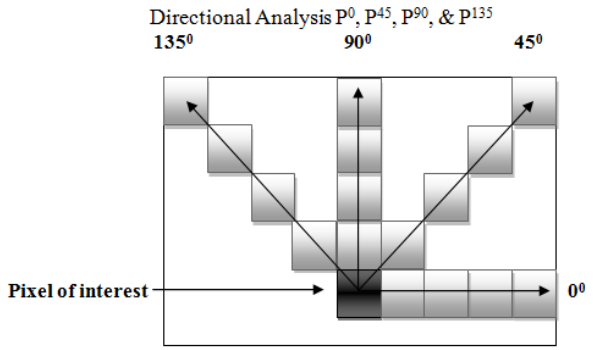


Figure 1 : Different direction of gray level co-occurrence matrix

d) Neural network

Neural network is classifier that classifies the output based on the input data provided in it at the time of training. There are other classifiers that can be used for the classification purpose of support vector machines, like Bayers classifier etc but the neural network is best suited for the identification of pattern .(Jayas, Paliwal, & Visen, 2000)Neural network works like human brain, as the body consists of large number of neurons which are used to transfer information from any body part to the human brain. For example when a human being places a hand in the front of fire then neuron in the human body sense the heat and sends information from one neuron to another and ultimately the information reaches to the brain which guides the human being to remove his hand. Similarly neural network consist of neurons in the hidden layer which process all the information to give the desired output. A block diagram representation of a neural network is shown in Fig 2. . The block diagram shows that neural network consist of three layers which are input layer, hidden layer and the output layer. The input layer defines the input given to the neural network which is processed in the middle layer by considering the suitable number of neurons and this middle layer is called as hidden layer.(Tsoukalas & Uhrig, 1996) Hidden layer process the input at the training time to provides the desired output at the testing time. The last layer of the neural network is the output layer which shows the output result.

II. Proposed Methodology

Different fruit images which are used in this experiment are captured under a constant light source. Proposed methodology is as follows first the image of fruits is captured and from the captured image various features such as shape, color and texture are obtained. After the features are extracted then artificial neural network is used to classify the fruit based on these extracted features.

a) Image Capture

First and most important part to start the project is to capture the images of different fruits. For this a black box setup is created in which constant light source is provided. Digital Camera (Nikon) is placed at a height of 1 foot to capture the image of fruit. To capture the image of fruit from all different direction, fruits are rotated manually to get image of all its side. Different fruits image is captured using digital camera as shown in Fig 2.

Figure 2 : Image of different fruit such as pomegranate And apple

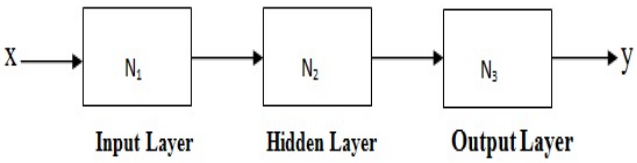
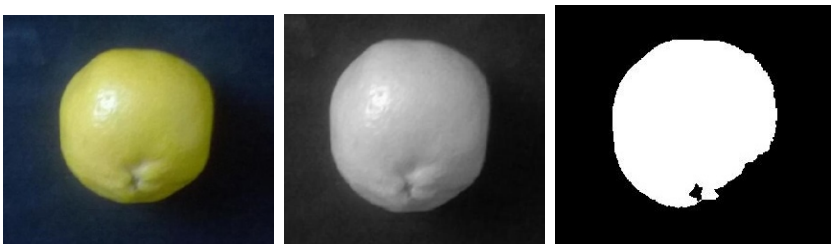


Figure 3 : Block Diagram Representation of Neural Network



(a) (b) (c)

Figure 4 : (a) Original; (b) gray scale image (c) Noise free binary image

b) Image Preprocessing

Image captured from digital camera cannot be used directly because it has lots of noise due to dust and light effect. Image processing is done to improve the quality of image. For this edge detection is applied to remove high frequency noise by using low pass Gaussian filter. Desired fruit image is obtained after filtering and this image can be used for features extraction

c) Methodology

After the image is noise free it can be used to extract different shape, color and texture features. Extracted feature are stored in the data base of artificial neural network for knowledge gain. When a new image is encountered different feature are extracted from fruit sample image. These features are used to identify and classified using artificial neural network. A block diagram is shown in Fig. 5. Shows the process for recognition and classification.

d) Feature Extraction

An Algorithm is developed to extract 4 shape features, 16 color features and 22 texture features from fruit image.

i. *Shape feature*

Four shape features are calculated from an image are area, perimeter, major axis length and minor axis length. (Riyadi, Rahni, Mustafa, & Hussain, 2007) Number of pixels in an image is used for determining the area of the image. Fig 4 (c) shows the noise free binary image P. Using equation 1 area of an image is calculated. In this equation a binary image is used in which object pixel is represented by P(x,y)=1 and backgrounds pixel is P(x,y)=0.

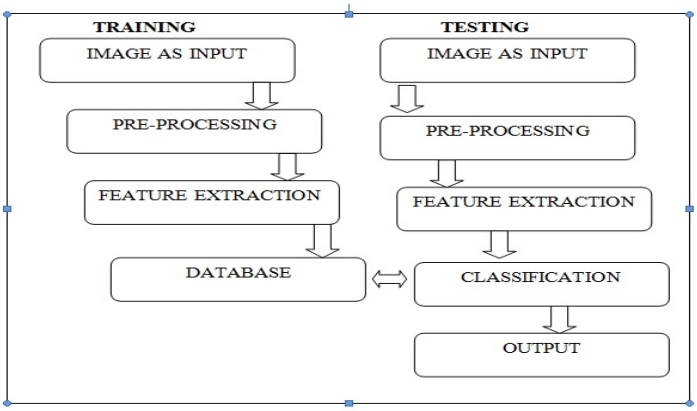


Figure 5 : Flow diagram for the methodology

Represented by P(x,y)=0. Step for color features extraction calculation are given in Algorithm 2.

$$Area = \sum_{x,y} I(x,y) \tag{1}$$

Algorithm 1: Shape feature extraction

Input: image

Output: 4 shape features

Start

Step 1: read an RGB image

Step 2: convert an RGB image into gray scale image

Step 3: determine the threshold to differentiate between object and background using Otsu thresholding.

Step 4: convert a gray scale image into binary image.

Step 5: calculate area, perimeter, major axis length and minor axis length.

Stop

ii. *Color feature calculation*

Image captured using digital camera is a colored image which consist of RGB (red, green and blue) component. For color feature extraction RGB is converted into some other color space such as HSI, HSV. HSI stands for hue, saturation and intensity. HSI can be calculated from RGB using equation (2), (3) and (4). For above color space mean and variance is calculated and these calculated values are stored in the artificial neural network. Steps for color features extraction are given in Algorithm 2.

$$H = \begin{cases} \theta & B \le G \\ 360 - \theta & B \ge G \end{cases} \tag{2}$$

$$\theta = cos^{-1}\left\{\frac{1}{2}\left(\frac{|(R-G)+(R-B)|}{|(R-G)^2+(R-B)\sqrt{G-B}|}\right)\right\}$$

The saturation component is given by

$$S = 1 - \left(\frac{3}{R+G+B}\right)[\min(R,G,B)] \tag{3}$$

Intensity component is given by

$$I = \frac{1}{3}(R+G+B) \tag{4}$$

Algorithm 2: color features extraction

Input: image

Output: 16 color feature

Start

Step 1: Read a RGB image.

Step 2: Convert a RGB image into HIS, HSV, L*A*B and YbCbCr.

Step3: calculate mean and standard deviation for each color space.

Stop

iii. *Texture feature extraction*

Texture is calculated by the outer part of an object which measures the roughness, coarseness and smoothness of an image. Texture is classified by the spatial distribution of gray levels in a neighborhood. It also helps in surface determination and shape determination. Gray level co-occurrence matrix is used to calculate different texture features(Clausi, 2002). Gray level co-occurrence matrix (GLCM) is used to extract texture features of an image. The Grey Level Co-occurrence Matrix, GLCM is also called as Grey Tone Spatial Dependency Matrix. It represents the image in the form of tabulation which contains different combinations of pixel brightness value (gray levels) that occurs in an image. To calculate different texture feature like entropy, energy, homogeneity and dissimilarity a gray level co-occurrence matrix is created. It represents the relation between the two pixels at a time, called the reference and the neighboring pixel. The Grey Level Co-occurrence Matrix, GLCM can be analyzed in four different directions are Horizontal (00), Vertical (900) and Diagonal: Bottom left to top right (-450) Top left to bottom right (-1350) Denoted as P0, P45, P90, & P135 respectively as shown in fig 1. . First step is to extract texture features are given in Algorithm3.

$$P_{i,j} = \frac{1}{P_0 + P_{45} + P_{90} + P_{135}} \quad (5)$$

$$contrast \;\; equation = \sum_{i,j=0}^{N-1} P_{i,j}\left(i - j\right)^2 \quad (6)$$

$$Dissimilarity\ Equation = \sum_{i,j=0} P_{i,j}\left(i - j\right) \quad (7)$$

$$Angular\ second\ Moment = \sum_{i,j=0}^{N-1} P_{i,j}^{\ 2} \quad (8)$$

$$Energy = \sqrt{ASM} \quad (9)$$

$$Entropy\ Equation = \sum_{i,j=0}^{N-1} P_{i,j}\left\{-InP_{i,j}\right\} \quad (10)$$

Algorithm 3: Texture feature extraction

Input: RGB image

Output: 22 texture feature

Start

Step1: convert a RGB image into gray scale image.

Step 2: Derive Gray level co-occurrence matrixes from the gray scale image for 4 different directions 00,450,900 and 1350.

Step 3: Gray level co-occurrence matrix is calculated using equation (5).

Step4: Gray level co-occurrence matrix help in calculating contrast, dissimilarity, angular second moment, energy and entropy using equation (6) to (10).

Stop.

III. Recognition and Classification of Fruits

In this section neural network, training and testing is explained.

a) Artificial Neural Network

Neural network is used as a classifier which recognizes fruits and classifies them to the class to which they belong (Cochocki & Unbehauen, 1993). Input layer of neural network depends upon number of input. It has a hidden layer, which consist of neuron which process the information and generate the output. It has five output layers because fruits are classified in five different classes. Neural network perform the classification on shape, color, texture and both color and texture. Result is compared on all these methods and checked which will give the best result.

b) Training And Testing

In training time, neural network is trained to identify the type of fruit image. All the data generated during the training time are stored in the data base of Neural network. When a new image is encountered during testing time, features are extracted from the new image which is compared with data stored in neural network and it classifies the fruit in suitable class based on bases of their knowledge gained during training time. Training and Testing model of neural network is shown in Fig.6. This model consists of input layer, hidden layer and output layer. In the input layer (38) color and texture features are calculated. Hidden layer (10) consist of neurons which generate output. Output layer (5) represents the five different fruits that are classified.

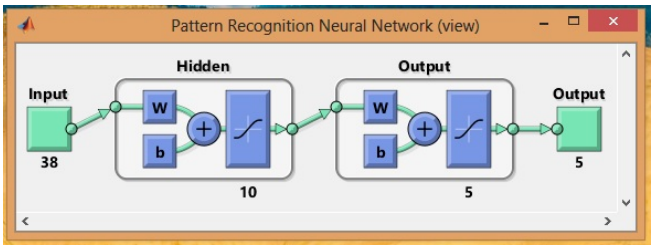


Figure 6 : Training and Testing Model

IV. Result and Discussion

Table 1 show the result of classification. Column first of the table gives the image of different fruits. Remaining column gives the percentage of fruits that are classified accurately on shape, color, texture and both color and texture. 100 images of each fruit is taken out of which 50 images is used during the training time and remaining 50 image is used for testing. Percentage means how much testing image of each fruits is accurately identified.

a) Discussion

Table1 show the comparison between the classification on the basis of shape, color and texture. First the fruits are classified on the basis of shape. For shape classification four parameters are calculated which are area, perimeter, major axis length and minor axis length. It gives good result when different shape fruit are to be classified. By looking into the table it finds that only 72 % of apples are accurately classified. This occurs because most of the time shape of an apple resembles to the shape of Orange and pomegranate. This is the main drawback of shape basis classification. To overcome this drawback a new feature is used that is color .In Table 1 third Column shows the classification percentage on color basis. As the classification accuracy is improved to 94% for apple because apple and orange have different color. But colour basis classification also faces problem when two fruits have same color. Many a times apple and pomegranate have same red color so this will affect the classification and

only 84 % of pomegranates are accurately classified. Texture features is also included to perform the classification but it also does not improve the classification because most of the fruits have smooth surface. But the classification accuracy is efficiently improved when color and texture feature are amalgamated. Classification accuracy is improved for all fruits and 96 % pomegranates are accurately classified.

Table 1 : Classification Result for Neural Network

Image of fruits		Accuracy based on (%)			
		Shape	Color	Texture	Color + Texture
Apple	Training=50	72	94	80	96
	Testing=50				
Banana	Training=50	98	96	96	98
	Testing=50				
Orange	Training=50	90	90	94	98
	Testing=50				
Mango	Training=50	86	86	90	92
	Testing=50				
Pomegranate	Training=50	70	84	88	96
	Testing=50				

V. Conclusion

This paper proposes that when color and texture features are amalgamated, it gives better result over the all other previous method such as shape, color and texture. From the result we can find that shape based classification gives 83.2% accuracy, Color basis gives 90%, Texture basis give 89.60% and results are improved to 96 % when the color and texture features are amalgamated. Hence it can be concluded that color and texture together give better result. This result can further be improved by considering the shape also along with color and texture but it may lead to increasing degree of complexity and computation.

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An Improved Apriori Algorithm based on Matrix Data Structure

By Shalini Dutt, Naveen Choudhary & Dharm Singh

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Abstract- Mining regular/frequent itemsets is very important concept in association rule mining which shows association among the variables in huge database. the classical algorithm used for extracting regular itemsets faces two fatal deficiencies .firstly it scans the database multiple times and secondly it generates large number of irregular itemsets hence increases spatial and temporal complexties and overall decreases the efficiency of classical apriori algorithm.to overcome the limitations of classical algorithm we proposed an improved algorithm in this paper with a aim of minimizing the temporal and spatial complexities by cutting off the database scans to one by generating compressed data structure bit matrix(b_matrix)-and by reducing redundant computations for extracting regular itemsets using top down method. theoritical analysis and experimental results shows that improved algorithm is better than classical apriori algorithm.

Keywords: *Apriori algorithm, frequent itemsets, association rule.*

GJCST-C Classification : *E.1*

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Keywords: apriori algorithm, frequent itemsets, association rule.

I. Introduction

In last few decades data has become so vast that extracting information from this huge data becomes very important issue in data mining . hence data mining brought into scene from last few years. Mining association rules is important process in data mining which shows relationship among the variables or affairs stored in data warehouse, database and other information repositories. Association rule mining is two step process. First it generates regular/frequent itemset set of items having count equal or greater than user specified parameter i.e., minimum support and second it discovers association rules from these frequent itemsets. In this regard first association rule mining algorithm apriori algorithm was proposed in 1994 to discover regular itemset. Limitations of apriori results in lot of research in the field of data mining to build more efficient algorithms in respect of space and time. This paper puts forward an improved algorithm using matrix data structure with simply counting rows and columns and transaction reduction strategies using top down approach for finding out largest regular itemset to smallest regular itemset.

In this way, it can greatly reduces complexity and increases the efficiency of improved algorithm.

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The remaining section of this paper is organized as follows: Section 2 contains Apriori Algorithm. In section 3, elaborate the proposed improved algorithm for extracting regular itemset and. Section 4 contains experimental results and conclusion.

II. Apriori Algorithm

The apriori algorithm is standard and classical algorithm for mining regular/frequent itemsets (if an itemset satisfies minimum threshold i.e, min_support , it is called regular itemset. The set of regular k-itemsets is commonly denoted by LK.) brought by R. Agarwal and R. Shrikant in 1994, that leads to generate association rules called association rule mining. It uses bottom–up and iterative approach known as breadth first search (level wise search where k-itemset used to discover k+1 itemset). It generates all regular itemsets(a set of items is referred as an itemset ,n-itemset consist of n items) and apriori property is introduced to reduce the search space .

Apriori property→all non-empty subsets of a regular itemset must also regular. For example if {1,2,3} is a regular itemset, then {(1,2),(1,3),(2,3),(1),(2)and(3)} are must be regular itemset. it uses two key operations first, Join operation→ to discover regular k-itemset, a set of candidate k-itemset is generated by joining L_{K-1} with itself. Second, Prune operation→discard the itemset if support count of itemset is less than minimum support required and also discard the itemset if it is not following apriori property , remove itemset that have subset that is not regular. apriori algorithm generates regular itemset as follows First , regular 1-itemsets are discovered by scanning the transactional database to calculate the count of each item and select the items those satisfying required minimum support , denoted by L_1. Next L_1, regular 1-itemset is used to discover L_2 (set of regular 2-itemset) and L_2 is used to discover L_3 (set of regular 3-itemset) and so on until no more regular itemsets can be discovered and generation of each L_k needs one complete scan of the database . Advantage of this algorithm is , it is simple and easy to mine regular itemsets if database is small. also faces two fatal deficiencies. First, it scans the database multiple times, so greatly high the I/O cost and second, generate large no. of candidate itemsets if database is huge and overall decreases the efficiency of algorithm.

III. Improved Apriori Algorithm

The improved algorithm proposed in this paper works in two phases. In first phase required compressed data structure i.e, b_matrix is constructed and then this compressed data structure is used in second phase to generate regular itemsets. This algorithm employs top-down approach to discover regular item sets from largest regular item set to smallest regular itemset.

Algorithm steps

1. In first phase b_matrix is constructed for the given transactional database. rows in b_matrix represents each transaction and column represents items in transactional database. In b_matrix, each cell will contain values either 1 or 0 for showing the existence of items in transactional database. Entry value will be 1, if the item is present in the respective row else 0, if the item is absent in the row. With two more columns count and redundant transaction counter (TC). Here count column represents the size of row(the sum of total no of 1's in that particular row) and remove those columns whose sum is not equal or greater than predefined min_support value and then update count column. If row is duplicated in database then it is represented by the value in the redundant transaction counter column and delete unnecessary duplicate transaction/row and if row is not duplicate then redundant transaction counter column is set to 1. Then rearrange the b_matrix in descending order based on count column. This is our required compressed data structure and here the phase 1 of our improved algorithm completes.
2. Now generate regular itemsets directly from b_matrix. Select first row from b_matrix and match its count value with next row count respectively. If the next row count is more or equal to the processing row count then do AND operation among the rows, if result is same to the processing row item set structure then increase the count value of support of processing row item set by one and continue this procedure of matching and AND operation through rest of the rows in b_matrix and then check the value of total support. If it is greater or equal to predefined min_support count then extract the item set and its subsets and move them to frequent array list. The same procedure will be repeated for rest of the transactions in b_matrix until all rows are not checked.

The gain of improved algorithm is that it lessen the no. of comparisons to mine largest regular item set for duplicate transactions and transactions having smaller item sets in size that is count value (since they do not have all the items of row under process) and another major advantage is once largest regular item set is discovered then its subsets are searched and moved into frequent array list. While searching for next largest regular item set it checks first, transaction under processing is previously present in frequent array list because of prior largest itemset and its subsets, if itemset is already in frequent array list, it avoids number of comparisons needed to calculate the support count of itemset. Hence decreases number of scans and time needed to extract the regular itemset.

IV. Illustration

Consider the implementation of this improved algorithm through a sample below. TABLE-I shows a transactional database consist of 9 transactions. Set the minimum support counts as 3(min_support=3).

Table 1

TID	ITEMS
T1	I1,I2,I5
T2	I2,I4
T3	I2,I3
T4	I1,I2,I4
T5	I1,I3
T6	I2,I3
T7	I1,I3
T8	I1,I2,I3,I5
T9	I1,I2,I3

a) Phase-1

Step1- Scan the transactional database and convert it into desired compressed data structure that is b_matrix M_{9*6}. Where each row represents one transaction and column represents distinct items in whole transactional database and last column i.e, **count** represents the size of row. In b_matrix entry value will be 1, if item is present in the corresponding row else 0,if item is not present in the corresponding row.

Step2- After this rearrange the b_matrix in desending order based on **count** column after removing , those columns whose sum is not equal or greater than required minimum support value. Here min_support is 3, hence remove columns for items 4 and 5 and update **count** column and also merge the duplicate rows in TC column of b_matrix to reduce the computations for redundant rows for finding regular item set.

b) Phase-2

Step3- Now select first row TID-8 and extract its itemset {1, 2, 3} and calculate its support count in b_matrix using AND operation with rows having count value equal or greater than its own count value. If AND operation results in same item set structure as processing row's item set structure, then increase its support count value. after complete AND operation , check value of support count of item set , if it is equal or greater than required min_support than it is frequent/regular , then move itemset with its subset into frequent array list and move to next row. Here item set support is less than required min_support; hence it is not regular move to next row.

Table 2 : (b_matrix)

TID	I1	I2	I3	COUNT	TC
T8	1	1	1	3	2
T1	1	1	0	2	2
T3	0	1	1	2	2
T5	1	0	1	2	2
T2	0	1	0	1	1

Step4- select next row TID-1 and extract its item set {1, 2}. After AND operation its support count is 4, hence it is regular, move item set with its subset into frequent array list. So here regular /frequent array list is {(1, 2), (1) and (2)}. And move to next row.

Step5- select next row TID-3 and extract its item set {2,3}.first check item set in frequent array list , if it is present in frequent array list , then it is regular , no need of AND operation with other rows to calculate its support count. But TID-3 is not present in frequent array list. So do AND operation with rows TID-8,1and 5.after AND operation its support count is 4. Hence it is regular, move {2, 3} {2} and {3} into frequent array list. Now frequent array list is {(1, 2), (2, 3), (1), (2) and (3)}. Move to next row.

Step6- select next row TID-5 and extract its item set {1,3}. Check in frequent array list, not found. Do AND operation with rows TID-8, 1 and 3 and calculate its support count i.e, 4. Hence it is regular, move {1, 3}, {1} and {3} into frequent array list.

Step7- select last row TID-2 and extract its item set {2}. Check in frequent array list, found. Hence it is regular no need of further set of AND operation to calculate its support count. The final frequent array list will be ***Frequent array list*** : {(1,2),(2,3),(1,3),(1),(2)and(3)} extracted in less time by avoiding unnecessary comparisons as per our improved algorithm.

V. Experimental Results

All the experiments are carried out on core i7 Intel based PC machine with 2 GB main memory, running on window 7 operating environment and the program code is written in java. Our experimental benchmark dataset is taken from artificial data set of IBM that is, T1014D100K datasets. there are 100000 data records / affairs and 870 items in T1014D100K dataset. The improved algorithm is compared with classical apriori algorithm using same hardware, dataset and minimum support requirement. The output of both the algorithms is same which demonstrates that our algorithm is competent. the time computation is started from the spot when the file is read into the memory until all the regular itemsets are generated. redundant rate in transactional database is high hence using compressed data structure we eliminate it and reduces space and time complexities in proposed algorithm. from the results shown in figure 1. we can conclude that time and space expenses are lesser as compared to classical algorithm in proposed algorithm.

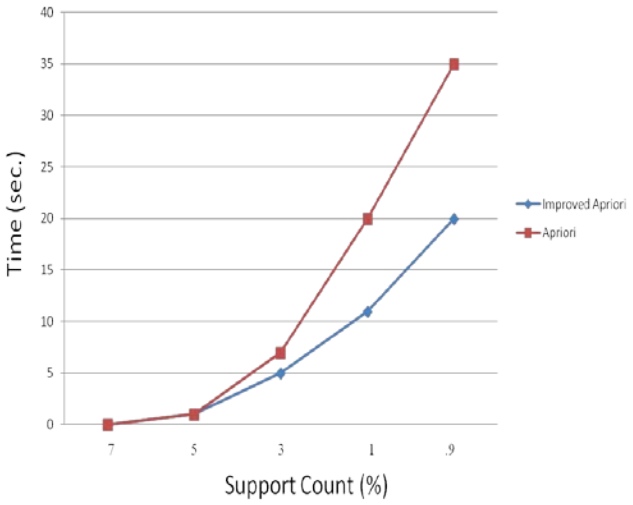

Figure 1 : Execution Time of database

VI. Conclusion

This proposed algorithm for mining regular itemset using bit matrix needs only single scan of whole transactional database to construct compressed data structure . hence greatly reduces I/O cost and it also doesn't generate irregular itemset. So improved algorithm decreases temporal complexity and spatial complexity and have higher efficiency as compared to our classical apriori algorithm.

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Application Areas of Data Mining in Indian Retail Banking Sector

By Sudhakar M & Dr. C. V. K Reddy

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Abstract- Banking systems collect huge amounts of data on day to day basis, be it customer information, transaction details, risk profiles, credit card details, credit limit and collateral details, compliance and Anti Money Laundering (AML) related information, trade finance data, SWIFT and telex messages. Thousands of decisions are taken in a bank daily. These decisions include credit decisions, default decisions, relationship start up, investment decisions, AML and Illegal financing related. One needs to depend on various reports and drill down tools provided by the banking systems to arrive at these critical decisions. But this is a manual process and is error prone and time consuming due to large volume of transactional and historical data. Interesting patterns and knowledge can be mined from this huge volume of data that in turn can be used for this decision making process. This article explores and reviews various data mining techniques that can be applied in banking areas. It provides an overview of data mining techniques and procedures. It also provides an insight into how these techniques can be used in banking areas to make the decision making process easier and productive.

Keywords: data mining, banking, unstructured data, default detection, customer classification, AML.

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I. Introduction

Banking industry has hugely benefited from the advancements in digital technology (Sing and Tigga,2010). Concept of data stored at branches has given way to centralized databases. Number of channels to access bank accounts has multiplied. Banking systems have become technically strong and customer oriented with online transactions, electronic wire transfers, ATM and cash and cheque deposit machines (Bhambri, 2011). As number of channels has increased so is the number of transactions and the related data stored. So currently banks have huge electronic data repositories in their computing storage systems. Data has grown in terms of both dimensionality and size (Kaur and Sing, 2011). With advancements in data mining techniques and know how, this mountain of data is turning out to be the most valuable asset of the organization (Tiwari, 2010). Valuable knowledge and interesting patterns are hidden in this data. There are huge potential for banks to apply data mining in their decision making processes in areas like marketing, credit risk management, detection of money laundering, liquidity management, investment banking and detection of fraud transactions in time Failures in these areas can lead to unpleasant outcomes for the bank such as losing customers to competition, financial loss, reputational loss and hefty fines from the regulators.

Figure 1 shows decision making in conventional settings. They are mostly done by manual procedures. Users go through reports generated by banking information system and use it in their decision making process. They may also use drill down tools provided by the system for analyzing data to arrive at critical decisions. Manual analysis has limitations because volumes of data that can be manually analyzed are limited and hence the decisions may not be as accurate as intended (Bhasin, 2006). For example, it could be possible that loan installments are being paid regularly though there is an alarming negative trend in the customers turnover and the account may be about to default. These associations are not easy to detect through manual processes. It is assumed that valuable information are hidden in this volume of operational and historic data that can be used for critical decision making process if they are discovered and put to use by capable tools (Kazi and Ahmed, 2012). For example, a decision support system based on data mining techniques can be employed to improve the quality of lending process in a bank (Ionita and Ionita, 2011). Figure 2 shows how data mining can improve decision making process.

II. Data Mining and Knowledge Discovery Concepts

Data Mining and Knowledge Discovery is one of recent developments in line with data management technologies. It combines the fields of statistics, machine learning, database management, information science and visualization. It is an emerging field. Despite this, it is increasingly being used in the industry as a tool to study their customers and make smart decisions (Ramageri, 2010). Knowledge discovery from databases is defined as the process of identifying valid, novel, potentially useful and ultimately understandable patterns of data. One of the crucial steps in Knowledge discovery

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is Data Mining and often they are used as synonyms (Deshpan de and Thakare, 2010). Data Mining is the process of discovering valuable information from large data stores to answer critical business questions. It unveils implicit relationships, trends, patterns, exceptions and anomalies that were hidden to human analysis. In today's highly competitive market environment customers are spoilt by choices. Banks need to be proactive in analyzing customer preferences and profiles and tune their products and services accordingly to retain customer base (Bhambri, 2011). By segmenting customers into bad customers and good customers, bank can cut losses before it is too late. By analyzing patterns of transactions, bank can track fraud transactions before it affects its profitability where data mining could help.

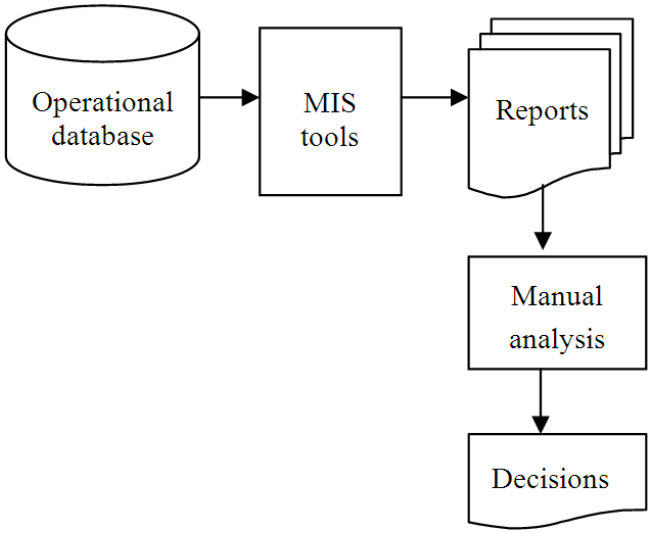


Figure 1 : Conventional decision making process

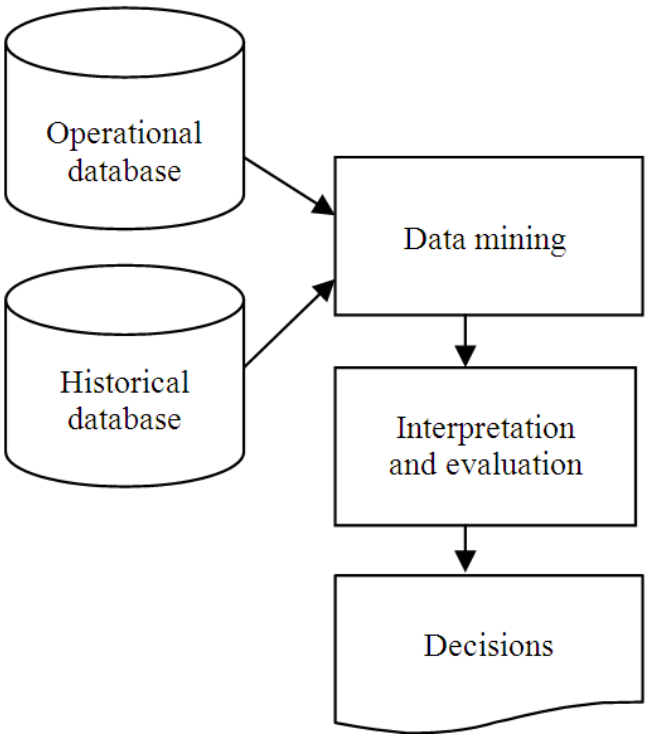
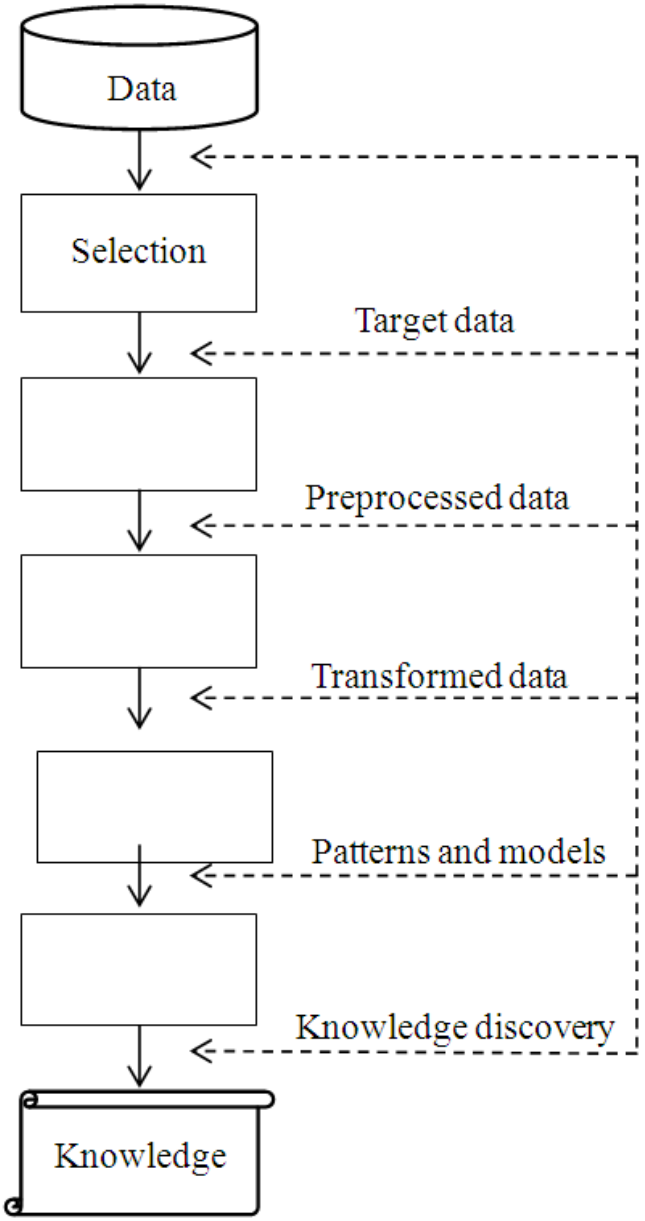


Figure 2 : Decision making with data mining

Data mining is the process of deriving knowledge hidden from large volumes of raw data. The knowledge must be new, not obvious, must be relevant and can be applied in the domain where this knowledge has been obtained. The logical process flow involved in data mining and knowledge discovery is shown in Figure 3. Data mining process can be broken down to the following iterative sequence of following steps.



a) Data Selection

Data required for the analysis are identified and brought from the data source. This is the first step in data mining process. Data source can be from operational or historical database or from a data warehouse.

b) Data Preprocessing

It involves Data Cleaning and Data Integration.

c) Data Cleaning

This is the stage where noise, irrelevant and inconsistent data are removed from the data selected.

d) Data Integration

In a production environment, there could be multiple databases storing same information. These heterogeneous data sources are combined in a common source.

e) Data Transformation and Data Reduction

Data are transformed or consolidated by performing summary or aggregation operations so that they are simpler to handle for the mining operations. Redundant or highly correlated data items can be dropped out so that data mining results would be more effective.

f) Data Mining

In this crucial step, intelligent data mining techniques are applied in order to extract data patterns. There could be many potentially useful patterns depending on the techniques used which need to be further analyzed for identifying the crucial ones.

g) Pattern Evaluation

In this stage, the patterns identified in the previous steps are evaluated for their relevance and usefulness in the applied domain. There are standard measures to find out if a pattern is interesting.

h) Knowledge Presentation

Here visualization and knowledge representation techniques are used to present mined knowledge to the user.

III. Data Mining Techniques

Techniques applied for mining knowledge can be divided into various classes depending on the nature of knowledge that system is unearthing. We will now look into these important techniques.

a) Association

This technique is used to unearth unsuspected data dependencies. In other words, it tries to detect data items that are associated or connected or correlated with each other which are not obvious previously. For example, if customers who are enquiring about a banking product, more often enquire about another unrelated product, then this technique can find this pattern out and inform the marketing team. More formally, the task is to uncover hidden associations from a large database. The idea is to derive a set of strong association rules in the form of "$A1 \wedge A2 \wedge \ldots Am \wedge B1 \wedge B2 \wedge \ldots Bn$" where Aj (for $i \in \{1 \ldots m\}$) and Bj (for $j \in \{1 \ldots n\}$) are set of attribute-values from the relevant data sets in a database. For example, data recorded by a point of sales system would indicate that if customers buy certain items, they are most likely to buy certain other items. Such information can be used as decisions for marketing activities promotional pricing or product placements (Tiwari, 2010). In addition to this, association rules are employed in application areas including web usage mining, intrusion detection and bioinformatics. Typically all association rules are not interesting. From a large data set, a very large and a high proportion of the rules mined will be usually of little

value. An associative relationship is considered to be useful if it satisfies a predefined support and confidence values (Geng and Hamilton, 2006). Hence, a rule is discarded if it does not satisfy this minimum support threshold and minimum confidence threshold. All these discovered strong association rules may not be interesting enough to present. Additional analysis need to be performed to uncover interesting statistical correlations between associated attribute-value pairs (Geng and Hamilton, 2006). Various types of association include (Ramageri, 2010):

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

b) Classification and Prediction

This is the most commonly applied data mining technique. It is employed when the classes of data in the population are known. For example, in the case of detecting fraudulent banking transactions from a bank's transactions database, there can only be two classes, namely fraudulent and non-fraudulent. It constructs a model from the sample data items with known class labels and use this model to predict the class of objects in the population whose classes are not known. Each tuple from the database contains one or more predicting attributes which determines the predicted class label of the tuple according to the constructed model. In the banking scene, classification technique is employed for Fraud detection (both corporate and credit fraud) (Ngai et al., 2011) These models are constructed usually using a decision tree model or a neural network model. A decision tree is a flow chart like recursive structure to express classification rules where each node specifies a test on an attribute value, each branch specifies a mutually exclusive outcome of the test together with a subsidiary decision tree for each outcome and tree leaves represent classes or class distributions. It can easily be converted to classification rules or can be used to compact description of data (Asghar and Iqbal, 2009). Fuzzy sets are applied to the classification techniques when parameters to consider are of fuzzy in nature. For example, the length of URL parameter for detecting phishing sites can range from low to highwith other values in between (Aburrous et al., 2010). Other commonly used classification technique involves application of neural networks. A neural network is essentially a network of processing nodes with weighted connections between the nodes where the weights are determined by a learning process using training data. Neural networks are computationally more expensive than their decision tree counterparts (Kumar et al. 2011).

Classification works with discrete and unordered data and helps to identify class labels of the members of the population. But prediction models works with continuous-valued functions. That is, it is used to predict missing or unavailable numerical data values from the sample attribute values. Commonly used technique for prediction is regression analysis. It is a statistical methodology that is used to forecast values from existing numerical values. In predictive models for data mining, we have a set of independent variables whose values are already known and a set of dependent or response variables whose values we want to predict. Regression helps us to express the relationship between these variables as a linear or non-linear function. In many real world problems related to banking such as stock price predictions, or credit scoring follow complex models with many independent variables and requires multidimensional regression analysis and logistic regression (Li and Liao, 2011).

c) Cluster Analysis and Concept Formation

Clustering is similar to classification. But subtle difference is that classes are not known before. Clustering is used to generate class labels. The objects are classified or grouped based on the principle of maximizing the similarity within a class based on the observed pattern. A regularly used and the simplest of clustering algorithms is K-means algorithm (Kaur and Kaur, 2013). Heuristics based on the domain information can be applied to cluster data where K-Means algorithm produces a large number of outliers (Shashidhar and Varadarajan, 2011). Self- Organizing Map is an important neural network based technique employed for clustering and has been applied for problems in banking domain (Shih, 2011). Concept formation is a closely related process to clustering and is used to learn summaries from data. This process integrates learning and classification tasks to identify summaries and organize learned summaries into a hierarchy. In banking area, clustering and concept formation can be employed for classifying customers with same kind of transactions or queries or profiles or subscribe to similar products or has similar risk aptitude. For example, in banking sector salaried customers tend to join investment plans with regular contributions. Knowledge about these classes will help banks to design products to each class of customers and can embark on targeted and more effective marketing campaigns.

IV. Application Areas of Data Mining in Banking

Banking information systems contains huge volumes of data both operational and historical. Data mining can assist critical decision making processes in a bank (Ionita and Ionita, 2011). Banks who apply data mining techniques in their decision making hugely benefit and hold an edge over others who don't. Some of these decisions are in the areas of marketing, risk management and default detection, fraud detection, customer relationship management and money

laundering detection (Khac and Kechadi, 2010; heepa and Dhanapal, 2009). These applications are described below.

a) Risk Management and Default Detection

Every lending decision a bank takes involve a certain amount of risk. Quantifying this risk can make the risk management process easier and limit the risk of financial loss to the bank. Knowing customers' capability to repay can greatly enhance a credit manager's decisions. Data mining can also help to identify which customer is going to delay or default a loan repayment (Kazi and Ahmed, 2012). This advanced knowledge can help the bank to take corrective measures to prevent losses. For such forecasting, parameters to consider are turnover trends,balance sheet figures, limit utilization, behavioral patterns and cheque return patterns. Historical default patterns can also help in predicting future defaults when same patterns are discovered (Costa et al., 2007). Data mining techniques are applied to enhance the accuracy of credit scores and predict default probabilities (Li and Liao, 2011). Credit score is a value representing a borrower's creditworthiness. Behavioral scores are obtained from probability models of customer behavior to forecast their future behaviors in various situations. Data mining can derive this score using the past behaviors of the borrower related to debt repayments by analyzing available credit history (He et al., 2010).

b) Marketing

Marketing is one of the mostly used application area for Data Mining by the industry in general (Zhang et al., 2008). Banking is not an exception. Retaining customers and finding new customers are getting increasingly difficult because of cut throat competition prevailing in the market these days. Only way to retain a customer or win a new customer is to be proactive and know beforehand what the customer expects and offer him what he wants. This is where data mining can help a great deal (Chopra et al., 2011). Data mining applied to customer relationship management systems can analyze customer data and can discover key indicators to help the bank to be equipped with the knowledge of factors that affected customer's demands in the past and their needs in the future (Ngai et al., 2009). This enables the bank to targeted marketing. Sequential patterns can be analyzed to investigate changing customer preferences and can approach customers pro-actively (Sundari and Thangadurai, 2010). Data mining techniques can help in classifying customers according to the customer's attributes, behavior, needs, preferences, value and other factors (Ren et al., 2010). Mainly two scoring models are used for this classification purposes, namely credit scoring model and behavioral scoring model. This classification is valuable information for making customer oriented marketing strategies tailor made for the target category and provide different services for each customer category (Ping and Liang, 2010). For example it can determine how customers will react to a change in interest rates, which customers will be likely to accept new product offers, what collateral would require from a specific customer segment for reducing loan losses. Different levels of analysis like RFM (Recency, Frequency and Monitory) analysis, LTV (Life Time Value) of customers coupled with K-Means clustering can be employed to develop an effective customer segmentation thereby increasing targeted marketing (Varun et al., 2012). Data mining can also reveal possibility of cross selling such as selling home loans to credit card customers by analyzing associations from the past data (Qiu et al., 2009). It can also develop a model of existing home loan customers to analyze their profiles to explore similar customers in other portfolios (like demand deposits or customers with Sreekumar Pulakkazhy and R.V.S. Balan / Journal of Computer Science 9 (10): 1252-1259, 2013insurance products) to find out potential customers for home loans (Shinde et al., 2012).

c) Fraud Detection

Banks lose millions of dollars annually to various frauds. Detecting fraudulent transactions can help the banks to act early and limit the damages. Fraud detection is the process of identifying fraudulent transactions from genuine transactions or in other words this process segregates a list of transactions into two classes namely fraudulent and legitimate (Ogwueleka, 2011). Most important area where fraud detection can help is the credit card products. Clustering methods can be used to classify transactions and outliers can be analyzed for frauds (Dheepa and Dhanapal, 2009). Probability density of credit card user's past behavior can be modeled and the probability of current behavior can be calculated to detect frauds (Dheepa and Dhanapal, 2009). Patterns of customer's transactions can be discovered and alerts can be generated if any measurable deviations are found. Financial statement fraud detection is another area that can employ data mining principles to effective use.

Banks make credit decisions based on financial statements produced by customers. These statements may contain overstated assets, sales and profits or it may understate losses and liabilities. Even though these statements may have been audited, these kinds of frauds are hard to detect using normal auditing procedures. Classification techniques based on neural network, regression and decision tree are used for classifying fraudulent ratios in the statements from the nonfraudulent data (Sharma and Panigrahi, 2012).

d) Money Laundering Detection

Money Laundering is the process of hiding the illegal origin of "black" money so as to legitimize it (Khac and Kechadi, 2010). Banks are commonly used as

channels to launder money. Therefore governments and financial regulators require banks to implement processes, systems and procedures to detect and prevent money laundering transactions. Failure to detect and prevent such illegal transactions can invite hefty fines both monetarily and operationally which can prove very costly for the bank and even can make its survival difficult. Conventional rule-based transaction analysis based on reports and tools will not be sufficient to detect more complicated transaction patterns like smurfing and networked transactions (Khac et al., 2011). Here data miningtechniques can be applied to dig out transaction patterns that can lead to money laundering. Typically such systems take client risk assessment data, transaction risk measurement data and patterns and behavior patterns into consideration for detecting money laundering patterns. Transactions are then grouped into clusters based on their similarities found in these chosen attributes (Khac et al., 2011). In a large database of banking transactions, it is possible that a huge number of patterns emerge and will be classified as money laundering transactions thereby increasing false positives. Statistical false reduction methods based on decision tree classification are employed to limit the number of false patterns detected (Anuar et al., 2008).

e) Investment Banking

Investment is an action of investing money into an asset or item for profit/income. Banks often offer investment services to their customers. There are a vast number of financial instruments in the market.

Data mining like K-means clustering can be applied to choose the best investments based on customer's profile (Ingle and Meshram, 2012). Capability to predict asset prices (for example stock prices) from historic prices can increase returns from investment tremendously. Data mining techniques for prediction like neural networks and linear regression can be employed for prediction of prices for stocks (Naeini et al., 2010). Data mining can also be applied in time series analysis for financial applications (Tak-chung, 2011).

V. Conclusion

Data mining is a process to extract knowledge from existing data. It is used as a tool in banking and finance in general to discover useful information from the operational and historical data to enable better decision-making. It is an interdisciplinary field, confluence of Statistics, Database technology, Information science, Machine learning and Visualization. It involves steps that include data selection, data integration, data transformation, data mining, pattern evaluation, knowledge presentation. Banks use data mining in various application areas like marketing, fraud detection, risk management, money laundering detection and investment banking. The patterns detected help the bank to forecast future events that can help in its decision-making processes. More and more banks are investing in data mining technologies to be more competitive.

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To avoid postal delays, all transaction is preferred by e-mail. A finished manuscript submission is confirmed by e-mail immediately and your paper enters the editorial process with no postal delays. When a conclusion is made about the publication of your paper by our Editorial Board, revisions can be submitted online with the same procedure, with an occasion to view and respond to all comments.

Complete support for both authors and co-author is provided.

4. MANUSCRIPT'S CATEGORY

Based on potential and nature, the manuscript can be categorized under the following heads:

Original research paper: Such papers are reports of high-level significant original research work.

Review papers: These are concise, significant but helpful and decisive topics for young researchers.

Research articles: These are handled with small investigation and applications.

Research letters: The letters are small and concise comments on previously published matters.

5. STRUCTURE AND FORMAT OF MANUSCRIPT

The recommended size of original research paper is less than seven thousand words, review papers fewer than seven thousands words also.Preparation of research paper or how to write research paper, are major hurdle, while writing manuscript. The research articles and research letters should be fewer than three thousand words, the structure original research paper; sometime review paper should be as follows:

Papers: These are reports of significant research (typically less than 7000 words equivalent, including tables, figures, references), and comprise:

(a)Title should be relevant and commensurate with the theme of the paper.

(b) A brief Summary, "Abstract" (less than 150 words) containing the major results and conclusions.

(c) Up to ten keywords, that precisely identifies the paper's subject, purpose, and focus.

(d) An Introduction, giving necessary background excluding subheadings; objectives must be clearly declared.

(e) Resources and techniques with sufficient complete experimental details (wherever possible by reference) to permit repetition; sources of information must be given and numerical methods must be specified by reference, unless non-standard.

(f) Results should be presented concisely, by well-designed tables and/or figures; the same data may not be used in both; suitable statistical data should be given. All data must be obtained with attention to numerical detail in the planning stage. As reproduced design has been recognized to be important to experiments for a considerable time, the Editor has decided that any paper that appears not to have adequate numerical treatments of the data will be returned un-refereed;

(g) Discussion should cover the implications and consequences, not just recapitulating the results; conclusions should be summarizing.

(h) Brief Acknowledgements.

(i) References in the proper form.

Authors should very cautiously consider the preparation of papers to ensure that they communicate efficiently. Papers are much more likely to be accepted, if they are cautiously designed and laid out, contain few or no errors, are summarizing, and be conventional to the approach and instructions. They will in addition, be published with much less delays than those that require much technical and editorial correction.

The Editorial Board reserves the right to make literary corrections and to make suggestions to improve briefness.

It is vital, that authors take care in submitting a manuscript that is written in simple language and adheres to published guidelines.

Format

Language: The language of publication is UK English. Authors, for whom English is a second language, must have their manuscript efficiently edited by an English-speaking person before submission to make sure that, the English is of high excellence. It is preferable, that manuscripts should be professionally edited.

Standard Usage, Abbreviations, and Units: Spelling and hyphenation should be conventional to The Concise Oxford English Dictionary. Statistics and measurements should at all times be given in figures, e.g. 16 min, except for when the number begins a sentence. When the number does not refer to a unit of measurement it should be spelt in full unless, it is 160 or greater.

Abbreviations supposed to be used carefully. The abbreviated name or expression is supposed to be cited in full at first usage, followed by the conventional abbreviation in parentheses.

Metric SI units are supposed to generally be used excluding where they conflict with current practice or are confusing. For illustration, 1.4 l rather than 1.4 × 10-3 m3, or 4 mm somewhat than 4 × 10-3 m. Chemical formula and solutions must identify the form used, e.g. anhydrous or hydrated, and the concentration must be in clearly defined units. Common species names should be followed by underlines at the first mention. For following use the generic name should be constricted to a single letter, if it is clear.

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Abstract, used in Original Papers and Reviews:

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Key Words

A major linchpin in research work for the writing research paper is the keyword search, which one will employ to find both library and Internet resources.

One must be persistent and creative in using keywords. An effective keyword search requires a strategy and planning a list of possible keywords and phrases to try.

Search engines for most searches, use Boolean searching, which is somewhat different from Internet searches. The Boolean search uses "operators," words (and, or, not, and near) that enable you to expand or narrow your affords. Tips for research paper while preparing research paper are very helpful guideline of research paper.

Choice of key words is first tool of tips to write research paper. Research paper writing is an art.A few tips for deciding as strategically as possible about keyword search:

- One should start brainstorming lists of possible keywords before even begin searching. Think about the most important concepts related to research work. Ask, "What words would a source have to include to be truly valuable in research paper?" Then consider synonyms for the important words.
- It may take the discovery of only one relevant paper to let steer in the right keyword direction because in most databases, the keywords under which a research paper is abstracted are listed with the paper.
- One should avoid outdated words.

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Numerical Methods: Numerical methods used should be clear and, where appropriate, supported by references.

Acknowledgements: Please make these as concise as possible.

References

References follow the Harvard scheme of referencing. References in the text should cite the authors' names followed by the time of their publication, unless there are three or more authors when simply the first author's name is quoted followed by et al. unpublished work has to only be cited where necessary, and only in the text. Copies of references in press in other journals have to be supplied with submitted typescripts. It is necessary that all citations and references be carefully checked before submission, as mistakes or omissions will cause delays.

References to information on the World Wide Web can be given, but only if the information is available without charge to readers on an official site. Wikipedia and Similar websites are not allowed where anyone can change the information. Authors will be asked to make available electronic copies of the cited information for inclusion on the Global Journals Inc. (US) homepage at the judgment of the Editorial Board.

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Figures: Figures are supposed to be submitted as separate files. Always take in a citation in the text for each figure using Arabic numbers, e.g. Fig. 4. Artwork must be submitted online in electronic form by e-mailing them.

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Even though low quality images are sufficient for review purposes, print publication requires high quality images to prevent the final product being blurred or fuzzy. Submit (or e-mail) EPS (line art) or TIFF (halftone/photographs) files only. MS PowerPoint and Word Graphics are unsuitable for printed pictures. Do not use pixel-oriented software. Scans (TIFF only) should have a resolution of at least 350 dpi (halftone) or 700 to 1100 dpi (line drawings) in relation to the imitation size. Please give the data for figures in black and white or submit a Color Work Agreement Form. EPS files must be saved with fonts embedded (and with a TIFF preview, if possible).

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1. Choosing the topic: In most cases, the topic is searched by the interest of author but it can be also suggested by the guides. You can have several topics and then you can judge that in which topic or subject you are finding yourself most comfortable. This can be done by asking several questions to yourself, like Will I be able to carry our search in this area? Will I find all necessary recourses to accomplish the search? Will I be able to find all information in this field area? If the answer of these types of questions will be "Yes" then you can choose that topic. In most of the cases, you may have to conduct the surveys and have to visit several places because this field is related to Computer Science and Information Technology. Also, you may have to do a lot of work to find all rise and falls regarding the various data of that subject. Sometimes, detailed information plays a vital role, instead of short information.

2. Evaluators are human: First thing to remember that evaluators are also human being. They are not only meant for rejecting a paper. They are here to evaluate your paper. So, present your Best.

3. Think Like Evaluators: If you are in a confusion or getting demotivated that your paper will be accepted by evaluators or not, then think and try to evaluate your paper like an Evaluator. Try to understand that what an evaluator wants in your research paper and automatically you will have your answer.

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11. Revise what you wrote: When you write anything, always read it, summarize it and then finalize it.

12. Make all efforts: Make all efforts to mention what you are going to write in your paper. That means always have a good start. Try to mention everything in introduction, that what is the need of a particular research paper. Polish your work by good skill of writing and always give an evaluator, what he wants.

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16. Use proper verb tense: Use proper verb tenses in your paper. Use past tense, to present those events that happened. Use present tense to indicate events that are going on. Use future tense to indicate future happening events. Use of improper and wrong tenses will confuse the evaluator. Avoid the sentences that are incomplete.

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21. Arrangement of information: Each section of the main body should start with an opening sentence and there should be a changeover at the end of the section. Give only valid and powerful arguments to your topic. You may also maintain your arguments with records.

22. Never start in last minute: Always start at right time and give enough time to research work. Leaving everything to the last minute will degrade your paper and spoil your work.

23. Multitasking in research is not good: Doing several things at the same time proves bad habit in case of research activity. Research is an area, where everything has a particular time slot. Divide your research work in parts and do particular part in particular time slot.

24. Never copy others' work: Never copy others' work and give it your name because if evaluator has seen it anywhere you will be in trouble.

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26. Go for seminars: Attend seminars if the topic is relevant to your research area. Utilize all your resources.

27. Refresh your mind after intervals: Try to give rest to your mind by listening to soft music or by sleeping in intervals. This will also improve your memory.

28. Make colleagues: Always try to make colleagues. No matter how sharper or intelligent you are, if you make colleagues you can have several ideas, which will be helpful for your research.

29. Think technically: Always think technically. If anything happens, then search its reasons, its benefits, and demerits.

30. Think and then print: When you will go to print your paper, notice that tables are not be split, headings are not detached from their descriptions, and page sequence is maintained.

31. Adding unnecessary information: Do not add unnecessary information, like, I have used MS Excel to draw graph. Do not add irrelevant and inappropriate material. These all will create superfluous. Foreign terminology and phrases are not apropos. One should NEVER take a broad view. Analogy in script is like feathers on a snake. Not at all use a large word when a very small one would be sufficient. Use words properly, regardless of how others use them. Remove quotations. Puns are for kids, not grunt readers. Amplification is a billion times of inferior quality than sarcasm.

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33. Report concluded results: Use concluded results. From raw data, filter the results and then conclude your studies based on measurements and observations taken. Significant figures and appropriate number of decimal places should be used. Parenthetical remarks are prohibitive. Proofread carefully at final stage. In the end give outline to your arguments. Spot out perspectives of further study of this subject. Justify your conclusion by at the bottom of them with sufficient justifications and examples.

34. After conclusion: Once you have concluded your research, the next most important step is to present your findings. Presentation is extremely important as it is the definite medium though which your research is going to be in print to the rest of the crowd. Care should be taken to categorize your thoughts well and present them in a logical and neat manner. A good quality research paper format is essential because it serves to highlight your research paper and bring to light all necessary aspects in your research.

Informal Guidelines of Research Paper Writing

Key points to remember:

- Submit all work in its final form.
- Write your paper in the form, which is presented in the guidelines using the template.
- Please note the criterion for grading the final paper by peer-reviewers.

Final Points:

A purpose of organizing a research paper is to let people to interpret your effort selectively. The journal requires the following sections, submitted in the order listed, each section to start on a new page.

The introduction will be compiled from reference matter and will reflect the design processes or outline of basis that direct you to make study. As you will carry out the process of study, the method and process section will be constructed as like that. The result segment will show related statistics in nearly sequential order and will direct the reviewers next to the similar intellectual paths throughout the data that you took to carry out your study. The discussion section will provide understanding of the data and projections as to the implication of the results. The use of good quality references all through the paper will give the effort trustworthiness by representing an alertness of prior workings.

Writing a research paper is not an easy job no matter how trouble-free the actual research or concept. Practice, excellent preparation, and controlled record keeping are the only means to make straightforward the progression.

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· Adhere to recommended page limits

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- Separating a table/chart or figure - impound each figure/table to a single page
- Submitting a manuscript with pages out of sequence

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· Keep on paying attention on the research topic of the paper

· Use paragraphs to split each significant point (excluding for the abstract)

· Align the primary line of each section

· Present your points in sound order

· Use present tense to report well accepted

· Use past tense to describe specific results

· Shun familiar wording, don't address the reviewer directly, and don't use slang, slang language, or superlatives

· Shun use of extra pictures - include only those figures essential to presenting results

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Choose a revealing title. It should be short. It should not have non-standard acronyms or abbreviations. It should not exceed two printed lines. It should include the name(s) and address (es) of all authors.

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The summary should be two hundred words or less. It should briefly and clearly explain the key findings reported in the manuscript--must have precise statistics. It should not have abnormal acronyms or abbreviations. It should be logical in itself. Shun citing references at this point.

An abstract is a brief distinct paragraph summary of finished work or work in development. In a minute or less a reviewer can be taught the foundation behind the study, common approach to the problem, relevant results, and significant conclusions or new questions.

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- Fundamental goal
- To the point depiction of the research
- Consequences, including definite statistics - if the consequences are quantitative in nature, account quantitative data; results of any numerical analysis should be reported
- Significant conclusions or questions that track from the research(es)

Approach:

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- Center on shortening results - bound background information to a verdict or two, if completely necessary
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- Present a justification. Status your particular theory (es) or aim(s), and describe the logic that led you to choose them.
- Very for a short time explain the tentative propose and how it skilled the declared objectives.

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- Explain materials individually only if the study is so complex that it saves liberty this way.
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- If use of a definite type of tools.
- Materials may be reported in a part section or else they may be recognized along with your measures.

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- Report the method (not particulars of each process that engaged the same methodology)
- Describe the method entirely
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- Simplify - details how procedures were completed not how they were exclusively performed on a particular day.
- If well known procedures were used, account the procedure by name, possibly with reference, and that's all.

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- It is embarrassed or not possible to use vigorous voice when documenting methods with no using first person, which would focus the reviewer's interest on the researcher rather than the job. As a result when script up the methods most authors use third person passive voice.
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What to keep away from

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- Leave out information that is immaterial to a third party.

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The principle of a results segment is to present and demonstrate your conclusion. Create this part a entirely objective details of the outcome, and save all understanding for the discussion.

The page length of this segment is set by the sum and types of data to be reported. Carry on to be to the point, by means of statistics and tables, if suitable, to present consequences most efficiently.You must obviously differentiate material that would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matter should not be submitted at all except requested by the instructor.

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- Sum up your conclusion in text and demonstrate them, if suitable, with figures and tables.
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- Present a background, such as by describing the question that was addressed by creation an exacting study.
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- Do not discuss or infer your outcome, report surroundings information, or try to explain anything.
- Not at all, take in raw data or intermediate calculations in a research manuscript.
- Do not present the similar data more than once.
- Manuscript should complement any figures or tables, not duplicate the identical information.
- Never confuse figures with tables - there is a difference.

Approach

- As forever, use past tense when you submit to your results, and put the whole thing in a reasonable order.
- Put figures and tables, appropriately numbered, in order at the end of the report
- If you desire, you may place your figures and tables properly within the text of your results part.

Figures and tables

- If you put figures and tables at the end of the details, make certain that they are visibly distinguished from any attach appendix materials, such as raw facts
- Despite of position, each figure must be numbered one after the other and complete with subtitle
- In spite of position, each table must be titled, numbered one after the other and complete with heading
- All figure and table must be adequately complete that it could situate on its own, divide from text

Discussion:

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Discussion	Well organized, meaningful specification, sound conclusion, logical and concise explanation, highly structured paragraph reference cited	Wordy, unclear conclusion, spurious	Conclusion is not cited, unorganized, difficult to comprehend
References	Complete and correct format, well organized	Beside the point, Incomplete	Wrong format and structuring

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